Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 1

Exercise 1

We have a bank account that initially offers a compound interes rate of 9%, and after 1 year the conditions are modified and then we obtain a compound interes rate of 3%. The initial deposit is 8000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****8.***** euros.

3) We will have ****2.***** euros.

4) We will have ****7.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Between the months $t=1$ and $t=5$, the funds in certain account (in millions of euros) are given by the function $F(t) = 15 + 60t - 21t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=1$ and $t=2$.

1) It oscillates between 51 and 74.

2) It oscillates between 56 and 67.

3) It oscillates between 47 and 67.

4) It oscillates between 40 and 67.

5) It oscillates between 40 and 67.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(2 + 2t + 2t^2 + 2t^3\right)$ per-unit.

The initial deposit in the account is 7000 euros. Compute the deposit after 1 year.

1) 7277.8283 euros

2) 7357.8283 euros

3) 7297.8283 euros

4) 7312.396 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 \\ 1 & 1 \end{pmatrix} . \left(X - \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix} \right) = \begin{pmatrix} 1 & 0 \\ -3 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + (1 - m) y - 2 z == 3 + 2 m$
$-x + y + z == -4$
$-2 x + y + 2 z == -7$

has only a solution. For that solution compute the value of variable x

1) $x = 7$.

2) $x = 1$.

3) $x = -4$.

4) $x = 2$.

5) $x = 6$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (1 \;\; -1) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (5 \;\; -4) \rangle$

1) $\begin{pmatrix} 9 & -8 \\ 10 & -9 \end{pmatrix}$ 2) $\begin{pmatrix} 9 & 10 \\ -8 & -9 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & 3 \\ -3 & -1 \end{pmatrix}$ 4) $\begin{pmatrix} 9 & -2 \\ 40 & -9 \end{pmatrix}$ 5) $\begin{pmatrix} 9 & 40 \\ -2 & -9 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 2

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 6% in 3 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a compound interes rate of 5%. The initial deposit is 9000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****5.***** euros.

2) We will have ****9.***** euros.

3) We will have ****4.***** euros.

4) We will have ****6.***** euros.

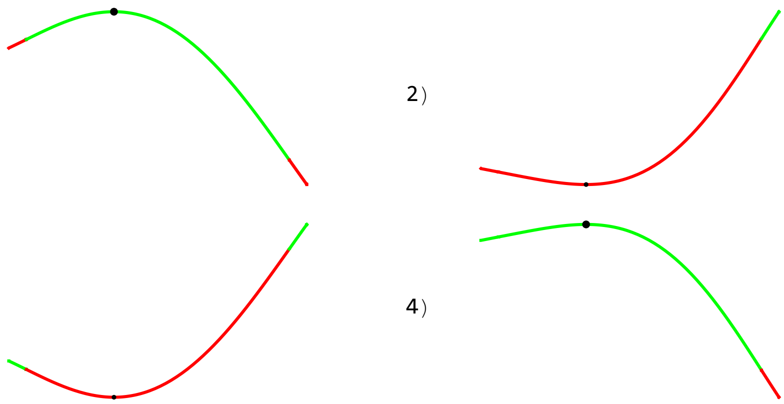
5) We will have ****3.***** euros.

Exercise 2

Study the shape properties of $f(x) = 1 - 6x^2 - x^3 + \frac{x^4}{2}$

to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -6 + 11x - 6x^2 + x^3$ and the horizontal axis between the points $x = -1$ and $x = 3$.

1) $\frac{33}{2} = 16.5$

2) 21

3) $\frac{41}{2} = 20.5$

4) 18

5) 19

6) 20

7) $\frac{37}{2} = 18.5$

8) $\frac{39}{2} = 19.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & 0 \\ 1 & 1 \end{pmatrix}\right) . \begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} = \begin{pmatrix} 2 & 6 \\ 0 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -1 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - 2 y - 3 z == 3 + 2 m$
$x - y - 2 z == 4$
$-x + 2 y + 3 z == -5$

has only a solution. For that solution compute the value of variable x

1) $x = -8$.

2) $x = 7$.

3) $x = 8$.

4) $x = 2$.

5) $x = -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -96 & 224 \\ -42 & 98 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-7 \ \ -3)$.

2) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(-16 \ \ -7)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(3 \ \ 2)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(1 \ \ 3)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-7 \ \ -3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 3

Exercise 1

We have a bank account that initially offers a continuous compound rate of 3% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 9% . The initial deposit is 13 000 euros. Compute the amount of money in the account after 2 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****7.***** euros.

3) We will have ****2.***** euros.

4) We will have ****5.***** euros.

5) We will have ****6.***** euros.

Exercise 2

Between the months $t=1$ and $t=7$, the funds in certain account (in millions of euros) are given by the function $F(t) = 11+18t-12t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=6$ and $t=7$.

1) It oscillates between 119 and 235.

2) It oscillates between 11 and 19.

3) It oscillates between 125 and 239.

4) It oscillates between 115 and 242.

5) It oscillates between 11 and 235.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \frac{1}{100}\left(2t+2t^3+2t^4\right) \text{ per-unit.}$$

The initial deposit in the account is 10 000 euros. Compute the deposit after 3 years.

1) 43412.0699 euros

2) 43362.0699 euros

3) 43409.9708 euros

4) 43452.0699 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -7 & -5 \\ 10 & 7 \end{pmatrix}^{-1} . \left(X + \begin{pmatrix} -1 & 0 \\ -3 & -1 \end{pmatrix}\right) = \begin{pmatrix} -17 & -17 \\ 24 & 24 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - 2 y + z == 3 + m$
$(-5 + m) x + 3 y - z == -10 + m$
$2 x - 2 y + z == 5$

has only a solution. For that solution compute the value of variable y

1) $y = 4$.

2) $y = 8$.

3) $y = -3$.

4) $y = -1$.

5) $y = -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (6\ \ 5), (-5\ \ -4) \rangle$

1) $\begin{pmatrix} -1 & -1 \\ 0 & 1 \end{pmatrix}$ 2) $\begin{pmatrix} -1 & 0 \\ -1 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 2 \\ 3 & -3 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 2 \\ 0 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 4

Exercise 1

We have one bank account that offers a compound interes rate of 3% where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 19 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **0.***** years.

2) In **2.***** years.

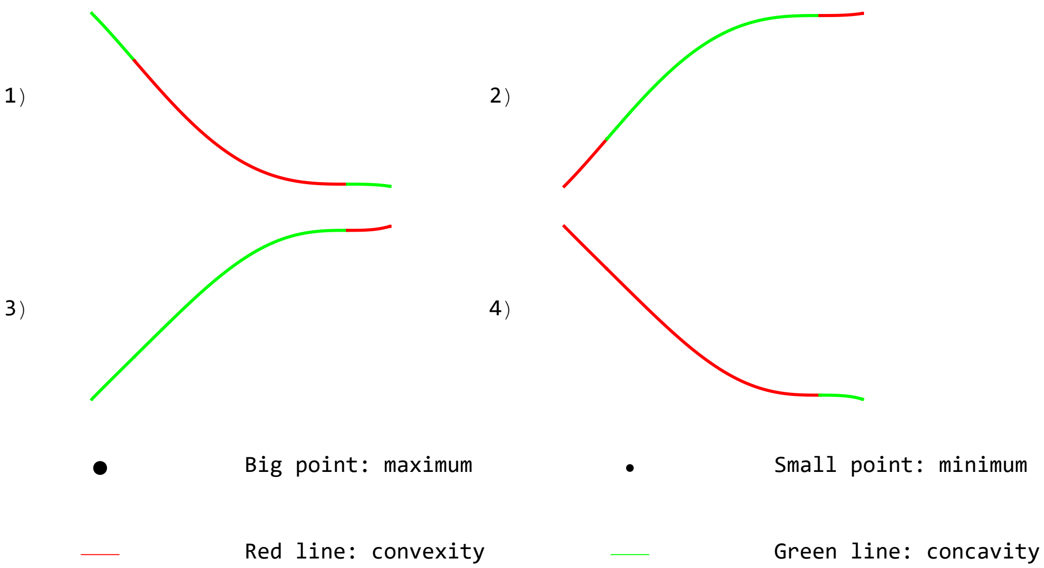
3) In **5.***** years.

4) In **4.***** years.

5) In **8.***** years.

Exercise 2

Study the shape properties of $f(x) = 3 + 2x^3 + 2x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.



Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{14} e^{-3+3t}$ per-unit.

The initial deposit in the account is 18 000 euros. Compute the deposit after 1 year.

1) 18391.8757 euros

2) 18421.8757 euros

3) 18451.8757 euros

4) 18411.8757 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 1 & 1 & 0 \\ 0 & -1 & 1 \\ 0 & -3 & 2 \end{pmatrix}\right) . \begin{pmatrix} 2 & 1 & -1 \\ 1 & 1 & -1 \\ 1 & 1 & 0 \end{pmatrix} = \begin{pmatrix} -3 & -2 & 2 \\ 2 & 1 & -2 \\ 0 & 0 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x - y - z == -1$
$-2x + 3y + 2z == 3$
$(-2 + m)x + 4y + 3z == 2 - 2m$

has only a solution.

1) We have unique solution for $m \neq -4$.

2) We have unique solution for $m \neq -1$.

3) We have unique solution for $m \leq 1$.

4) We have unique solution for $m \leq 1$.

5) We have unique solution for $m \neq -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 10 & -25 & -18 \\ -6 & 17 & 12 \\ 13 & -35 & -25 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-3\ \ 0\ \ 1)$.

2) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2\ \ 0\ \ 2)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2\ \ 0\ \ 1)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1\ \ 1\ \ -2)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(3\ \ 3\ \ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 5

Exercise 1

We have a bank account that initially offers a compound interes rate of 4% , and after 4 years the conditions are modified and then we obtain a compound interes rate of 6% . The initial deposit is 8000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****4.***** euros.

3) We will have ****1.***** euros.

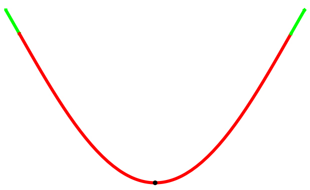
4) We will have ****2.***** euros.

5) We will have ****3.***** euros.

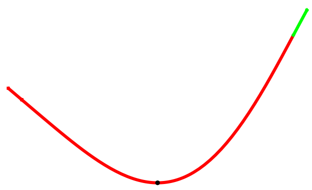
Exercise 2

Study the shape properties of $f(x) = 5 - 12x^2 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

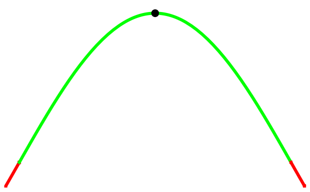
1)



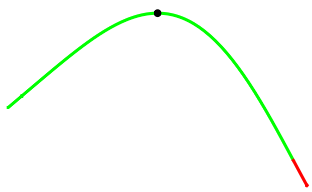
2)



3)



4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound
interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10} \sin(4 + 2t)$ per-unit.

The initial deposit in the account is 12 000 euros. Compute the deposit after 2π years.

1) 12060. euros

2) 12090. euros

3) 12020. euros

4) 12000. euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 4 & 5 \\ 7 & 9 \end{pmatrix}^{-1} . X . \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} 15 & -5 \\ -12 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -2 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + y - 2 z == 2 m$
$x + y - 2 z == 2$
$x + z == 3$

has only a solution. For that solution compute the value of variable x

1) $x = 4$.

2) $x = -9$.

3) $x = 1$.

4) $x = 0$.

5) $x = 2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (-5 \ \ 2), \ (-13 \ \ 5) \rangle$

1) $\begin{pmatrix} -3 & 1 \\ -2 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & -1 \\ 2 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & 3 \\ -1 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & 1 \\ 0 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 6

Exercise 1

We have one bank account that offers a continuous compound rate of 4% where we initially deposit 7000 euros. How long time is it necessary until the amount of money in the account reaches 13 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **5.***** years.

2) In **0.***** years.

3) In **1.***** years.

4) In **9.***** years.

5) In **6.***** years.

Exercise 2

Between the months $t=2$ and $t=9$, the funds in certain account (in millions of euros) are given by the function $F(t) = -5 + 168\,t - 33\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=7$.

1) It oscillates between 215 and 292.

2) It oscillates between 208 and 261.

3) It oscillates between 240 and 267.

4) It oscillates between 215 and 267.

5) It oscillates between 219 and 265.

Exercise 3

Compute the area enclosed by the function $f(x) = 18 + 9x - 2x^2 - x^3$ and the horizontal axis between the points $x = -4$ and $x = 1$.

1) $\frac{187}{4} = 46.75$

2) $\frac{189}{4} = 47.25$

3) $\frac{127}{4} = 31.75$

4) $\frac{403}{12} = 33.5833$

5) $\frac{515}{12} = 42.9167$

6) $\frac{191}{4} = 47.75$

7) $\frac{193}{4} = 48.25$

8) $\frac{179}{4} = 44.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & 3 \\ -2 & 5 \end{pmatrix} . X . \begin{pmatrix} -1 & -2 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -2 \\ -2 & -4 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + z == 1$
$-x + y - z == -3$
$-x + y == -2$

has only a solution. For that solution compute the value of variable x

1) $x = -2$.

2) $x = 1$.

3) $x = 9$.

4) $x = 0$.

5) $x = -6$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -47 & 18 \\ -120 & 46 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

2) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-3\ \ -2)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2\ \ 5)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2\ \ 5)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(0\ \ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 7

Exercise 1

We have a bank account that initially offers a continuous compound rate of 6% , and after 4 years the conditions are modified and then we obtain a compound interes rate of 8% . The initial deposit is 10 000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****9.***** euros.

2) We will have ****4.***** euros.

3) We will have ****7.***** euros.

4) We will have ****1.***** euros.

5) We will have ****2.***** euros.

Exercise 2

Between the months $t=1$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t) = -11 + 120\,t - 27\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t=1$ and $t=2$.

1) It oscillates between 84 and 135.

2) It oscillates between 84 and 169.

3) It oscillates between 85 and 140.

4) It oscillates between 84 and 137.

5) It oscillates between 164 and 165.

Exercise 3

Compute the area enclosed by the function $f(x) = -6x - 2x^2$ and the horizontal axis between the points $x = -5$ and $x = 3$.

1) $\frac{214}{3} = 71.3333$

2) $\frac{223}{3} = 74.3333$

3) $\frac{220}{3} = 73.3333$

4) $\frac{56}{3} = 18.6667$

5) $\frac{443}{6} = 73.8333$

6) $\frac{110}{3} = 36.6667$

7) $\frac{160}{3} = 53.3333$

8) $\frac{437}{6} = 72.8333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & 2 \\ -1 & 1 \end{pmatrix} . X . \begin{pmatrix} 1 & 1 \\ -1 & 0 \end{pmatrix} = \begin{pmatrix} -2 & -1 \\ -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ 0 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2 + m) x - 4 y - 3 z == 7 - m$
$3 x + 4 y + 3 z == -8$
$x + y + z == -2$

has only a solution. For that solution compute the value of variable x

1) $x = -1$.

2) $x = -2$.

3) $x = 0$.

4) $x = -6$.

5) $x = -9$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2 \;\; 3) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (5 \;\; 8) \rangle$

1) $\begin{pmatrix} -31 & -48 \\ 20 & 31 \end{pmatrix}$ 2) $\begin{pmatrix} -31 & -80 \\ 12 & 31 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & 0 \\ 0 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -31 & 20 \\ -48 & 31 \end{pmatrix}$ 5) $\begin{pmatrix} -31 & 12 \\ -80 & 31 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 8

Exercise 1

We have a bank account that initially offers a compound interes rate of 9% , and after 4 years the conditions are modified and then we obtain a compound interes rate of 3% . The initial deposit is 9000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****7.***** euros.

3) We will have ****5.***** euros.

4) We will have ****3.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Between the months $t=1$ and $t=8$, the true value of the shares of a company (in euros) are given by the function $C(t)= 235+288t-42t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=6$ and $t=8$.

1) It oscillates between 483 and 883.

2) It oscillates between 882 and 882.

3) It oscillates between 870 and 892.

4) It oscillates between 875 and 883.

5) It oscillates between 871 and 880.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t)=\left(\frac{1}{100}(2-5t)\right)\cos(8t) \text{ per-unit.}$$

The initial deposit in the account is 14 000 euros. Compute the deposit after 2π years.

1) 13997.901 euros

2) 14 000 euros

3) 13 910 euros

4) 14 080 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix}^{-1} .X. \begin{pmatrix} -1 & 2 & 6 \\ -2 & 3 & 9 \\ -1 & 1 & 4 \end{pmatrix}^{-1} = \begin{pmatrix} -4 & 3 & -1 \\ -2 & 3 & -4 \\ 7 & -5 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(1+m)\,x + y - z == 2\,m$
$-x + 2\,y - z == -5$
$x - y + z == 4$

has only a solution.

1) We have unique solution for $m \geq -3$.

2) We have unique solution for $m \geq -5$.

3) We have unique solution for $m \neq -2$.

4) We have unique solution for $m \neq 1$.

5) We have unique solution for $m \neq -3$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (7 \ \ 2) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-4 \ \ -1) \rangle$

1) $\begin{pmatrix} 8 & 2 \\ -28 & -7 \end{pmatrix}$ 2) $\begin{pmatrix} 8 & -28 \\ 2 & -7 \end{pmatrix}$ 3) $\begin{pmatrix} 8 & -4 \\ 14 & -7 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -3 \\ -3 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} 8 & 14 \\ -4 & -7 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 9

Exercise 1

We have one bank account that offers a periodic compound interes rate of 2% in 3 periods (compounding frequency) where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **2.***** years.

3) In **4.***** years.

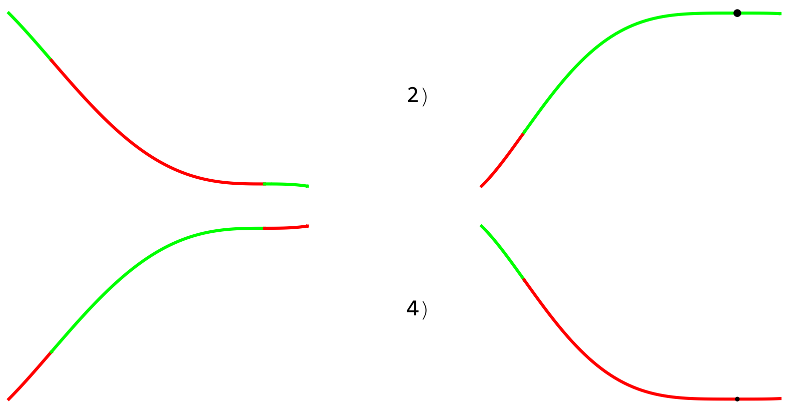
4) In **0.***** years.

5) In **6.***** years.

Exercise 2

Study the shape properties of $f(x) = 5 + x^3 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -36 + 12x + 9x^2 - 3x^3$ and the horizontal axis between the points $x = -3$ and $x = 5$.

1) 228

2) 144

3) $\frac{461}{2} = 230.5$

4) $\frac{447}{2} = 223.5$

5) $\frac{63}{2} = 31.5$

6) 230

7) $\frac{459}{2} = 229.5$

8) 231

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 \\ 3 & 1 \end{pmatrix} . X + \begin{pmatrix} 1 & -2 \\ 1 & -1 \end{pmatrix} = \begin{pmatrix} 1 & -2 \\ 1 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ 0 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(4 + m)\, x + 2y - z == 2 + 2m$
$x + y == 0$
$-x - y + z == 2$

has only a solution. For that solution compute the value of variable x

1) $x = 5$.

2) $x = 2$.

3) $x = 1$.

4) $x = -2$.

5) $x = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (-2\ 5), (1\ -3) \rangle$

1) $\begin{pmatrix} -1 & 0 \\ -1 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} -1 & -2 \\ -2 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & -2 \\ 0 & -3 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 3 \\ -3 & 0 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 10

Exercise 1

We have a bank account that initially offers a continuous compound rate of 8% , and after 1 year the conditions are modified and then we obtain a periodic compound interes rate of 8% in 10 periods (compounding frequency) . The initial deposit is 14 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****8.***** euros.

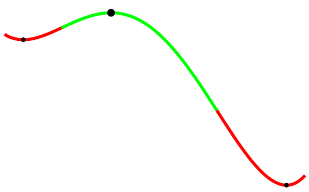
3) We will have ****7.***** euros.

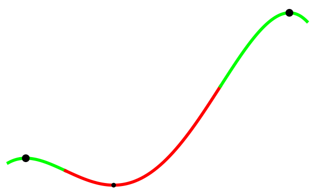
4) We will have ****9.***** euros.

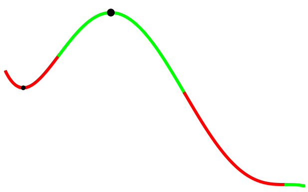
5) We will have ****1.***** euros.

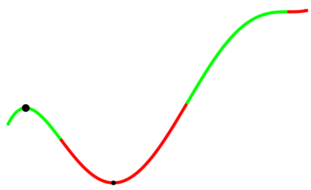
Exercise 2

Study the shape properties of the $f(x) = 4 + 120x^2 - 45x^4 + 12x^5$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound
interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(3t + 3t^2 + t^3\right)$ per-unit.

The initial deposit in the account is 7000 euros. Compute the deposit after 3 years.

1) 12860.8525 euros

2) 12840.8525 euros

3) 12850.8525 euros

4) 12852.0868 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} 3 & 1 \\ 2 & 1 \end{pmatrix} = \begin{pmatrix} 6 & 2 \\ 3 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-3 + m)\, x - y + 2z == -7 + 2m$
$-2x - y + 2z == -5$
$x - z == 3$

has only a solution. For that solution compute the value of variable z

1) $z = 5$.

2) $z = -8$.

3) $z = -3$.

4) $z = -4$.

5) $z = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-4\ \ 3), (-3\ \ 2) \rangle$

1) $\begin{pmatrix} -3 & -3 \\ 1 & -2 \end{pmatrix}$ 2) $\begin{pmatrix} -1 & 0 \\ -3 & 1 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 2 \\ 2 & -3 \end{pmatrix}$ 4) $\begin{pmatrix} 0 & -2 \\ 2 & 2 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 11

Exercise 1

We have one bank account that offers a continuous compound rate of 2% where we initially deposit 8000 euros. How long time is it necessary until the amount of money in the account reaches 10 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **0.***** years.

2) In **5.***** years.

3) In **6.***** years.

4) In **1.***** years.

5) In **8.***** years.

Exercise 2

Between the months $t=1$ and $t=7$, the funds in certain account (in millions of euros) are given by the function $F(t) = 1 + 36t - 21t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=1$ and $t=2$.

1) It oscillates between −107 and 18.

2) It oscillates between −2 and 28.

3) It oscillates between 11 and 16.

4) It oscillates between 5 and 18.

5) It oscillates between −107 and 18.

Exercise 3

Compute the area enclosed by the function $f(x) = 6x - 2x^2$ and the horizontal axis between the points $x=-4$ and $x=5$.

1) 121

2) $\frac{247}{3} = 82.3333$

3) $\frac{241}{2} = 120.5$

4) $\frac{193}{3} = 64.3333$

5) 119

6) 120

7) 99

8) 117

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix} \right) = \begin{pmatrix} 0 & 0 \\ -3 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(3 - m)\,x + m\,y + z == -1 - m$
$-2\,x + y == -1$
$3\,x - y + z == 0$

has only a solution. For that solution compute the value of variable y

1) $y = 4$.

2) $y = 9$.

3) $y = 3$.

4) $y = -2$.

5) $y = -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -8 & -6 & -6 \\ 4 & 2 & 4 \\ 4 & 4 & 2 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3\ 2\ 2)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2\ -3\ -1)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-1\ 1\ -1)$.

4) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2\ -1\ -1)$.

5) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-3\ 2\ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 12

Exercise 1

We have a bank account that initially offers a continuous compound rate of 2% , and after 2 years the conditions are modified and then we obtain a compound interes rate of 8% . The initial deposit is 5000 euros. Compute the amount of money in the account after 9 years from the moment of the first deposit.

1) We will have ****2.***** euros.

2) We will have ****9.***** euros.

3) We will have ****1.***** euros.

4) We will have ****6.***** euros.

5) We will have ****8.***** euros.

Exercise 2

Between the months $t=4$ and $t=11$, the funds in certain account (in millions of euros) are given by the function $F(t) = 7+336t-45t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=6$.

1) It oscillates between 749 and 840.

2) It oscillates between 760 and 838.

3) It oscillates between 839 and 840.

4) It oscillates between 759 and 835.

5) It oscillates between 759 and 920.

Exercise 3

Compute the area enclosed by the function $f(x) = -3+4x-x^2$ and the horizontal axis between the points $x=-3$ and $x=0$.

1) 40

2) 39

3) 36

4) 41

5) $\frac{75}{2} = 37.5$

6) 42

7) 38

8) $\frac{77}{2} = 38.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -2 \\ 1 & 1 \end{pmatrix} . \left(X - \begin{pmatrix} 0 & -1 \\ 1 & 1 \end{pmatrix} \right) = \begin{pmatrix} 3 & -2 \\ -2 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y == -1 - m$
$-2 x + 2 y + z == 3$
$-x + y + z == 1$

has only a solution. For that solution compute the value of variable x

1) $x = 5$.

2) $x = -4$.

3) $x = -2$.

4) $x = 6$.

5) $x = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2 \;\; -5) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-1 \;\; 3) \rangle$

1) $\begin{pmatrix} -11 & -20 \\ 6 & 11 \end{pmatrix}$ 2) $\begin{pmatrix} -11 & 6 \\ -20 & 11 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & 0 \\ -3 & -3 \end{pmatrix}$ 4) $\begin{pmatrix} -11 & 30 \\ -4 & 11 \end{pmatrix}$ 5) $\begin{pmatrix} -11 & -4 \\ 30 & 11 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 13

Exercise 1

We have a bank account that initially offers a continuous compound rate of 4% , and after 3 years the conditions are modified and then we obtain a periodic compound interes rate of 6% in 6 periods (compounding frequency) . The initial deposit is 12 000 euros. Compute the amount of money in the account after 7 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****9.***** euros.

3) We will have ****0.***** euros.

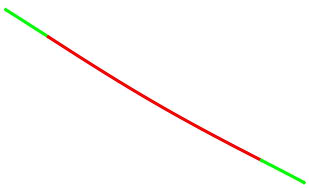
4) We will have ****7.***** euros.

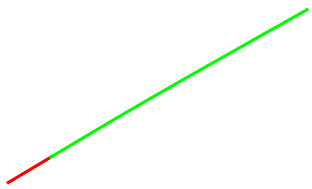
5) We will have ****2.***** euros.

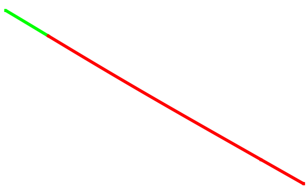
Exercise 2

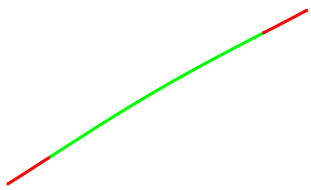
Study the shape properties of $f(x) = 3 - 24 x^2 + 16 x^3 - 5 x^4 + \frac{3 x^5}{5}$

to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \left(\frac{1}{100}(-5 + 8t)\right)\sin(5t) \text{ per-unit.}$$

The initial deposit in the account is 19 000 euros. Compute the deposit after 4π years.

1) 15599.3738 euros

2) 15519.3738 euros

3) 15539.3738 euros

4) 15629.3738 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 2 & 3 \\ 1 & 2 \end{pmatrix}\right) \cdot \begin{pmatrix} -3 & -4 \\ -2 & -3 \end{pmatrix} = \begin{pmatrix} -12 & -17 \\ -7 & -10 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * \\ 0 & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ 1 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$$x - 2y - z == -5$$
$$x - y - z == -3$$
$$(-1 + m)\, x + 2y + z == 5 - 2m$$

has only a solution. For that solution compute the value of variable z

1) $z = 3$.

2) $z = 7$.

3) $z = 4$.

4) $z = -1$.

5) $z = -9$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(8\ \ 3)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2\ \ 0)$.

3) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(1\ \ -1)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1\ \ -1)$.

5) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(8\ \ 3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 14

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 1% in 9 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a periodic compound interes rate of 1% in 2 periods (compounding frequency). The initial deposit is 11 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****5.***** euros.

3) We will have ****1.***** euros.

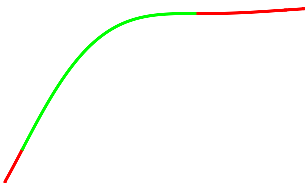
4) We will have ****9.***** euros.

5) We will have ****4.***** euros.

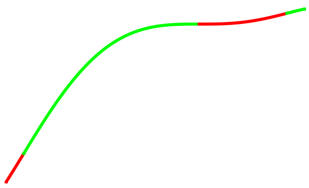
Exercise 2

Study the shape properties of $f(x) = 1 + 20x^3 - 15x^4 + 2x^6$ to decide which amongst the following ones is the representation of the function.

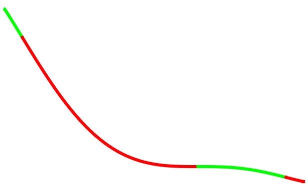
1)



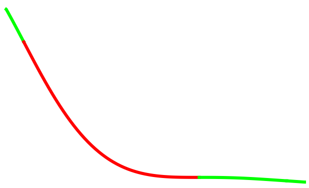
2)



3)



4)



● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -6x + 3x^2$ and the horizontal axis between the points $x = -5$ and $x = 4$.

1) 224

2) 216

3) $\frac{453}{2} = 226.5$

4) 184

5) 176

6) 227

7) $\frac{451}{2} = 225.5$

8) 226

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} -1 & -1 & 1 \\ 0 & 1 & 0 \\ -2 & 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} 2 & 1 & 1 \\ -3 & -1 & 0 \\ -3 & -1 & 1 \end{pmatrix} = \begin{pmatrix} -7 & -3 & -1 \\ 1 & 0 & -2 \\ -2 & -1 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ -1 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + y - 2 z == -2 + m$
$x + y - z == -1$
$-2 x - 2 y + 3 z == 2$

has only a solution.

1) We have unique solution for $m \neq 4$.

2) We have unique solution for $m \leq -3$.

3) We have unique solution for $m \leq 2$.

4) We have unique solution for $m \leq 4$.

5) We have unique solution for $m \neq -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-1 \;\; -4) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (2 \;\; 7) \rangle$

1) $\begin{pmatrix} -3 & 0 \\ -3 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} 15 & 56 \\ -4 & -15 \end{pmatrix}$ 3) $\begin{pmatrix} 15 & 8 \\ -28 & -15 \end{pmatrix}$ 4) $\begin{pmatrix} 15 & -4 \\ 56 & -15 \end{pmatrix}$ 5) $\begin{pmatrix} 15 & -28 \\ 8 & -15 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 15

Exercise 1

We have one bank account that offers a periodic compound interes rate of 3% in 3 periods (compounding frequency) where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 21 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **8.***** years.

2) In **4.***** years.

3) In **7.***** years.

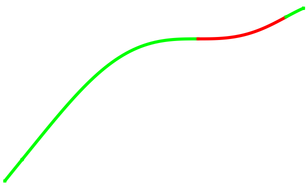
4) In **0.***** years.

5) In **5.***** years.

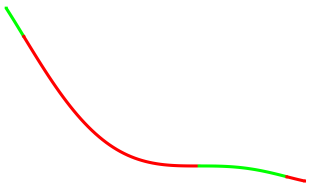
Exercise 2

Study the shape properties of $f(x) = 4 - 40x^3 + 9x^5 + 2x^6$ to decide which amongst the following ones is the representation of the function.

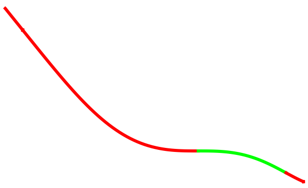
1)



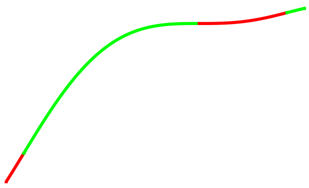
2)



3)



4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{8} e^{-9+3t}$ per-unit.

The initial deposit in the account is 12 000 euros. Compute the deposit after 3 years.

1) 12600.4985 euros

2) 12590.4985 euros

3) 12530.4985 euros

4) 12510.4985 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix} . X . \begin{pmatrix} 1 & 2 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} 5 & 8 \\ -3 & -5 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1+m)\,x - y + z == -2 + 2\,m$
$-3\,x + y == -7$
$-2\,x + z == -5$

has only a solution. For that solution compute the value of variable y

1) $y = -1$.

2) $y = -6$.

3) $y = 2$.

4) $y = 8$.

5) $y = -8$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (17 \;\; 12) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (7 \;\; 5) \rangle$

1) $\begin{pmatrix} -169 & -70 \\ 408 & 169 \end{pmatrix}$ 2) $\begin{pmatrix} -169 & -120 \\ 238 & 169 \end{pmatrix}$ 3) $\begin{pmatrix} -169 & 408 \\ -70 & 169 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 0 \\ 1 & -2 \end{pmatrix}$ 5) $\begin{pmatrix} -169 & 238 \\ -120 & 169 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 16

Exercise 1

We have one bank account that offers a compound interes rate of 1% where we initially deposit 9000 euros. How long time is it necessary until the amount of money in the account reaches 16 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **6.***** years.

2) In **7.***** years.

3) In **2.***** years.

4) In **9.***** years.

5) In **0.***** years.

Exercise 2

Between the months $t=3$ and $t=10$, the funds in certain account (in millions of euros) are given by the function $F(t) = -6 + 540\,t - 57\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t=3$ and $t=5$.

1) It oscillates between 1694 and 1695.

2) It oscillates between 1155 and 1519.

3) It oscillates between 1153 and 1527.

4) It oscillates between 1155 and 1695.

5) It oscillates between 1164 and 1526.

Exercise 3

Compute the area enclosed by the function $f(x) = 9 + 6\,x - 3\,x^2$ and the horizontal axis between the points $x=-5$ and $x=0$.

1) $\frac{337}{2} = 168.5$

2) 168

3) 165

4) $\frac{335}{2} = 167.5$

5) 155

6) 167

7) $\frac{339}{2} = 169.5$

8) 169

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 0 & 1 \\ -1 & -2 \end{pmatrix}\right) \cdot \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} 0 & 0 \\ 0 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-3+m)\,x + y - 3z == 8 - m$
$2x - y + 3z == -7$
$x - y + 2z == -4$

has only a solution. For that solution compute the value of variable y

1) $y = 1$.

2) $y = 6$.

3) $y = -6$.

4) $y = -1$.

5) $y = -8$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2\ \ 0)$.

2) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1\ \ 2)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-2\ \ 2)$.

4) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-5\ \ -3)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1\ \ 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1),(0,1,1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by ⟨(2,1)⟩, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 17

Exercise 1

We have a bank account that initially offers a continuous compound rate of 3% , and after 4 years the conditions are modified and then we obtain a periodic compound interes rate of 1% in 11 periods (compounding frequency) . The initial deposit is 14 000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****0.***** euros.

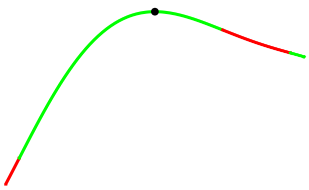
3) We will have ****7.***** euros.

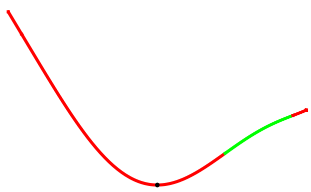
4) We will have ****5.***** euros.

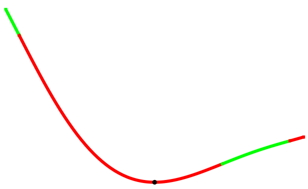
5) We will have ****4.***** euros.

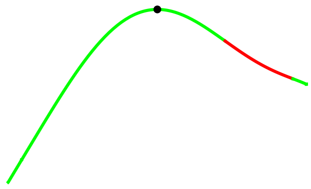
Exercise 2

Study the shape properties of $f(x) = 3 + 24x^2 - 8x^3 - x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

— Red line: convexity

— Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 4x - 2x^2 - 2x^3$ and the horizontal axis between the points $x = -2$ and $x = 2$.

1) $\frac{46}{3} = 15.3333$

2) 0

3) $\frac{32}{3} = 10.6667$

4) $\frac{37}{3} = 12.3333$

5) $\frac{55}{3} = 18.3333$

6) $\frac{49}{3} = 16.3333$

7) $\frac{43}{3} = 14.3333$

8) $\frac{52}{3} = 17.3333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} \right) = \begin{pmatrix} -1 & 2 \\ 0 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - 3 y - 2 z == 4 - m$
$x + y == -3$
$y + z == -1$

has only a solution. For that solution compute the value of variable z

1) $z = -9$.

2) $z = -8$.

3) $z = -4$.

4) $z = 8$.

5) $z = 1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -2 & 1 \\ -4 & 2 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2 \;\; -1)$.

2) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(3 \;\; 1)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(1 \;\; 2)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-2 \;\; 2)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(0 \;\; -1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 18

Exercise 1

We have one bank account that offers a periodic compound interes rate of 2% in 5 periods (compounding frequency) where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **5.***** years.

2) In **2.***** years.

3) In **1.***** years.

4) In **7.***** years.

5) In **0.***** years.

Exercise 2

Between the months $t=4$ and $t=11$, the funds in certain account (in millions of euros) are given by the function $F(t)=11+360t-48t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=9$ and $t=11$.

1) It oscillates between 814 and 834.

2) It oscillates between 811 and 825.

3) It oscillates between 811 and 875.

4) It oscillates between 820 and 833.

5) It oscillates between 811 and 875.

Exercise 3

Compute the area enclosed by the function $f(x) = -12 - 2x + 2x^2$ and the horizontal axis between the points $x = -5$ and $x = 0$.

1) $\frac{245}{3} = 81.6667$

2) $\frac{145}{3} = 48.3333$

3) $\frac{481}{6} = 80.1667$

4) $\frac{475}{6} = 79.1667$

5) $\frac{233}{3} = 77.6667$

6) $\frac{487}{6} = 81.1667$

7) $\frac{493}{6} = 82.1667$

8) $\frac{239}{3} = 79.6667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 3 \\ -1 & -2 \end{pmatrix} . X . \begin{pmatrix} 2 & 1 \\ -3 & -1 \end{pmatrix} = \begin{pmatrix} 5 & 1 \\ -4 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + m y + 2 m z == -6 m$
$-x - 2 z == 4$
$y + z == -4$

has only a solution. For that solution compute the value of variable x

1) $x = -1$.

2) $x = 0$.

3) $x = 5$.

4) $x = 7$.

5) $x = -3$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -18 & -10 & -6 \\ 8 & 3 & 3 \\ 44 & 28 & 14 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} 1 & -1 & -1 \end{pmatrix}$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $\begin{pmatrix} 3 & 0 & 3 \end{pmatrix}$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} 2 & 1 & 2 \end{pmatrix}$.

4) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} 2 & -1 & -4 \end{pmatrix}$.

5) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $\begin{pmatrix} 2 & -1 & -4 \end{pmatrix}$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 19

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 2% in 11 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a continuous compound rate of 9%. The initial deposit is 10 000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****0.***** euros.

3) We will have ****2.***** euros.

4) We will have ****7.***** euros.

5) We will have ****3.***** euros.

Exercise 2

Between the months $t=2$ and $t=7$, the true value of the shares of a company (in euros) are given by the function $C(t) = 27 + 48t - 18t^2 + 2t^3$.

Determine the interval where the value oscillates between the months $t=3$ and $t=6$.

1) It oscillates between 62 and 100.

2) It oscillates between 50 and 106.

3) It oscillates between 59 and 167.

4) It oscillates between 59 and 67.

5) It oscillates between 59 and 99.

Exercise 3

Compute the area enclosed by the function $f(x) = 18 + 9x - 2x^2 - x^3$ and the horizontal axis between the points $x = -2$ and $x = 4$.

1) $\frac{286}{3} = 95.3333$

2) $\frac{283}{3} = 94.3333$

3) $\frac{575}{6} = 95.8333$

4) $\frac{563}{6} = 93.8333$

5) $\frac{569}{6} = 94.8333$

6) $\frac{280}{3} = 93.3333$

7) $\frac{551}{6} = 91.8333$

8) 54

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -2 & -2 \\ -3 & -4 & -5 \\ 2 & 3 & 3 \end{pmatrix}^{-1} . X + \begin{pmatrix} 0 & -1 & -4 \\ 1 & 2 & 5 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 3 & 4 & -9 \\ 0 & 3 & 4 \\ -1 & -4 & 5 \end{pmatrix}$$

1) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$m x - z == -1 + 2 m$
$2 x - y - 2 z == 1$
$-x + y + z == 0$

has only a solution.

1) We have unique solution for $m \neq -1$.

2) We have unique solution for $m \leq -3$.

3) We have unique solution for $m \leq 3$.

4) We have unique solution for $m \geq -3$.

5) We have unique solution for $m \neq 3$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3 \ \ -4) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (4 \ \ -5) \rangle$

1) $\begin{pmatrix} 31 & -40 \\ 24 & -31 \end{pmatrix}$ 2) $\begin{pmatrix} 31 & 24 \\ -40 & -31 \end{pmatrix}$ 3) $\begin{pmatrix} 31 & -24 \\ 40 & -31 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -1 \\ 2 & 2 \end{pmatrix}$ 5) $\begin{pmatrix} 31 & 40 \\ -24 & -31 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 20

Exercise 1

We have a bank account that initially offers a continuous compound rate of 3% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 6% . The initial deposit is 5000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****2.***** euros.

2) We will have ****6.***** euros.

3) We will have ****9.***** euros.

4) We will have ****5.***** euros.

5) We will have ****7.***** euros.

Exercise 2

Between the months $t=0$ and $t=5$, the true value of the shares of a company (in euros) are given by the function $C(t)=8+48t-18t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=2$ and $t=4$.

1) It oscillates between 8 and 48.

2) It oscillates between 30 and 52.

3) It oscillates between 40 and 48.

4) It oscillates between 50 and 45.

5) It oscillates between 40 and 42.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t)=\left(\frac{2-t}{198}\right)e^{-1+3t}$ per-unit.

The initial deposit in the account is 18000 euros. Compute the deposit after 2 years.

1) 19525.0691 euros

2) 19535.0691 euros

3) 19515.0691 euros

4) 19615.0691 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 & -1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}^{-1} .X - \begin{pmatrix} 1 & 0 & 2 \\ 0 & 0 & -1 \\ 1 & 1 & 1 \end{pmatrix} = \begin{pmatrix} 0 & -2 & -3 \\ -1 & 0 & 1 \\ -2 & -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + m z == -3 m$
$m x + y + m z == -2 - 3 m$
$-x - y == 3$

has only a solution.

1) We have unique solution for $m \le 4$.

2) We have unique solution for $m \ne -2$.

3) We have unique solution for $m \le 3$.

4) We have unique solution for $m \le -4$.

5) We have unique solution for $m \ne 2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & 1 & 3 \\ -6 & 10 & 27 \\ 2 & -3 & -8 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(1\ 6\ -2)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-2\ -1\ -1)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-3\ 1\ 2)$.

4) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(1\ 6\ -2)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(1\ -2\ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors $((1,1,-1),(0,1,1)$ and $(1,0,1))$ for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 21

Exercise 1

We have a bank account that initially offers a compound interes rate of 3% , and after 2 years the conditions are modified and then we obtain a compound interes rate of 7% . The initial deposit is 5000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****0.***** euros.

3) We will have ****7.***** euros.

4) We will have ****8.***** euros.

5) We will have ****3.***** euros.

Exercise 2

Between the months $t=0$ and $t=7$, the funds in certain account (in millions of euros) are given by the function $F(t) = -17 - 18t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=4$.

1) It oscillates between −233 and −17.

2) It oscillates between −171 and −71.

3) It oscillates between −233 and −17.

4) It oscillates between −177 and −73.

5) It oscillates between −170 and −63.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\sin(-1+3t)$ per-unit.

The initial deposit in the account is 4000 euros. Compute the deposit after 4π years.

1) 4060 euros

2) 4080 euros

3) 4000 euros

4) 3920 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -3 \\ 3 & 8 \end{pmatrix}^{-1} . X - \begin{pmatrix} 2 & 3 \\ 3 & 5 \end{pmatrix} = \begin{pmatrix} -10 & -11 \\ 0 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m)\, x + y + z == -3$
$2\, x + y + 2\, z == -5$
$x + z == -2$

has only a solution. For that solution compute the value of variable y

1) $y = -1$.

2) $y = -4$.

3) $y = -9$.

4) $y = 6$.

5) $y = 5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -44 & 9 \\ -196 & 40 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3 \;\; -14)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(3 \;\; 1)$.

3) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(0 \;\; -2)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1 \;\; -2)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2 \;\; 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1),(0,1,1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by ⟨(2,1)⟩, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 22

Exercise 1

We have a bank account that initially offers a compound interes rate of 9%
, and after 1 year the conditions are modified and then we obtain a
periodic compound interes rate of 10% in 6 periods (compounding frequency)
. The initial deposit is 13 000 euros. Compute the amount of money in the account after
3 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****8.***** euros.

3) We will have ****0.***** euros.

4) We will have ****5.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Between the months $t=1$ and $t=7$
, the true value of the shares of a company (in euros) are given by the function $C(t)=51+84t-27t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=2$ and $t=4$.

1) It oscillates between 87 and 118.

2) It oscillates between 82 and 122.

3) It oscillates between 2 and 127.

4) It oscillates between 83 and 127.

5) It oscillates between 2 and 127.

Exercise 3

Certain bank account offers a variable continuous compound
interes rate. The interest rate for each year is given by the function

$I(t)=(\frac{1}{100}(3+t+t^2))\log(4t)$ per-unit.

In the year t=1 we deposint in the account 18 000
euros. Compute the deposit in the account after (with respect to t=1) 2 years.

1) 26754.3832 euros

2) 26774.3832 euros

3) 26824.3832 euros

4) 26814.3832 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 4 & 3 \\ 0 & -2 & -3 \\ 0 & 1 & 1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} 1 & 0 & 1 \\ -1 & 0 & 0 \\ 0 & -1 & 2 \end{pmatrix} \right) = \begin{pmatrix} -2 & -11 & 7 \\ 1 & 6 & -4 \\ -1 & -4 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y == 2 - m$
$y + z == -1$
$m x + 2 z == 2 - m$

has only a solution.

1) We have unique solution for $m \neq 1$.

2) We have unique solution for $m \geq -4$.

3) We have unique solution for $m \neq -1$.

4) We have unique solution for $m \leq 3$.

5) We have unique solution for $m \neq 0$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 3 & -2 \\ 4 & -3 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1 \ \ 1)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(0 \ \ -2)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(3 \ \ 3)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1 \ \ -2)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2 \ \ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvales is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1),(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 23

Exercise 1

We have one bank account that offers a compound interes rate of 6% where we initially deposit 14 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **2.***** years.

2) In **7.***** years.

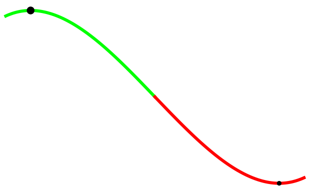
3) In **4.***** years.

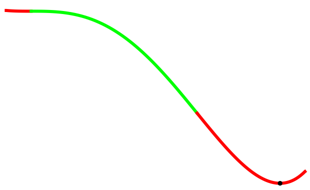
4) In **9.***** years.

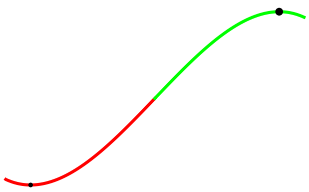
5) In **0.***** years.

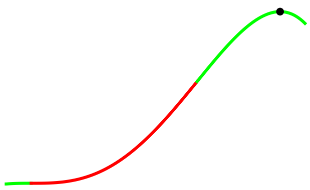
Exercise 2

Study the shape properties of the $f(x) = 4 + 24 x^2 + 16 x^3 + 3 x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -18 - 15x + 6x^2 + 3x^3$ and the horizontal axis between the points $x = -2$ and $x = 2$.

1) 56

2) $\frac{115}{2} = 57.5$

3) 58

4) $\frac{113}{2} = 56.5$

5) $\frac{109}{2} = 54.5$

6) 40

7) 57

8) $\frac{117}{2} = 58.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 5 & -1 & -2 \\ -4 & 1 & 1 \\ 1 & 0 & 0 \end{pmatrix}^{-1} .X. \begin{pmatrix} 3 & -5 & -1 \\ -2 & 4 & 1 \\ 1 & -2 & 0 \end{pmatrix}^{-1} = \begin{pmatrix} -1 & -1 & 0 \\ 5 & 6 & -3 \\ -6 & -7 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x + m y == 2 - m$
$-2x + (1 + m) y + z == 2 - m$
$-x + y + 2z == -1$

has only a solution.

1) We have unique solution for $m \neq -1$.

2) We have unique solution for $m \geq -2$.

3) We have unique solution for $m \neq 4$.

4) We have unique solution for $m \neq 1$.

5) We have unique solution for $m \geq -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -76 & -34 & -16 \\ 123 & 55 & 26 \\ 99 & 45 & 20 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda=-5$ is an eigenvalue with eigenvector $\begin{pmatrix} 7 & -11 & -9 \end{pmatrix}$.

2) The matrix is diagonalizable and $\lambda=-2$ is an eigenvalue with eigenvector $\begin{pmatrix} 7 & -11 & -9 \end{pmatrix}$.

3) The matrix is diagonalizable and $\lambda=2$ is an eigenvalue with eigenvector $\begin{pmatrix} -1 & -2 & 0 \end{pmatrix}$.

4) The matrix is diagonalizable and $\lambda=-1$ is an eigenvalue with eigenvector $\begin{pmatrix} -3 & -1 & -3 \end{pmatrix}$.

5) The matrix is diagonalizable and $\lambda=-2$ is an eigenvalue with eigenvector $\begin{pmatrix} -3 & 5 & 4 \end{pmatrix}$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 24

Exercise 1

We have one bank account that offers a periodic compound interes rate of 3% in 8 periods (compounding frequency) where we initially deposit 14 000 euros. How long time is it necessary until the amount of money in the account reaches 21 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **3.***** years.

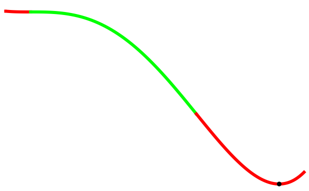
3) In **1.***** years.

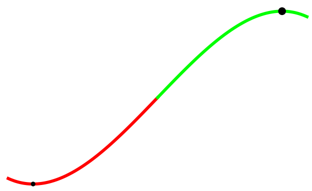
4) In **4.***** years.

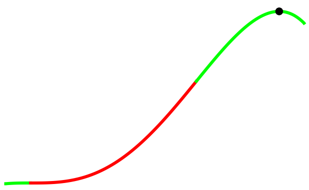
5) In **0.***** years.

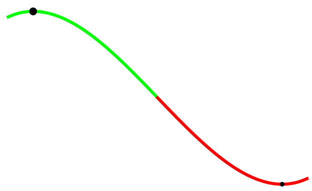
Exercise 2

Study the shape properties of the $f(x) = 5 - 8x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(2 t^2 + t^3\right)$ per-unit.

The initial deposit in the account is 9000 euros. Compute the deposit after 1 year.

1) 9092.8793 euros

2) 9072.8793 euros

3) 9132.8793 euros

4) 9082.8793 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 2 & 4 \\ 0 & -1 & -3 \\ 0 & 1 & 2 \end{pmatrix} . \left(X - \begin{pmatrix} 1 & 0 & 0 \\ -2 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix} \right) = \begin{pmatrix} 1 & -4 & -5 \\ 0 & 2 & 3 \\ 1 & -2 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2 + m)\, x + 2 y - 3 z == -10 + 2 m$
$2 x - y + 2 z == 8$
$3 x - 2 y + 3 z == 12$

has only a solution.

1) We have unique solution for $m \neq -3$.

2) We have unique solution for $m \geq -4$.

3) We have unique solution for $m \geq -5$.

4) We have unique solution for $m \geq 2$.

5) We have unique solution for $m \neq 2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -3 & 0 & 6 \\ 0 & 0 & 0 \\ -2 & 0 & 4 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(6\ 1\ 3)$.

2) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(3\ 3\ 2)$.

3) The matrix is diagonalizable and $\lambda = 4$ is an eigenvalue with eigenvector $(-1\ 1\ -1)$.

4) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(2\ -1\ -1)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(4\ 1\ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 25

Exercise 1

We have a bank account that initially offers a continuous compound rate of 9% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 6% . The initial deposit is 13 000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****9.***** euros.

2) We will have ****2.***** euros.

3) We will have ****3.***** euros.

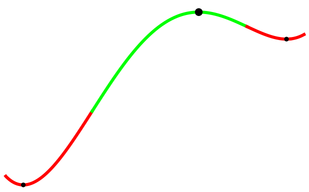
4) We will have ****5.***** euros.

5) We will have ****8.***** euros.

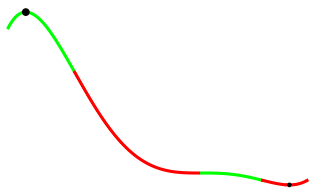
Exercise 2

Study the shape properties of the $f(x) = 5 - 40x^3 + 15x^4 + 12x^5$ to decide which amongst the following ones is the representation of the function.

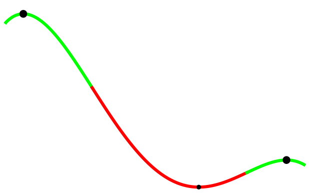
1)



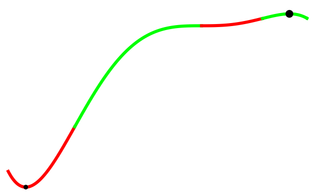
2)



3)



4)



Big point: maximum — Small point: minimum

Red line: convexity — Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -6 + 3x + 3x^2$ and the horizontal axis between the points $x = -4$ and $x = 2$.

1) 47

2) $\frac{93}{2} = 46.5$

3) 45

4) 48

5) 7

6) 34

7) 18

8) $\frac{95}{2} = 47.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & 1 & -1 \\ 1 & 1 & -1 \\ -2 & -1 & 2 \end{pmatrix} . X . \begin{pmatrix} 1 & 1 & -2 \\ -1 & 0 & 1 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 4 & 2 & -7 \\ 2 & 1 & -3 \\ -3 & -2 & 5 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$m x - 3 y + (1 + m) z == -5$$
$$-x + y - z == 1$$
$$x - 2 y + 2 z == -4$$

has only a solution.

1) We have unique solution for $m \le 5$.

2) We have unique solution for $m \ge -1$.

3) We have unique solution for $m \le -1$.

4) We have unique solution for $m \ne 3$.

5) We have unique solution for $m \ne 4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (3\ \ -1), (7\ \ -2) \rangle$

1) $\begin{pmatrix} -3 & 1 \\ -2 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 2 \\ -3 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & 0 \\ 3 & -1 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 2 \\ 1 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 26

Exercise 1

We have one bank account that offers a compound interes rate of 3% where we initially deposit 15 000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **8.***** years.

2) In **9.***** years.

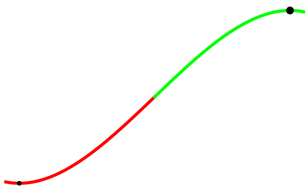
3) In **6.***** years.

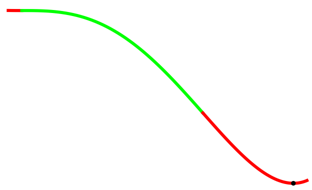
4) In **4.***** years.

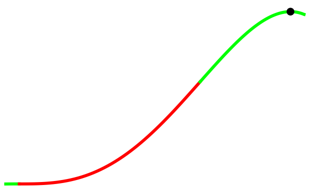
5) In **0.***** years.

Exercise 2

Study the shape properties of the $f(x) = 1 - 96x - 24x^2 + 8x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -9 - 12x - 3x^2$ and the horizontal axis between the points $x = -2$ and $x = 1$.

1) $\frac{51}{2} = 25.5$

2) 25

3) $\frac{47}{2} = 23.5$

4) 26

5) 24

6) 18

7) 22

8) $\frac{49}{2} = 24.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -2 & 1 \\ 1 & -1 \end{pmatrix} . X + \begin{pmatrix} 0 & -1 \\ 1 & 2 \end{pmatrix} = \begin{pmatrix} 0 & 2 \\ 1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-5 + m)\,x - 2y - z == 9 - m$
$3x + 2y + z == -7$
$x + y + z == -4$

has only a solution. For that solution compute the value of variable y

1) $y = -7$.

2) $y = 1$.

3) $y = -3$.

4) $y = 8$.

5) $y = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (11 \;\; -18) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (8 \;\; -13) \rangle$

1) $\begin{pmatrix} 143 & 104 \\ -198 & -144 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -3 \\ 2 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} 143 & 88 \\ -234 & -144 \end{pmatrix}$ 4) $\begin{pmatrix} 143 & -198 \\ 104 & -144 \end{pmatrix}$ 5) $\begin{pmatrix} 143 & -234 \\ 88 & -144 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 27

Exercise 1

We have one bank account that offers a compound interes rate of 1% where we initially deposit 6000 euros. How long time is it necessary until the amount of money in the account reaches 8000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **3.***** years.

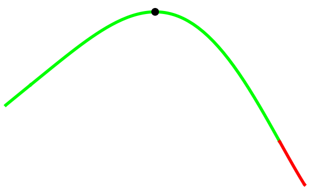
3) In **8.***** years.

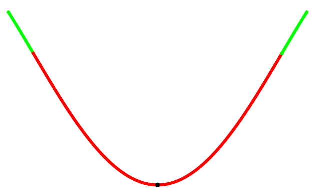
4) In **0.***** years.

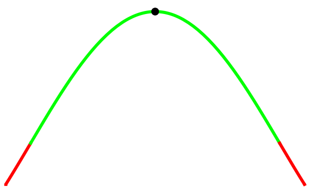
5) In **2.***** years.

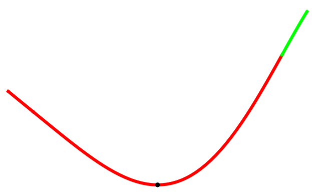
Exercise 2

Study the shape properties of $f(x) = 1 - 3x^2 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -9 + 6x + 3x^2$ and the horizontal axis between the points $x = -2$ and $x = 1$.

1) $\frac{61}{2} = 30.5$

2) $\frac{59}{2} = 29.5$

3) 30

4) $\frac{63}{2} = 31.5$

5) 29

6) 31

7) $\frac{57}{2} = 28.5$

8) 27

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 1 & -1 \\ 1 & 0 \end{pmatrix}\right) . \begin{pmatrix} 1 & -1 \\ -2 & 3 \end{pmatrix}^{-1} = \begin{pmatrix} -2 & 0 \\ 0 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(4 + m)\, x + y - z == -1$
$x + y == -1$
$-x + z == 0$

has only a solution. For that solution compute the value of variable y

1) $y = 2$.

2) $y = -9$.

3) $y = -1$.

4) $y = 4$.

5) $y = 7$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3 \ \ -2) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (5 \ \ -3) \rangle$

1) $\begin{pmatrix} -3 & -3 \\ -1 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} 9 & 15 \\ -6 & -10 \end{pmatrix}$ 3) $\begin{pmatrix} 9 & -6 \\ 15 & -10 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -1 \\ -1 & 0 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & -3 \\ -3 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 28

Exercise 1

We have one bank account that offers a continuous compound rate of 5% where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 19 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **5.***** years.

2) In **2.***** years.

3) In **0.***** years.

4) In **3.***** years.

5) In **9.***** years.

Exercise 2

Between the months $t=3$ and $t=8$, the true value of the shares of a company (in euros) are given by the function $C(t) = 88 + 90\,t - 24\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t=3$ and $t=8$.

1) It oscillates between 181 and 300.

2) It oscillates between 188 and 296.

3) It oscillates between 187 and 294.

4) It oscillates between 188 and 196.

5) It oscillates between 183 and 290.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\cos(-7+3\,t)$ per-unit.

The initial deposit in the account is 5000 euros. Compute the deposit after 5π years.

1) 5188.4299 euros

2) 5223.8622 euros

3) 5143.8622 euros

4) 5193.8622 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 2 & 0 & -1 \\ -1 & 1 & 0 \\ -1 & 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} 2 & 1 & 0 \\ 3 & 2 & 0 \\ 3 & 2 & 1 \end{pmatrix} = \begin{pmatrix} -3 & -3 & -2 \\ 2 & 2 & 1 \\ -4 & -2 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ 1 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$(-1 + m)\, x - y - z == -2 - 2\, m$
$2\, x + 5\, y + 3\, z == 12$
$x + 3\, y + 2\, z == 8$

has only a solution.

1) We have unique solution for $m \geq -3$.

2) We have unique solution for $m \neq 4$.

3) We have unique solution for $m \neq 1$.

4) We have unique solution for $m \leq 3$.

5) We have unique solution for $m \neq 0$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -16 & -15 \\ 18 & 17 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2\ \ -2)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1\ \ 0)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1\ \ 1)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(5\ \ -6)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1\ \ 1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 29

Exercise 1

We have one bank account that offers a compound interes rate of 6% where we initially deposit 8000 euros. How long time is it necessary until the amount of money in the account reaches 16 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **3.***** years.

2) In **0.***** years.

3) In **8.***** years.

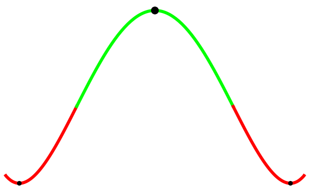
4) In **1.***** years.

5) In **4.***** years.

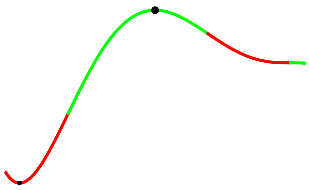
Exercise 2

Study the shape properties of the $f(x) = 3 + 240 x^2 - 80 x^3 - 30 x^4 + 12 x^5$ to decide which amongst the following ones is the representation of the function.

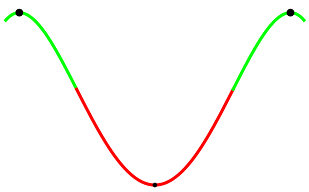
1)



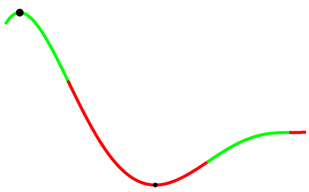
2)



3)



4)



● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(3+2t)\right)\log(5t)$ per-unit.

In the year $t=1$ we deposint in the account 15 000 euros. Compute the deposit in the account after (with respect to $t=1$) 3 years.

1) 27590.6714 euros

2) 27640.6714 euros

3) 27620.6714 euros

4) 27670.6714 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 4 & 1 \\ -1 & 0 \end{pmatrix} \cdot \left(X + \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix}\right) = \begin{pmatrix} 8 & -15 \\ -2 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + y + z == 4 + m$
$(-1 + m)\, x + 3 y + 2 z == 9 + m$
$-x + y + z == 3$

has only a solution. For that solution compute the value of variable y

1) $y = 2$.

2) $y = -3$.

3) $y = 3$.

4) $y = -5$.

5) $y = 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (5 \ -3), (-3 \ 2) \rangle$

1) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 2) $\begin{pmatrix} -1 & 2 \\ 3 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} -1 & -2 \\ 3 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & -3 \\ 3 & -1 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & -2 \\ -2 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 30

Exercise 1

We have a bank account that initially offers a compound interes rate of 5% , and after 4 years the conditions are modified and then we obtain a continuous compound rate of 4% . The initial deposit is 10 000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****2.***** euros.

3) We will have ****1.***** euros.

4) We will have ****6.***** euros.

5) We will have ****0.***** euros.

Exercise 2

Between the months $t = 4$ and $t = 9$, the funds in certain account (in millions of euros) are given by the function $F(t) = -20 + 324\,t - 45\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t = 7$ and $t = 8$.

1) It oscillates between 684 and 736.

2) It oscillates between 716 and 729.

3) It oscillates between 715 and 730.

4) It oscillates between 709 and 736.

5) It oscillates between 711 and 737.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\cos(5 + 6\,t)$ per-unit.

The initial deposit in the account is 9000 euros. Compute the deposit after 3π years.

1) 9000 euros

2) 8980 euros

3) 8940 euros

4) 8910 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 \\ -1 & 2 \end{pmatrix}.X - \begin{pmatrix} 3 & -5 \\ -1 & 2 \end{pmatrix} = \begin{pmatrix} -4 & 5 \\ 3 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-5+m)\,x - y + 2\,z == 7 - m$
$x + y == 1$
$-x + z == 3$

has only a solution. For that solution compute the value of variable y

1) $y = 5$.

2) $y = 4$.

3) $y = 2$.

4) $y = -1$.

5) $y = 8$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle\,(-1\;\;-2)\,\rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle\,(1\;\;1)\,\rangle$

1) $\begin{pmatrix} 1 & -1 \\ 2 & -2 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 1 \\ -3 & -1 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & 0 \\ 1 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -1 \\ -3 & 0 \end{pmatrix}$ 5) $\begin{pmatrix} 1 & 2 \\ -1 & -2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 31

Exercise 1

We have one bank account that offers a continuous compound rate of 5% where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **0.***** years.

2) In **2.***** years.

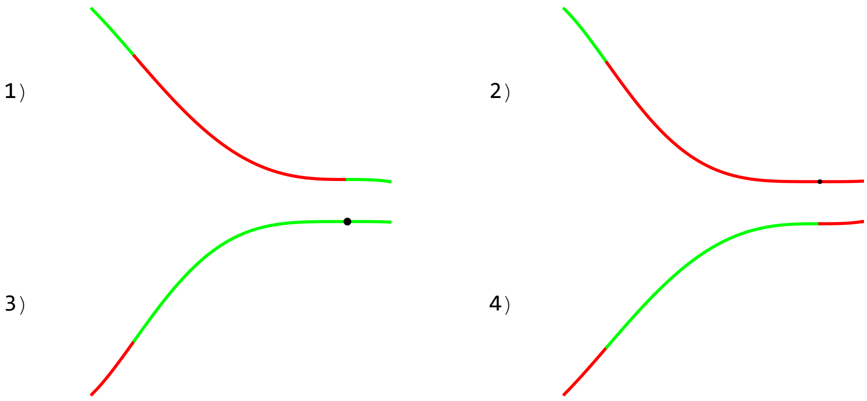
3) In **8.***** years.

4) In **1.***** years.

5) In **4.***** years.

Exercise 2

Study the shape properties of $f(x) = 3 + x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 4 - x^2$ and the horizontal axis between the points $x = -4$ and $x = -1$.

1) $\frac{46}{3} = 15.3333$

2) $\frac{83}{6} = 13.8333$

3) $\frac{95}{6} = 15.8333$

4) $\frac{49}{3} = 16.3333$

5) $\frac{37}{3} = 12.3333$

6) 9

7) $\frac{43}{3} = 14.3333$

8) $\frac{89}{6} = 14.8333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 3 & 0 & 2 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix} . X . \begin{pmatrix} 1 & 4 & 2 \\ 1 & 5 & 3 \\ 1 & 4 & 3 \end{pmatrix}^{-1} = \begin{pmatrix} 8 & 1 & -8 \\ 1 & -1 & 0 \\ 2 & 2 & -4 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(2 + m) x - 2 y - 2 z == 8 + m$
$m x - z == 1 + m$
$-x + y + z == -4$

has only a solution.

1) We have unique solution for $m \leq 3$.

2) We have unique solution for $m \geq 4$.

3) We have unique solution for $m \geq -3$.

4) We have unique solution for $m \neq 2$.

5) We have unique solution for $m \neq 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-5\ \ -2) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (13\ \ 5) \rangle$

1) $\begin{pmatrix} 25 & 10 \\ -65 & -26 \end{pmatrix}$ 2) $\begin{pmatrix} 25 & -65 \\ 10 & -26 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & -3 \\ 1 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 2 \\ -1 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & -3 \\ -2 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 32

Exercise 1

We have one bank account that offers a compound interes rate of 5% where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 20 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **1.***** years.

2) In **2.***** years.

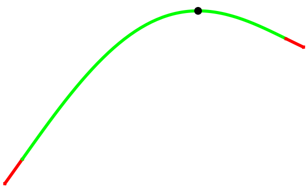
3) In **7.***** years.

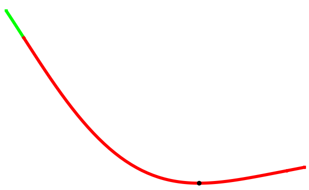
4) In **5.***** years.

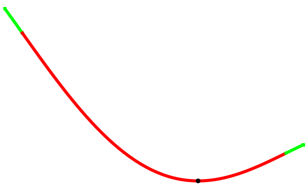
5) In **0.***** years.

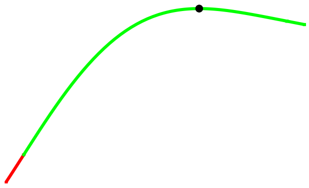
Exercise 2

Study the shape properties of $f(x) = 5 + 12x^2 - 6x^3 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

●	Big point: maximum	•	Small point: minimum
——	Red line: convexity	——	Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 3x - 2x^2 - x^3$ and the horizontal axis between the points $x = -1$ and $x = 4$.

1) $\frac{323}{4} = 80.75$

2) $\frac{355}{4} = 88.75$

3) $\frac{351}{4} = 87.75$

4) $\frac{1015}{12} = 84.5833$

5) $\frac{349}{4} = 87.25$

6) $\frac{361}{4} = 90.25$

7) $\frac{359}{4} = 89.75$

8) $\frac{343}{4} = 85.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & 3 \\ 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} 5 & 2 \\ 7 & 3 \end{pmatrix} = \begin{pmatrix} 28 & 12 \\ 7 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y + z == m$
$2 x + y - 2 z == 3$
$(2 - m) x + 2 y - 2 z == 2 - m$

has only a solution. For that solution compute the value of variable x

1) $x = 6$.

2) $x = 4$.

3) $x = -2$.

4) $x = -6$.

5) $x = 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle \begin{pmatrix} -2 & -1 \end{pmatrix} \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle \begin{pmatrix} -1 & -1 \end{pmatrix} \rangle$

1) $\begin{pmatrix} -1 & -1 \\ 2 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} 0 & -3 \\ -1 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & -3 \\ 1 & 2 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & -2 \\ 2 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 33

Exercise 1

We have one bank account that offers a periodic compound interes rate of 4% in 4 periods (compounding frequency) where we initially deposit 7000 euros. How long time is it necessary until the amount of money in the account reaches 13 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **3.***** years.

2) In **0.***** years.

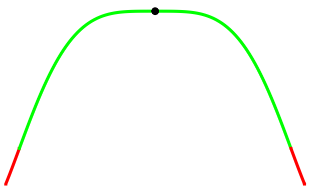
3) In **4.***** years.

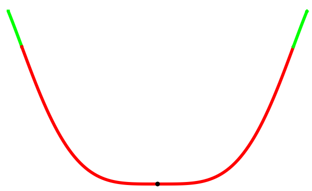
4) In **6.***** years.

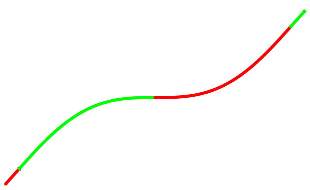
5) In **5.***** years.

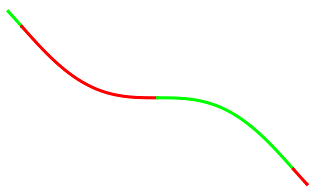
Exercise 2

Study the shape properties of $f(x) = 2 - 20x^4 + 2x^6$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -6 - 3x + 3x^2$ and the horizontal axis between the points $x = -5$ and $x = 0$.

1) $\frac{285}{2} = 142.5$

2) 142

3) $\frac{279}{2} = 139.5$

4) 144

5) 141

6) $\frac{283}{2} = 141.5$

7) $\frac{287}{2} = 143.5$

8) $\frac{265}{2} = 132.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 4 & 5 \\ 3 & 4 \end{pmatrix} . \left(X + \begin{pmatrix} 2 & -1 \\ -1 & 1 \end{pmatrix} \right) = \begin{pmatrix} -6 & 6 \\ -5 & 5 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(4 + m) x + y + z == -4 - m$
$2x + y == 0$
$-3x - 2y + z == -3$

has only a solution. For that solution compute the value of variable y

1) $y = 9$.

2) $y = 6$.

3) $y = -4$.

4) $y = 2$.

5) $y = 7$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 118 & -195 \\ 72 & -119 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} -5 & -3 \end{pmatrix}$.

2) The matrix is diagonalizable and $\lambda = 4$ is an eigenvalue with eigenvector $\begin{pmatrix} -1 & 0 \end{pmatrix}$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $\begin{pmatrix} -2 & -1 \end{pmatrix}$.

4) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} 2 & -2 \end{pmatrix}$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $\begin{pmatrix} 13 & 8 \end{pmatrix}$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 34

Exercise 1

We have a bank account that initially offers a continuous compound rate of 3% , and after 1 year the conditions are modified and then we obtain a compound interes rate of 8% . The initial deposit is 15 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****5.***** euros.

3) We will have ****0.***** euros.

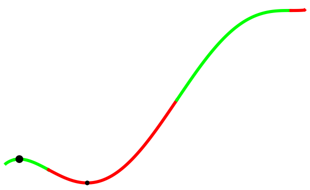
4) We will have ****2.***** euros.

5) We will have ****9.***** euros.

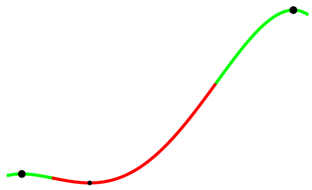
Exercise 2

Study the shape properties of the $f(x) = 1 + 480\,x + 120\,x^2 - 120\,x^3 - 15\,x^4 + 12\,x^5$ to decide which amongst the following ones is the representation of the function.

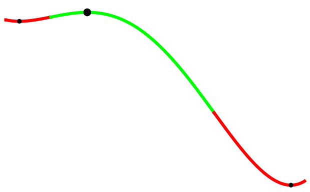
1)



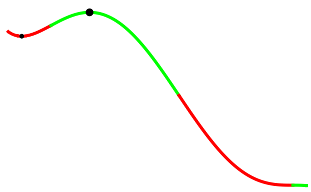
2)



3)



4)



● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{-1 + 3t}{333858}\right) e^{2+2t}$ per-unit.

The initial deposit in the account is 13000 euros. Compute the deposit after 3 years.

1) 13363.1398 euros

2) 13383.1398 euros

3) 13473.1398 euros

4) 13463.1398 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & -1 \\ -3 & 1 & 2 \\ 0 & 0 & 1 \end{pmatrix} . X + \begin{pmatrix} 3 & 1 & 0 \\ -1 & 0 & 1 \\ -2 & -1 & 0 \end{pmatrix} = \begin{pmatrix} 3 & 3 & 0 \\ 1 & -6 & 2 \\ -3 & -2 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & * \\ * & -2 & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ * & 0 & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & * & 1 \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x - y - z == 4$
$m x + 2 y + z == -3 + 2 m$
$(1 + m) x + y + z == 2 m$

has only a solution.

1) We have unique solution for $m \geq -4$.

2) We have unique solution for $m \geq 1$.

3) We have unique solution for $m \neq -1$.

4) We have unique solution for $m \leq 0$.

5) We have unique solution for $m \neq -4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (5\ \ 4) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (11\ \ 9) \rangle$

1) $\begin{pmatrix} -89 & -198 \\ 40 & 89 \end{pmatrix}$ 2) $\begin{pmatrix} -89 & 110 \\ -72 & 89 \end{pmatrix}$ 3) $\begin{pmatrix} -89 & -72 \\ 110 & 89 \end{pmatrix}$ 4) $\begin{pmatrix} -89 & 40 \\ -198 & 89 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & -2 \\ 0 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 35

Exercise 1

We have one bank account that offers a compound interes rate of 5% where we initially deposit 8000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **2.***** years.

2) In **6.***** years.

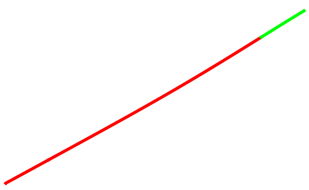
3) In **5.***** years.

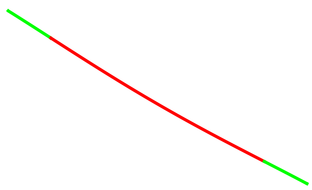
4) In **0.***** years.

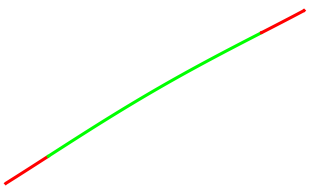
5) In **1.***** years.

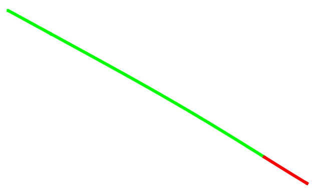
Exercise 2

Study the shape properties of $f(x) = 5 - 12x^2 + 10x^3 - 4x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(4 + 2t)\right)\log(t)$ per-unit.

In the year t=1 we deposint in the account 13000 euros. Compute the deposit in the account after (with respect to t=1) 4 years.

1) 20281.1039 euros

2) 20331.1039 euros

3) 20271.1039 euros

4) 20351.1039 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 & -1 \\ 1 & 3 & 4 \\ 1 & 2 & 4 \end{pmatrix} \cdot \left(X - \begin{pmatrix} 1 & -1 & 0 \\ -3 & 4 & -2 \\ 1 & -1 & 1 \end{pmatrix} \right) = \begin{pmatrix} -1 & 4 & -3 \\ -1 & -10 & 8 \\ -4 & -5 & 5 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$m x + y - 2 z == -1$$
$$(-2 + m) x + 2 y - 4 z == -2$$
$$3 x - y + 3 z == 1$$

has only a solution.

1) We have unique solution for $m \leq 0$.

2) We have unique solution for $m \geq 2$.

3) We have unique solution for $m \neq -5$.

4) We have unique solution for $m \leq 0$.

5) We have unique solution for $m \neq -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 3 & 2 & 1 \\ 1 & 1 & 1 \\ -2 & -2 & 0 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(1\ 1\ -2)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(3\ 0\ 1)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2\ -1\ 3)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2\ -1\ -2)$.

5) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(2\ -1\ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 36

Exercise 1

We have one bank account that offers a continuous compound rate of 5% where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 15 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **1.***** years.

2) In **8.***** years.

3) In **0.***** years.

4) In **3.***** years.

5) In **4.***** years.

Exercise 2

Between the months $t = 2$ and $t = 9$, the true value of the shares of a company (in euros) are given by the function $C(t) = 515 + 324\,t - 45\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t = 2$ and $t = 6$.

1) It oscillates between 989 and 1270.

2) It oscillates between 999 and 1271.

3) It oscillates between 998 and 1277.

4) It oscillates between 1244 and 1271.

5) It oscillates between 1006 and 1267.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \left(\frac{1}{100}(9 + 4\,t)\right)(\cos(2\pi t) + 1) \quad \text{per-unit.}$$

The initial deposit in the account is 5000 euros. Compute the deposit after 5 years.

1) 12938.5483 euros

2) 12988.5483 euros

3) 12948.5483 euros

4) 12928.5483 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -2 & -2 \\ 2 & 3 & 3 \\ 0 & 0 & 1 \end{pmatrix}.X.\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} -3 & 0 & 0 \\ 5 & 0 & 0 \\ -1 & -1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2+m)\,x + 2\,y + z == -4 - m$
$-5\,x + 3\,y + 2\,z == -5$
$-2\,x + y + z == -2$

has only a solution.

1) We have unique solution for $m \le 2$.

2) We have unique solution for $m \ge -5$.

3) We have unique solution for $m \ne 1$.

4) We have unique solution for $m \ne 2$.

5) We have unique solution for $m \le -4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 16 & -10 \\ 21 & -13 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(3\ \ 2)$.

2) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-2\ \ -3)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(5\ \ 7)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1\ \ 0)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(3\ \ -1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 37

Exercise 1

We have a bank account that initially offers a continuous compound rate of 5% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 1% . The initial deposit is 6000 euros. Compute the amount of money in the account after 7 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****4.***** euros.

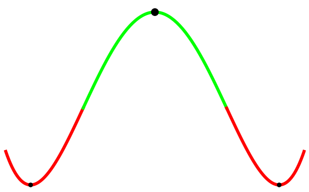
3) We will have ****1.***** euros.

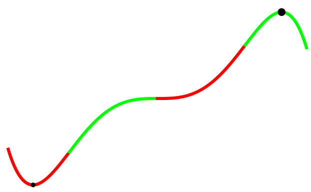
4) We will have ****3.***** euros.

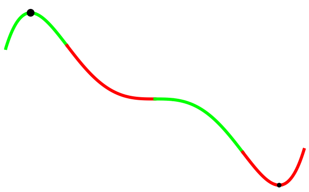
5) We will have ****7.***** euros.

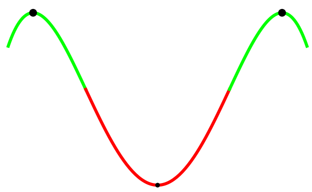
Exercise 2

Study the shape properties of the $f(x) = 4 - 20x^3 + 12x^5$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -4 + 2x + 2x^2$ and the horizontal axis between the points $x = -5$ and $x = 3$.

1) $\frac{56}{3} = 18.6667$

2) $\frac{449}{6} = 74.8333$

3) $\frac{214}{3} = 71.3333$

4) $\frac{437}{6} = 72.8333$

5) $\frac{110}{3} = 36.6667$

6) $\frac{220}{3} = 73.3333$

7) $\frac{160}{3} = 53.3333$

8) $\frac{223}{3} = 74.3333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 \\ 3 & 4 \end{pmatrix}^{-1} . X - \begin{pmatrix} 3 & 1 \\ 5 & 2 \end{pmatrix} = \begin{pmatrix} 2 & -6 \\ -9 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -2 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y - 2 z == -4 + 2 m$
$2 x + y + 2 z == 8$
$-2 m x + 2 y + 5 z == 10 - 4 m$

has only a solution. For that solution compute the value of variable y

1) $y = -3$.

2) $y = 8$.

3) $y = -6$.

4) $y = 0$.

5) $y = 6$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(1\ \ 2)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

3) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1\ \ -1)$.

4) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(-4\ \ -7)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-4\ \ -7)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 38

Exercise 1

We have a bank account that initially offers a compound interes rate of 7% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 3% . The initial deposit is 14 000 euros. Compute the amount of money in the account after 2 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****8.***** euros.

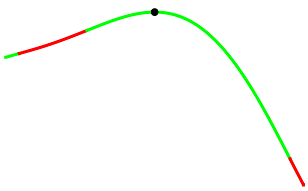
3) We will have ****9.***** euros.

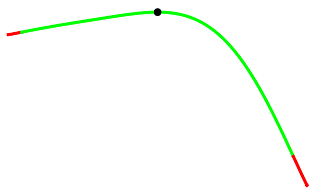
4) We will have ****6.***** euros.

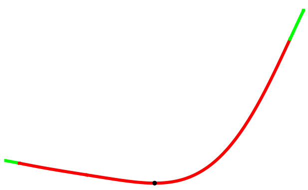
5) We will have ****0.***** euros.

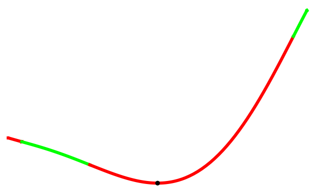
Exercise 2

Study the shape properties of $f(x) = 5 - 120x^2 - 80x^3 - 15x^4 + 6x^5 + 2x^6$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -3 + 2x + x^2$
and the horizontal axis between the points $x = -2$ and $x = 4$.

1) 18

2) $\frac{81}{2} = 40.5$

3) $\frac{75}{2} = 37.5$

4) $\frac{77}{2} = 38.5$

5) 36

6) 40

7) 38

8) 39

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 & 1 \\ 0 & 1 & 0 \\ 1 & -1 & 2 \end{pmatrix} . X . \begin{pmatrix} 1 & 0 & 0 \\ -1 & 1 & -1 \\ 3 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 0 & 1 \\ -3 & 0 & -1 \\ 9 & 0 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(1 + m) x - y + z == -1 - 2m$
$2x + y - 2z == -5$
$m x - y + 2z == 1 - 2m$

has only a solution.

1) We have unique solution for $m \geq -5$.

2) We have unique solution for $m \leq -6$.

3) We have unique solution for $m \neq 1$.

4) We have unique solution for $m \geq -5$.

5) We have unique solution for $m \neq -5$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (8 \ \ -5), \ (-3 \ \ 2) \rangle$

1) $\begin{pmatrix} -1 & 1 \\ 1 & 1 \end{pmatrix}$ 2) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & -3 \\ -2 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -3 \\ 1 & 0 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 0 \\ 3 & 0 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 39

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 2% in 2 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a continuous compound rate of 4%. The initial deposit is 10 000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****2.***** euros.

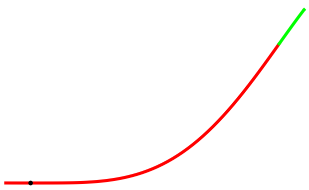
3) We will have ****9.***** euros.

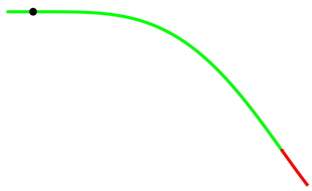
4) We will have ****0.***** euros.

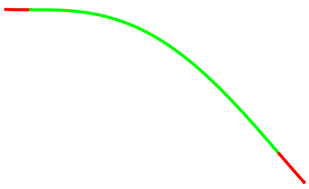
5) We will have ****5.***** euros.

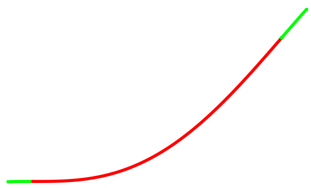
Exercise 2

Study the shape properties of $f(x) = 5 - 2x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(3 + 3t^2 + 3t^3\right)$ per-unit.

The initial deposit in the account is 18 000 euros. Compute the deposit after 3 years.

1) 47344.441 euros

2) 47414.441 euros

3) 47374.441 euros

4) 47364.441 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -1 \\ 1 & 0 \end{pmatrix} . \left(X - \begin{pmatrix} 2 & -1 \\ -3 & 2 \end{pmatrix} \right) = \begin{pmatrix} -2 & 1 \\ -1 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + 2 y + 4 z == 8 - m$
$-x - y - 2 z == -3$
$-x - z == 0$

has only a solution. For that solution compute the value of variable x

1) $x = 7$.

2) $x = 3$.

3) $x = -1$.

4) $x = -8$.

5) $x = 9$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (3\ 1),\ (8\ 3) \rangle$

1) $\begin{pmatrix} -1 & -3 \\ 0 & -1 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -2 \\ -1 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} -1 & -3 \\ -1 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & 1 \\ 3 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 40

Exercise 1

We have one bank account that offers a continuous compound rate of 4% where we initially deposit 8000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **7.***** years.

2) In **0.***** years.

3) In **8.***** years.

4) In **2.***** years.

5) In **3.***** years.

Exercise 2

Between the months $t=3$ and $t=7$, the true value of the shares of a company (in euros) are given by the function $C(t) = 188 + 144t - 30t^2 + 2t^3$.

Determine the interval where the value oscillates between the months $t=5$ and $t=7$.

1) It oscillates between 407 and 409.

2) It oscillates between 409 and 409.

3) It oscillates between 404 and 412.

4) It oscillates between 402 and 416.

5) It oscillates between 405 and 422.

Exercise 3

Compute the area enclosed by the function $f(x) = 4 - 6x + 2x^2$
and the horizontal axis between the points $x = -2$ and $x = 2$.

1) $\frac{173}{6} = 28.8333$

2) $\frac{88}{3} = 29.3333$

3) $\frac{91}{3} = 30.3333$

4) $\frac{191}{6} = 31.8333$

5) $\frac{82}{3} = 27.3333$

6) $\frac{100}{3} = 33.3333$

7) $\frac{97}{3} = 32.3333$

8) $\frac{94}{3} = 31.3333$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix}\right) . \begin{pmatrix} 0 & 1 & 0 \\ -1 & -2 & 1 \\ 0 & -1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 1 & 0 \\ -1 & -1 & 2 \\ 0 & 0 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y - 2 z == -2 - 2 m$
$x + 2 y + 3 z == 1$
$y + 2 z == 2$

has only a solution.

1) We have unique solution for $m \geq -3$.

2) We have unique solution for $m \neq -2$.

3) We have unique solution for $m \neq -1$.

4) We have unique solution for $m \geq -2$.

5) We have unique solution for $m \leq -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (-5 \;\; -3), \;\; (-8 \;\; -5) \rangle$

1) $\begin{pmatrix} -1 & -2 \\ 0 & 1 \end{pmatrix}$ 2) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & 3 \\ 2 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -1 \\ 1 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & 3 \\ -2 & 0 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 41

Exercise 1

We have one bank account that offers a continuous compound rate of 6% where we initially deposit 13 000 euros. How long time is it necessary until the amount of money in the account reaches 22 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **6.***** years.

2) In **8.***** years.

3) In **0.***** years.

4) In **5.***** years.

5) In **7.***** years.

Exercise 2

Between the months $t=1$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t)=-14+30t-18t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=5$.

1) It oscillates between −64 and 0.

2) It oscillates between −64 and −54.

3) It oscillates between −64 and 0.

4) It oscillates between −72 and −48.

5) It oscillates between −65 and −63.

Exercise 3

Compute the area enclosed by the function $f(x) = -9x - 3x^2$ and the horizontal axis between the points $x = -3$ and $x = 0$.

1) 18

2) $\frac{35}{2} = 17.5$

3) $\frac{33}{2} = 16.5$

4) $\frac{31}{2} = 15.5$

5) $\frac{27}{2} = 13.5$

6) 17

7) 15

8) 16

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -2 & -3 \\ 5 & 7 \end{pmatrix} . X . \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -2 \\ 2 & 5 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m)\, x - y - z == -2\, m$
$-x - z == 1$
$2\, x + y + z == -2$

has only a solution. For that solution compute the value of variable z

1) $z = -8$.

2) $z = -1$.

3) $z = -2$.

4) $z = -9$.

5) $z = 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2 \;\; 1) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (-3 \;\; -1) \rangle$

1) $\begin{pmatrix} 2 & 1 \\ -6 & -3 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -2 \\ 3 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} 2 & -3 \\ 2 & -3 \end{pmatrix}$ 4) $\begin{pmatrix} 2 & -6 \\ 1 & -3 \end{pmatrix}$ 5) $\begin{pmatrix} 2 & 2 \\ -3 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 42

Exercise 1

We have one bank account that offers a continuous compound rate of 5% where we initially deposit 5000 euros. How long time is it necessary until the amount of money in the account reaches 7000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **8.***** years.

2) In **3.***** years.

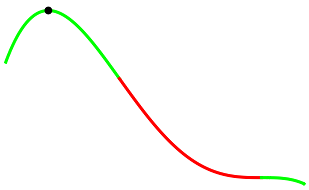
3) In **9.***** years.

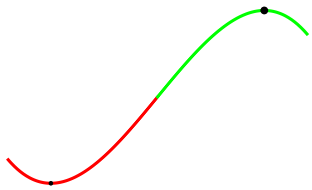
4) In **0.***** years.

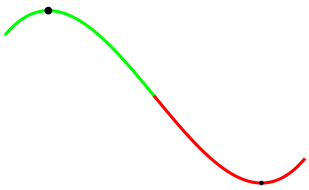
5) In **6.***** years.

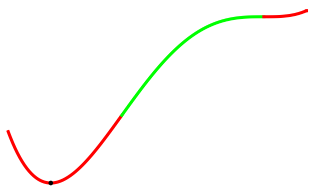
Exercise 2

Study the shape properties of the $f(x) = 2 + 12x - 9x^2 + 2x^3$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -x + x^2$ and the horizontal axis between the points $x = 1$ and $x = 4$.

1) $\frac{41}{2} = 20.5$

2) 16

3) $\frac{27}{2} = 13.5$

4) $\frac{39}{2} = 19.5$

5) 18

6) $\frac{33}{2} = 16.5$

7) $\frac{37}{2} = 18.5$

8) $\frac{31}{2} = 15.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 2 \\ 4 & 9 \end{pmatrix} . X . \begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}^{-1} = \begin{pmatrix} 2 & 0 \\ 9 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$(1 + m)\, x + y + z == 1$$
$$-2\, x + y + 2\, z == 0$$
$$-x + z == -1$$

has only a solution. For that solution compute the value of variable z

1) $z = 1$.

2) $z = -1$.

3) $z = -5$.

4) $z = -9$.

5) $z = 5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(8\ \ 11)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

3) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(1\ \ -1)$.

4) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2\ \ -1)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(0\ \ 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 43

Exercise 1

We have one bank account that offers a compound interes rate of 2% where we initially deposit 14 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **2.***** years.

3) In **1.***** years.

4) In **7.***** years.

5) In **0.***** years.

Exercise 2

Between the months $t = 3$ and $t = 7$, the funds in certain account (in millions of euros) are given by the function $F(t) = -8 + 120 t - 27 t^2 + 2 t^3$.

Determine the interval where the temperature oscillates between the months $t = 4$ and $t = 6$.

1) It oscillates between 167 and 168.

2) It oscillates between 163 and 195.

3) It oscillates between 175 and 177.

4) It oscillates between 171 and 163.

5) It oscillates between 167 and 172.

Exercise 3

Compute the area enclosed by the function $f(x) = 3 - 3x^2$ and the horizontal axis between the points $x = -2$ and $x = 4$.

1) $\frac{129}{2} = 64.5$

2) 64

3) $\frac{127}{2} = 63.5$

4) 65

5) 54

6) 46

7) $\frac{131}{2} = 65.5$

8) 62

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 3 & -2 \\ -4 & 3 \end{pmatrix}.X.\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -3 & -2 \\ 4 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -2 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m\,x - y + z == 2 + 2\,m$
$3\,x + y - 2\,z == 2$
$-2\,x + z == -2$

has only a solution. For that solution compute the value of variable y

1) $y = -3$.

2) $y = 8$.

3) $y = 0$.

4) $y = -8$.

5) $y = -5$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (3\ \ -5), (-1\ \ 2) \rangle$

1) $\begin{pmatrix} -2 & 2 \\ -3 & 1 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & 1 \\ 3 & -1 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 1 \\ -3 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & -3 \\ -3 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 44

Exercise 1

We have one bank account that offers a continuous compound rate of 4% where we initially deposit 13 000 euros. How long time is it necessary until the amount of money in the account reaches 19 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **7.***** years.

2) In **6.***** years.

3) In **8.***** years.

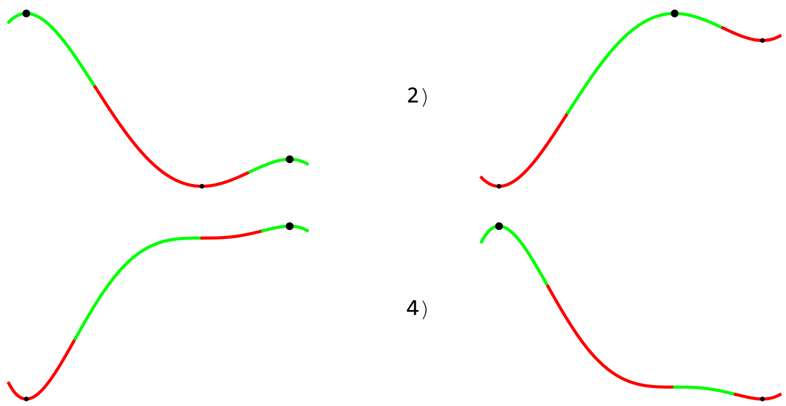
4) In **9.***** years.

5) In **0.***** years.

Exercise 2

Study the shape properties of the $f(x) = 2 - 40\,x^3 + 15\,x^4 + 12\,x^5$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = 8 - 2x^2$
and the horizontal axis between the points $x = -3$ and $x = 1$.

1) $\frac{80}{3} = 26.6667$

2) $\frac{68}{3} = 22.6667$

3) $\frac{145}{6} = 24.1667$

4) $\frac{77}{3} = 25.6667$

5) $\frac{74}{3} = 24.6667$

6) $\frac{40}{3} = 13.3333$

7) $\frac{163}{6} = 27.1667$

8) $\frac{157}{6} = 26.1667$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} -1 & 3 \\ -2 & 5 \end{pmatrix}\right) . \begin{pmatrix} 3 & 2 \\ -2 & -1 \end{pmatrix}^{-1} = \begin{pmatrix} -8 & -12 \\ -10 & -16 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + y - z == -3 + 2 m$
$x + y - z == -1$
$(-2 - m) x - 3 y + 4 z == 6 - 2 m$

has only a solution. For that solution compute the value of variable y

1) $y = 2$.

2) $y = -3$.

3) $y = -2$.

4) $y = -5$.

5) $y = 8$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle\ (27\ \ 17)\ ,\ (-35\ \ -22)\ \rangle$

1) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 2) $\begin{pmatrix} 0 & -3 \\ -2 & -1 \end{pmatrix}$ 3) $\begin{pmatrix} -1 & 1 \\ 3 & -3 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & 2 \\ 2 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} 0 & -2 \\ 0 & 1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 45

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 1% in 5 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a compound interes rate of 9%. The initial deposit is 14 000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****9.***** euros.

3) We will have ****1.***** euros.

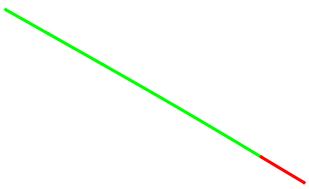
4) We will have ****2.***** euros.

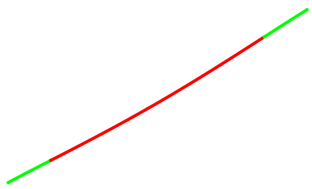
5) We will have ****0.***** euros.

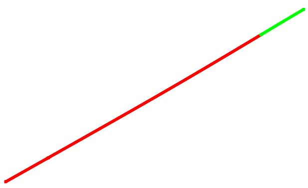
Exercise 2

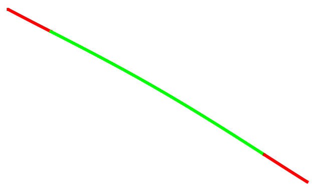
Study the shape properties of $f(x) = 2 + 24x^2 + 16x^3 + 5x^4 + \frac{3x^5}{5}$

to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity   Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{-3+2t}{16940}\right) e^{3+t}$ per-unit.

The initial deposit in the account is 5000 euros. Compute the deposit after 3 years.

1) 5160.9518 euros

2) 5230.9518 euros

3) 5220.9518 euros

4) 5150.9518 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 3 & -1 \\ 4 & -1 \end{pmatrix}\right) \cdot \begin{pmatrix} -1 & 2 \\ -1 & 1 \end{pmatrix}^{-1} = \begin{pmatrix} -2 & 6 \\ -5 & 10 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$x + y + z == -2$
$(2 - m)\, x + m\, y + z == -4 + 2\, m$
$2\, x + y + 2\, z == -5$

has only a solution. For that solution compute the value of variable x

1) $x = -7$.

2) $x = -4$.

3) $x = -1$.

4) $x = -3$.

5) $x = -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (4\ 5),\ (7\ 9) \rangle$

1) $\begin{pmatrix} -1 & 1 \\ -1 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & 2 \\ -1 & 2 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & 2 \\ -3 & 2 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & 3 \\ -1 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 46

Exercise 1

We have one bank account that offers a compound interes rate of 4% where we initially deposit 14 000 euros. How long time is it necessary until the amount of money in the account reaches 21 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **6.***** years.

2) In **0.***** years.

3) In **7.***** years.

4) In **5.***** years.

5) In **8.***** years.

Exercise 2

Between the months $t=4$ and $t=8$, the funds in certain account (in millions of euros) are given by the function $F(t)=9+120t-27t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=8$.

1) It oscillates between 175 and 256.

2) It oscillates between 184 and 265.

3) It oscillates between 175 and 264.

4) It oscillates between 179 and 270.

5) It oscillates between 184 and 185.

Exercise 3

Compute the area enclosed by the function $f(x)=3+2x-x^2$ and the horizontal axis between the points $x=0$ and $x=3$.

1) 13

2) 11

3) $\frac{23}{2} = 11.5$

4) $\frac{21}{2} = 10.5$

5) $\frac{25}{2} = 12.5$

6) 9

7) 14

8) 12

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 \\ -3 & 1 \end{pmatrix}^{-1} . X . \begin{pmatrix} 2 & 3 \\ 3 & 5 \end{pmatrix}^{-1} = \begin{pmatrix} -8 & 5 \\ -27 & 17 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$(3 + m)\, x + y - z == -8 - 2\, m$
$-2\, x + y == 3$
$-x - y + z == 4$

has only a solution. For that solution compute the value of variable x

1) $x = -7$.

2) $x = -2$.

3) $x = 5$.

4) $x = -4$.

5) $x = -5$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle\, (2\ \ 1)\, \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle\, (3\ \ 2)\, \rangle$

1) $\begin{pmatrix} -7 & 12 \\ -4 & 7 \end{pmatrix}$ 2) $\begin{pmatrix} -7 & -4 \\ 12 & 7 \end{pmatrix}$ 3) $\begin{pmatrix} -7 & -12 \\ 4 & 7 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 1 \\ 3 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -7 & 4 \\ -12 & 7 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 47

Exercise 1

We have a bank account that initially offers a compound interes rate of 2% , and after 4 years the conditions are modified and then we obtain a compound interes rate of 10% . The initial deposit is 11 000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****7.***** euros.

3) We will have ****2.***** euros.

4) We will have ****4.***** euros.

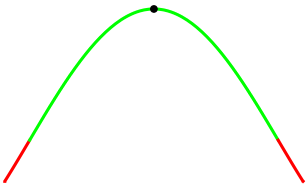
5) We will have ****3.***** euros.

Exercise 2

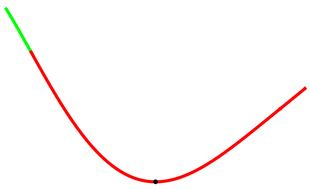
Study the shape properties of $f(x) = 5 - 3x^2 + \frac{x^4}{2}$

to decide which amongst the following ones is the representation of the function.

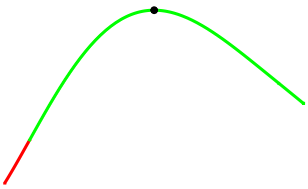
1)



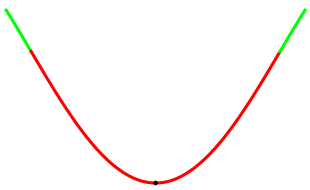
2)



3)



4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\cos(5+2t)$ per-unit.

The initial deposit in the account is 11000 euros. Compute the deposit after 3π years.

1) 11080 euros

2) 11000 euros

3) 10930 euros

4) 11090 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -1 & 3 \\ -1 & 0 & -1 \\ 1 & -2 & 2 \end{pmatrix} . X + \begin{pmatrix} 0 & -1 & -1 \\ 1 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & -2 & 3 \\ 1 & 2 & -1 \\ 3 & 1 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(1+m)\,x - y - z == -1 + 2m$
$x + y + z == 5$
$x + z == 4$

has only a solution.

1) We have unique solution for $m \neq -2$.

2) We have unique solution for $m \leq 1$.

3) We have unique solution for $m \geq -5$.

4) We have unique solution for $m \neq 0$.

5) We have unique solution for $m \neq 0$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3\ \ -1),\ (4\ \ -1) \rangle$

1) $\begin{pmatrix} -2 & 3 \\ -2 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 0 \\ 1 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & 3 \\ 3 & -3 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & 3 \\ 2 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 48

Exercise 1

We have a bank account that initially offers a continuous compound rate of 10% , and after 2 years the conditions are modified and then we obtain a periodic compound interes rate of 6% in 11 periods (compounding frequency) . The initial deposit is 8000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****3.***** euros.

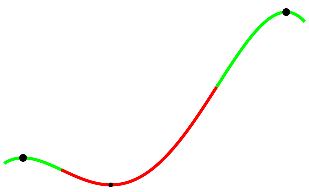
3) We will have ****2.***** euros.

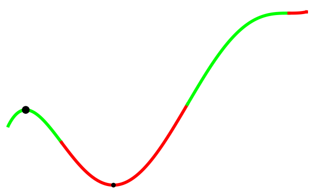
4) We will have ****6.***** euros.

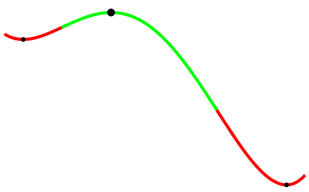
5) We will have ****1.***** euros.

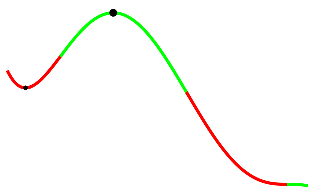
Exercise 2

Study the shape properties of the $f(x) = 5 + 120 x^2 - 45 x^4 + 12 x^5$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -9x + 3x^2$ and the horizontal axis between the points $x = -1$ and $x = 3$.

1) 21

2) 8

3) $\frac{41}{2} = 20.5$

4) 22

5) $\frac{47}{2} = 23.5$

6) 23

7) $\frac{43}{2} = 21.5$

8) 19

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} -1 & 1 & -1 \\ -2 & 1 & 0 \\ 2 & -1 & 1 \end{pmatrix}^{-1} = \begin{pmatrix} 0 & 0 & 0 \\ 5 & 1 & 4 \\ 1 & 2 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-y + z == 2$
$-x + y - 2z == 0$
$m x + z == -2m$

has only a solution.

1) We have unique solution for $m \geq -1$.

2) We have unique solution for $m \neq 0$.

3) We have unique solution for $m \leq 3$.

4) We have unique solution for $m \neq -2$.

5) We have unique solution for $m \geq 2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3 \ \ -2) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (2 \ \ -1) \rangle$

1) $\begin{pmatrix} 3 & -6 \\ 2 & -4 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & -3 \\ 2 & 2 \end{pmatrix}$ 3) $\begin{pmatrix} 3 & -2 \\ 6 & -4 \end{pmatrix}$ 4) $\begin{pmatrix} 3 & 2 \\ -6 & -4 \end{pmatrix}$ 5) $\begin{pmatrix} 3 & 6 \\ -2 & -4 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 49

Exercise 1

We have one bank account that offers a periodic compound interes rate of 5% in 12 periods (compounding frequency) where we initially deposit 9000 euros. How long time is it necessary until the amount of money in the account reaches 14 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **7.***** years.

2) In **1.***** years.

3) In **8.***** years.

4) In **0.***** years.

5) In **9.***** years.

Exercise 2

Between the months $t=4$ and $t=8$, the funds in certain account (in millions of euros) are given by the function $F(t) = -10 + 336\,t - 45\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t=5$ and $t=7$.

1) It oscillates between 742 and 823.

2) It oscillates between 795 and 823.

3) It oscillates between 798 and 813.

4) It oscillates between 791 and 815.

5) It oscillates between 822 and 823.

Exercise 3

Compute the area enclosed by the function $f(x) = -6x - 2x^2$
and the horizontal axis between the points $x = -4$ and $x = -1$.

1) $\frac{77}{6} = 12.8333$

2) $\frac{40}{3} = 13.3333$

3) $\frac{31}{3} = 10.3333$

4) 3

5) $\frac{37}{3} = 12.3333$

6) $\frac{71}{6} = 11.8333$

7) $\frac{43}{3} = 14.3333$

8) $\frac{83}{6} = 13.8333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 \\ 1 & -1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} -1 & 1 \\ 0 & -1 \end{pmatrix} \right) = \begin{pmatrix} -3 & 2 \\ -2 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-y + m z == 1 - 2 m$
$x + y - 2 z == 1$
$-x + 2 z == -2$

has only a solution. For that solution compute the value of variable y

1) $y = 9$.

2) $y = -2$.

3) $y = 5$.

4) $y = -7$.

5) $y = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-3 \ \ 2), \ (4 \ \ -3) \rangle$

1) $\begin{pmatrix} -1 & -2 \\ 2 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & -3 \\ 1 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} 0 & -3 \\ 1 & -1 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & -2 \\ -3 & 0 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 50

Exercise 1

We have one bank account that offers a
periodic compound interes rate of 5% in 8 periods (compounding frequency)
where we initially deposit 6000
euros. How long time is it necessary until the amount of money in the account reaches
14 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **8.***** years.

3) In **2.***** years.

4) In **0.***** years.

5) In **6.***** years.

Exercise 2

Between the months $t = 1$ and $t = 5$
, the funds in certain account (in millions of euros) are given by the function $F(t) = -9 + 48t - 18t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t = 2$ and $t = 4$.

1) It oscillates between 17 and 22.

2) It oscillates between 33 and 33.

3) It oscillates between 22 and 41.

4) It oscillates between 23 and 31.

5) It oscillates between 18 and 40.

Exercise 3

Certain bank account offers a variable continuous compound
interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}\left(4 + t + 4t^2\right)\right) \log(2t)$ per-unit.

In the year t=1 we deposint in the account 16 000
euros. Compute the deposit in the account after (with respect to t=1) 2 years.

1) 31740.3394 euros

2) 31770.3394 euros

3) 31800.3394 euros

4) 31730.3394 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 5 & 2 \\ 7 & 3 \end{pmatrix}\right) \cdot \begin{pmatrix} 2 & -3 \\ -1 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} -14 & -22 \\ -20 & -32 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-2x + (3+m)y - z == -2m$
$-x + y == 0$
$2x - y + z == -4$

has only a solution. For that solution compute the value of variable x

1) $x = 8$.

2) $x = -4$.

3) $x = 0$.

4) $x = 6$.

5) $x = -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (14 \; 9) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (3 \; 2) \rangle$

1) $\begin{pmatrix} -3 & -3 \\ 1 & -1 \end{pmatrix}$ 2) $\begin{pmatrix} -27 & -6 \\ 126 & 28 \end{pmatrix}$ 3) $\begin{pmatrix} -27 & -18 \\ 42 & 28 \end{pmatrix}$ 4) $\begin{pmatrix} -27 & 126 \\ -6 & 28 \end{pmatrix}$ 5) $\begin{pmatrix} -27 & 42 \\ -18 & 28 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 51

Exercise 1

We have a bank account that initially offers a compound interes rate of 9% , and after 3 years the conditions are modified and then we obtain a periodic compound interes rate of 3% in 12 periods (compounding frequency) . The initial deposit is 8000 euros. Compute the amount of money in the account after 9 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****8.***** euros.

3) We will have ****5.***** euros.

4) We will have ****0.***** euros.

5) We will have ****6.***** euros.

Exercise 2

Between the months $t=1$ and $t=8$, the true value of the shares of a company (in euros) are given by the function $C(t) = 137 + 192\,t - 36\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t=1$ and $t=5$.

1) It oscillates between 393 and 457.

2) It oscillates between 301 and 449.

3) It oscillates between 295 and 457.

4) It oscillates between 293 and 458.

5) It oscillates between 288 and 464.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\sin(-9 + 8\,t)$ per-unit.

The initial deposit in the account is 20 000 euros. Compute the deposit after 2π years.

1) 20 050 euros

2) 20 040 euros

3) 20 070 euros

4) 20 000 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & -1 \\ -1 & 1 & 0 \\ -1 & 1 & 1 \end{pmatrix} . X + \begin{pmatrix} 1 & 2 & 0 \\ -1 & -1 & 0 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 3 & 0 \\ -2 & -2 & -1 \\ 0 & -2 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m)\, x + y - 2 z == -3 + 2 m$
$x + y - z == 2$
$-x - y + 2 z == -1$

has only a solution.

1) We have unique solution for $m \geq 0$.

2) We have unique solution for $m \neq 5$.

3) We have unique solution for $m \neq 2$.

4) We have unique solution for $m \neq -1$.

5) We have unique solution for $m \leq 5$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (2 \ \ -1) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (5 \ \ -2) \rangle$

1) $\begin{pmatrix} 5 & -2 \\ 10 & -4 \end{pmatrix}$ 2) $\begin{pmatrix} 5 & 10 \\ -2 & -4 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & 1 \\ -1 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 1 \\ 1 & -3 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 3 \\ -2 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 52

Exercise 1

We have a bank account that initially offers a continuous compound rate of 3%, and after 1 year the conditions are modified and then we obtain a continuous compound rate of 5%. The initial deposit is 10000 euros. Compute the amount of money in the account after 9 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****2.***** euros.

3) We will have ****9.***** euros.

4) We will have ****0.***** euros.

5) We will have ****8.***** euros.

Exercise 2

Between the months $t=2$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t) = -17 + 72t - 24t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=3$.

1) It oscillates between 44 and 48.

2) It oscillates between 37 and 47.

3) It oscillates between −17 and 47.

4) It oscillates between 29 and 42.

5) It oscillates between −17 and 47.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{72}(-3+3t)\right)e^{-1+t}$ per-unit.

The initial deposit in the account is 13000 euros. Compute the deposit after 2 years.

1) 13422.6088 euros

2) 13404.7079 euros

3) 13444.7079 euros

4) 13414.7079 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -5 \\ -1 & 3 \end{pmatrix}.X.\begin{pmatrix} 3 & -2 \\ 5 & -3 \end{pmatrix} = \begin{pmatrix} -35 & 21 \\ 20 & -12 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y + z == -1 + m$
$x + y == 2$
$-2 x - y + z == -3$

has only a solution. For that solution compute the value of variable y

1) $y = 1$.

2) $y = -6$.

3) $y = 6$.

4) $y = 2$.

5) $y = -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -3 & -1 \\ 2 & 0 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(0 \ -1)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2 \ 1)$.

3) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(-1 \ 2)$.

4) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1 \ -1)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-1 \ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1),(0,1,1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by ⟨(2,1)⟩, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 53

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 7% in 5 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a compound interes rate of 7%. The initial deposit is 14 000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****8.***** euros.

2) We will have ****0.***** euros.

3) We will have ****7.***** euros.

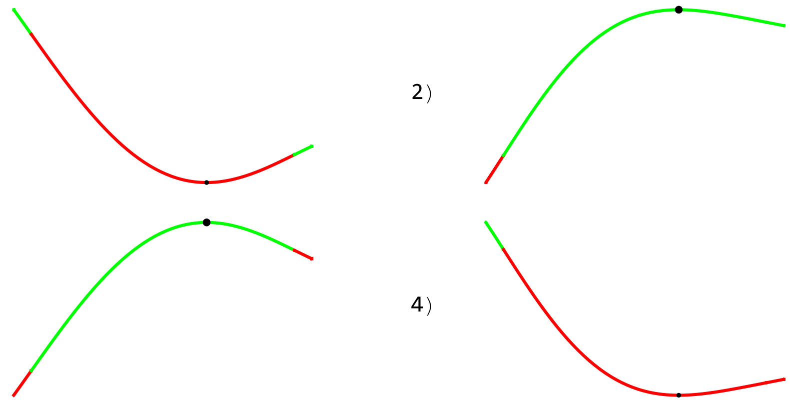
4) We will have ****5.***** euros.

5) We will have ****2.***** euros.

Exercise 2

Study the shape properties of $f(x) = 1 - 6x^2 + x^3 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{15} e^{-6+2t}$ per-unit.

The initial deposit in the account is 15 000 euros. Compute the deposit after 3 years.

1) 15597.1454 euros

2) 15567.1454 euros

3) 15507.1454 euros

4) 15527.1454 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 & 0 \\ -3 & 3 & -1 \\ 1 & 0 & 0 \end{pmatrix} . X + \begin{pmatrix} 1 & -2 & -1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} 0 & -1 & -1 \\ 3 & -1 & 2 \\ 0 & 1 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(2+m)\, x - y + 4 z == -3$
$-3 x + y - 4 z == 3$
$x + z == -1$

has only a solution.

1) We have unique solution for $m \neq 3$.

2) We have unique solution for $m \neq 1$.

3) We have unique solution for $m \geq 0$.

4) We have unique solution for $m \neq 0$.

5) We have unique solution for $m \leq 4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -227 & 361 \\ -144 & 229 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-19 \;\; -12)$.

2) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2 \;\; 0)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2 \;\; 1)$.

4) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-1 \;\; -1)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-3 \;\; 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 54

Exercise 1

We have a bank account that initially offers a continuous compound rate of 5%, and after 4 years the conditions are modified and then we obtain a compound interes rate of 8%. The initial deposit is 13 000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****4.***** euros.

3) We will have ****8.***** euros.

4) We will have ****9.***** euros.

5) We will have ****2.***** euros.

Exercise 2

Between the months $t=0$ and $t=7$, the funds in certain account (in millions of euros) are given by the function $F(t)=-16-9t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=5$.

1) It oscillates between -43 and -16.

2) It oscillates between -43 and 229.

3) It oscillates between -32 and 9.

4) It oscillates between -30 and 4.

5) It oscillates between -29 and 16.

Exercise 3

Compute the area enclosed by the function $f(x)=4+2x-2x^2$ and the horizontal axis between the points $x=-4$ and $x=5$.

1) $\frac{201}{2} = 100.5$

2) $\frac{205}{2} = 102.5$

3) 101

4) $\frac{203}{2} = 101.5$

5) 99

6) 102

7) 9

8) 81

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -2 \\ 1 & 1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} 5 & -2 \\ -2 & 1 \end{pmatrix} \right) = \begin{pmatrix} 2 & 0 \\ 1 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x + m y - z == -3 + m$
$-x + y == 2$
$-x + 2 y + z == 5$

has only a solution. For that solution compute the value of variable z

1) $z = -5$.

2) $z = 9$.

3) $z = -1$.

4) $z = 4$.

5) $z = 2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 1 & -1 & 1 \\ 3 & -3 & 1 \\ -3 & 1 & -3 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1 \ 1 \ -2)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3 \ -3 \ -1)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1 \ 1 \ -2)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(0 \ -2 \ 2)$.

5) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(0 \ 1 \ 1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 55

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 6% in 6 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a periodic compound interes rate of 3% in 2 periods (compounding frequency). The initial deposit is 15 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****3.***** euros.

3) We will have ****5.***** euros.

4) We will have ****1.***** euros.

5) We will have ****9.***** euros.

Exercise 2

Between the months $t = 4$ and $t = 11$, the true value of the shares of a company (in euros) are given by the function $C(t) = 827 + 360\,t - 48\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t = 8$ and $t = 10$.

1) It oscillates between 1619 and 1660.

2) It oscillates between 1627 and 1659.

3) It oscillates between 1627 and 1691.

4) It oscillates between 1618 and 1653.

5) It oscillates between 1627 and 1691.

Exercise 3

Compute the area enclosed by the function $f(x) = 6 + 4x - 2x^2$ and the horizontal axis between the points $x = -5$ and $x = 2$.

1) $\frac{775}{6} = 129.1667$

2) $\frac{383}{3} = 127.6667$

3) $\frac{266}{3} = 88.6667$

4) $\frac{386}{3} = 128.6667$

5) $\frac{769}{6} = 128.1667$

6) $\frac{374}{3} = 124.6667$

7) $\frac{389}{3} = 129.6667$

8) $\frac{380}{3} = 126.6667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -4 & -2 \\ 1 & -1 & -1 \\ 0 & 2 & 1 \end{pmatrix} . X . \begin{pmatrix} 0 & -1 & -1 \\ 1 & 2 & 2 \\ 2 & 2 & 3 \end{pmatrix} = \begin{pmatrix} 0 & 0 & -2 \\ 1 & 1 & 1 \\ 0 & 0 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ -1 & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ 1 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-2x + 2y + 3z == 1$
$-x + y + z == 1$
$(-1 - m)\, x + 2y + 3z == m$

has only a solution.

1) We have unique solution for $m \leq -3$.

2) We have unique solution for $m \neq 0$.

3) We have unique solution for $m \neq 3$.

4) We have unique solution for $m \geq -1$.

5) We have unique solution for $m \geq -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 19 & 16 \\ -25 & -21 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1 \;\; 1)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(4 \;\; -5)$.

3) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(1 \;\; -1)$.

4) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(0 \;\; 0)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-2 \;\; 3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 56

Exercise 1

We have a bank account that initially offers a continuous compound rate of 8% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 1% . The initial deposit is 5000 euros. Compute the amount of money in the account after 7 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****8.***** euros.

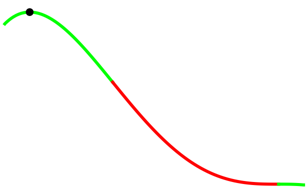
3) We will have ****2.***** euros.

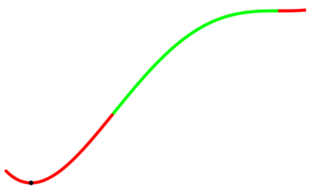
4) We will have ****9.***** euros.

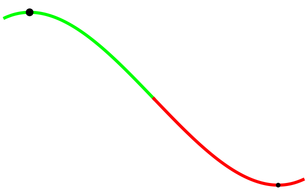
5) We will have ****5.***** euros.

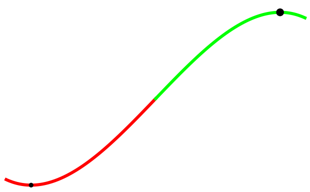
Exercise 2

Study the shape properties of the $f(x) = 3 + 8x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -12 - 2x + 2x^2$ and the horizontal axis between the points $x = -3$ and $x = 2$.

1) 45

2) $\frac{93}{2} = 46.5$

3) $\frac{91}{2} = 45.5$

4) 47

5) 43

6) $\frac{95}{3} = 31.6667$

7) 46

8) 48

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & -1 \\ 0 & 1 & 0 \\ -2 & -1 & 3 \end{pmatrix} .X. \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 3 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -1 & 0 \\ -1 & -4 & -1 \\ 3 & 6 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m)\, x - y + z == 2 - 2m$
$-x + y == 2$
$m\, x - 3y + 2z == -2m$

has only a solution.

1) We have unique solution for $m \leq -3$.

2) We have unique solution for $m \neq 4$.

3) We have unique solution for $m \geq -1$.

4) We have unique solution for $m \neq 2$.

5) We have unique solution for $m \leq 4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3\ 2), (-5\ -3) \rangle$

1) $\begin{pmatrix} -2 & 0 \\ -1 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} 0 & -3 \\ 1 & -1 \end{pmatrix}$ 3) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 3 \\ 2 & -2 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & -2 \\ 0 & 0 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 57

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 6% in 7 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a compound interes rate of 3%. The initial deposit is 8000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****5.***** euros.

2) We will have ****1.***** euros.

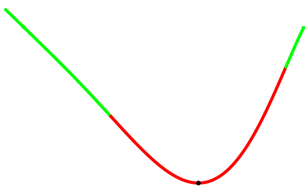
3) We will have ****0.***** euros.

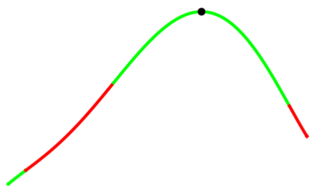
4) We will have ****2.***** euros.

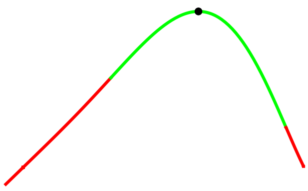
5) We will have ****8.***** euros.

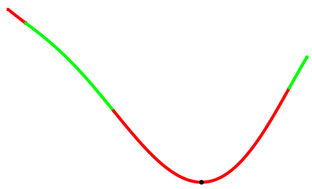
Exercise 2

Study the shape properties of $f(x) = 1 - 12x^2 - 2x^3 + 2x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 12 - 12x - 3x^2 + 3x^3$ and the horizontal axis between the points $x = -4$ and $x = 3$.

1) $\frac{749}{4} = 187.25$

2) $\frac{761}{4} = 190.25$

3) $\frac{735}{4} = 183.75$

4) $\frac{755}{4} = 188.75$

5) $\frac{385}{4} = 96.25$

6) $\frac{757}{4} = 189.25$

7) $\frac{465}{4} = 116.25$

8) $\frac{759}{4} = 189.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -5 \\ 1 & -2 \end{pmatrix} . X + \begin{pmatrix} -1 & 0 \\ 3 & -1 \end{pmatrix} = \begin{pmatrix} -6 & -5 \\ 1 & -3 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x + 2y - z == -1$
$-mx + y - z == 0$
$mx + z == -1$

has only a solution. For that solution compute the value of variable x

1) $x = -2$.

2) $x = -1$.

3) $x = 1$.

4) $x = 0$.

5) $x = 9$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2\ \ 3) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (1\ \ 2) \rangle$

1) $\begin{pmatrix} -4 & 2 \\ -6 & 3 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -1 \\ 2 & -1 \end{pmatrix}$ 3) $\begin{pmatrix} -4 & -6 \\ 2 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -4 & 6 \\ -2 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} -4 & -2 \\ 6 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 58

Exercise 1

We have one bank account that offers a continuous compound rate of 1% where we initially deposit 7000 euros. How long time is it necessary until the amount of money in the account reaches 15 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **4.***** years.

2) In **8.***** years.

3) In **0.***** years.

4) In **2.***** years.

5) In **6.***** years.

Exercise 2

Between the months $t=3$ and $t=8$, the true value of the shares of a company (in euros) are given by the function $C(t)=339+180t-33t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=3$ and $t=5$.

1) It oscillates between 636 and 691.

2) It oscillates between 633 and 660.

3) It oscillates between 663 and 664.

4) It oscillates between 636 and 664.

5) It oscillates between 633 and 661.

Exercise 3

Compute the area enclosed by the function $f(x) = -36 + 18x + 4x^2 - 2x^3$ and the horizontal axis between the points $x = 0$ and $x = 3$.

1) $\frac{116}{3} = 38.6667$

2) $\frac{63}{2} = 31.5$

3) $\frac{235}{6} = 39.1667$

4) $\frac{119}{3} = 39.6667$

5) $\frac{211}{6} = 35.1667$

6) $\frac{113}{3} = 37.6667$

7) $\frac{229}{6} = 38.1667$

8) $\frac{223}{6} = 37.1667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & 0 & -1 \\ 0 & 1 & -1 \\ 1 & 0 & 0 \end{pmatrix} . X + \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ -2 & -2 & 1 \end{pmatrix} = \begin{pmatrix} 2 & 1 & 0 \\ 1 & 1 & -1 \\ -3 & -2 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y + (1 + m) z == 1 - 2 m$
$-2 x + 2 y - 3 z == 2$
$3 x - 3 y + 5 z == -3$

has only a solution.

1) We have unique solution for $m \neq 2$.

2) We have unique solution for $m \geq 3$.

3) We have unique solution for $m \neq 2$.

4) We have unique solution for $m \geq -3$.

5) We have unique solution for $m \geq -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -8 & -12 \\ 4 & 6 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(3\ \ 0)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(0\ \ 1)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1\ \ 1)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle (1,1,-1) \rangle$ and λ=3 with eigenvectors $\langle (1,0,1) \rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle (1,1,-1),(0,1,1) \rangle$ and λ=3 with eigenvectors $\langle (1,0,1) \rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle (2,1) \rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 59

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 7% in 10 periods (compounding frequency), and after 3 years the conditions are modified and then we obtain a periodic compound interes rate of 7% in 6 periods (compounding frequency). The initial deposit is 13000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****0.***** euros.

3) We will have ****2.***** euros.

4) We will have ****6.***** euros.

5) We will have ****5.***** euros.

Exercise 2

Between the months $t=0$ and $t=5$, the funds in certain account (in millions of euros) are given by the function $F(t) = -3 - 12t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=4$.

1) It oscillates between -74 and -43.

2) It oscillates between -67 and -35.

3) It oscillates between -67 and -3.

4) It oscillates between -65 and -37.

5) It oscillates between -67 and -3.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \left(\frac{1}{100}\left(3 + 2t + 4t^2\right)\right)\log(t) \text{ per-unit.}$$

In the year t=1 we deposint in the account 12000 euros. Compute the deposit in the account after (with respect to t=1) 4 years.

1) 151486.3413 euros

2) 151406.3413 euros

3) 151446.3413 euros

4) 151476.3413 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & 1 \\ -2 & 1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} 0 & -1 \\ 1 & -1 \end{pmatrix} \right) = \begin{pmatrix} 2 & 0 \\ 2 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2 + m)\, x + y + z == 0$
$-x + z == 1$
$-2\, x - y + z == 2$

has only a solution. For that solution compute the value of variable z

1) $z = -1$.

2) $z = 1$.

3) $z = 4$.

4) $z = -3$.

5) $z = 5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -6 & -1 & -2 \\ 10 & 1 & 4 \\ 8 & 2 & 2 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1\ -2\ -1)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(0\ -2\ 3)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1\ -1\ -2)$.

4) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(-2\ 1\ 2)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(2\ -3\ 3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 60

Exercise 1

We have one bank account that offers a periodic compound interes rate of 6% in 2 periods (compounding frequency) where we initially deposit 13 000 euros. How long time is it necessary until the amount of money in the account reaches 15 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **2.***** years.

2) In **7.***** years.

3) In **0.***** years.

4) In **1.***** years.

5) In **5.***** years.

Exercise 2

Between the months $t=0$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t) = -16 + 72t - 21t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=6$.

1) It oscillates between 60 and 92.

2) It oscillates between −16 and 92.

3) It oscillates between 55 and 94.

4) It oscillates between 64 and 65.

5) It oscillates between 51 and 102.

Exercise 3

Compute the area enclosed by the function $f(x) = 3 - 4x + x^2$ and the horizontal axis between the points $x = -1$ and $x = 5$.

1) $\frac{56}{3} = 18.6667$

2) $\frac{50}{3} = 16.6667$

3) $\frac{44}{3} = 14.6667$

4) $\frac{97}{6} = 16.1667$

5) 12

6) $\frac{53}{3} = 17.6667$

7) $\frac{103}{6} = 17.1667$

8) $\frac{4}{3} = 1.3333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & 1 \\ -1 & 0 \end{pmatrix} . X . \begin{pmatrix} 1 & -3 \\ 0 & 1 \end{pmatrix} = \begin{pmatrix} -2 & 8 \\ -1 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x + z == 1$
$x + y == 0$
$(2 - m)\, x + y + z == 3 - m$

has only a solution. For that solution compute the value of variable z

1) $z = -8$.

2) $z = -7$.

3) $z = 8$.

4) $z = 2$.

5) $z = -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & -2 \\ 1 & 3 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-2\ \ -2)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2\ \ 1)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-1\ \ -2)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(1\ \ -1)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2\ \ 3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 61

Exercise 1

We have a bank account that initially offers a continuous compound rate of 6% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 5% . The initial deposit is 15 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****2.***** euros.

2) We will have ****1.***** euros.

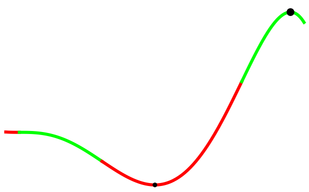
3) We will have ****9.***** euros.

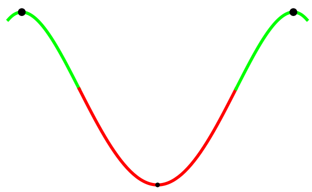
4) We will have ****7.***** euros.

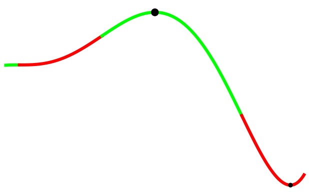
5) We will have ****0.***** euros.

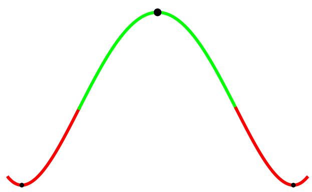
Exercise 2

Study the shape properties of the $f(x) = 4 - 240x^2 - 80x^3 + 30x^4 + 12x^5$ to decide which amongst the following ones is the representation of the function.

1)


2)


3)


4)


Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -12 - 12x + 3x^2 + 3x^3$ and the horizontal axis between the points $x = -4$ and $x = 5$.

1) $\frac{2093}{4} = 523.25$

2) $\frac{1809}{4} = 452.25$

3) $\frac{2099}{4} = 524.75$

4) $\frac{1215}{4} = 303.75$

5) $\frac{1823}{4} = 455.75$

6) $\frac{2105}{4} = 526.25$

7) $\frac{2101}{4} = 525.25$

8) $\frac{2107}{4} = 526.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 & -1 \\ 3 & 2 & -3 \\ 2 & 2 & -1 \end{pmatrix}^{-1} . X - \begin{pmatrix} 1 & 1 & 0 \\ 1 & 2 & 1 \\ -1 & -2 & 0 \end{pmatrix} = \begin{pmatrix} -6 & -2 & 1 \\ 2 & -2 & -2 \\ -2 & 1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(3 + m)x - 2y - z == -8 - 2m$
$-2x + y == 4$
$-3x + 2y + z == 8$

has only a solution.

1) We have unique solution for $m \neq 0$.

2) We have unique solution for $m \neq -2$.

3) We have unique solution for $m \leq 4$.

4) We have unique solution for $m \neq 2$.

5) We have unique solution for $m \geq -3$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 1 & 1 \\ -6 & -4 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1 \ -3)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1 \ -3)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2 \ 0)$.

4) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2 \ 1)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-3 \ -3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 62

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 3% in 2 periods (compounding frequency), and after 3 years the conditions are modified and then we obtain a continuous compound rate of 8%. The initial deposit is 11 000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****2.***** euros.

3) We will have ****1.***** euros.

4) We will have ****6.***** euros.

5) We will have ****0.***** euros.

Exercise 2

Between the months $t=2$ and $t=6$, the true value of the shares of a company (in euros) are given by the function $C(t) = 37 + 36t - 15t^2 + 2t^3$.

Determine the interval where the value oscillates between the months $t=4$ and $t=6$.

1) It oscillates between 74 and 140.

2) It oscillates between 73 and 148.

3) It oscillates between 64 and 65.

4) It oscillates between 64 and 145.

5) It oscillates between 69 and 145.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \left(\frac{1}{100}\left(1 + t + 3t^2\right)\right)\log(2t) \text{ per-unit.}$$

In the year t=1 we deposint in the account 16 000 euros. Compute the deposit in the account after (with respect to t=1) 3 years.

1) 57846.3253 euros

2) 57866.3253 euros

3) 57906.3253 euros

4) 57916.3253 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 & -1 \\ 1 & 1 & 0 \\ -1 & -2 & 1 \end{pmatrix} . X - \begin{pmatrix} 0 & 1 & -1 \\ -1 & 1 & -1 \\ 0 & 0 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -3 & 2 \\ 1 & -2 & 1 \\ 2 & 3 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & * \\ * & 0 & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ * & 1 & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & * & 0 \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x - 2z == -2$
$2x + y + 3z == 3$
$mx - y + (1 + m) z == 1$

has only a solution.

1) We have unique solution for $m \neq 3$.

2) We have unique solution for $m \geq -3$.

3) We have unique solution for $m \neq -2$.

4) We have unique solution for $m \neq 0$.

5) We have unique solution for $m \leq 4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-1 \;\; 1) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (-2 \;\; 1) \rangle$

1) $\begin{pmatrix} 1 & 2 \\ -1 & -2 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & -1 \\ -1 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & 1 \\ -2 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} 1 & -1 \\ 2 & -2 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 2 \\ -1 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 63

Exercise 1

We have a bank account that initially offers a compound interes rate of 1% , and after 2 years the conditions are modified and then we obtain a periodic compound interes rate of 9% in 6 periods (compounding frequency) . The initial deposit is 11 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****3.***** euros.

2) We will have ****8.***** euros.

3) We will have ****6.***** euros.

4) We will have ****1.***** euros.

5) We will have ****0.***** euros.

Exercise 2

Between the months $t = 3$ and $t = 10$, the funds in certain account (in millions of euros) are given by the function $F(t) = 1 + 210\,t - 36\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t = 8$ and $t = 9$.

1) It oscillates between 393 and 401.

2) It oscillates between 401 and 433.

3) It oscillates between 407 and 425.

4) It oscillates between 405 and 438.

5) It oscillates between 361 and 501.

Exercise 3

Compute the area enclosed by the function $f(x) = 12 + 2x - 8x^2 + 2x^3$ and the horizontal axis between the points $x = 2$ and $x = 5$.

1) $\frac{160}{3} = 53.3333$

2) $\frac{163}{3} = 54.3333$

3) $\frac{166}{3} = 55.3333$

4) $\frac{323}{6} = 53.8333$

5) $\frac{99}{2} = 49.5$

6) $\frac{329}{6} = 54.8333$

7) $\frac{335}{6} = 55.8333$

8) $\frac{311}{6} = 51.8333$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} . X . \begin{pmatrix} 1 & -2 \\ -1 & 3 \end{pmatrix} = \begin{pmatrix} -1 & 2 \\ 2 & -5 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x + (1 + 2m)y + z == -1 + 2m$
$x + my + z == -2 + m$
$2x - 2y + z == -4$

has only a solution. For that solution compute the value of variable y

1) $y = -6$.

2) $y = -8$.

3) $y = -3$.

4) $y = 1$.

5) $y = 4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 6 & 40 & -16 \\ -2 & -34 & 16 \\ -5 & -58 & 26 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 4$ is an eigenvalue with eigenvector $(-1\ -1\ 2)$.

2) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-2\ 1\ 1)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3\ -2\ 1)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2\ 1\ -1)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2\ -1\ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 64

Exercise 1

We have one bank account that offers a compound interes rate of 6% where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 20 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **4.***** years.

2) In **8.***** years.

3) In **0.***** years.

4) In **5.***** years.

5) In **6.***** years.

Exercise 2

Between the months $t=2$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t) = 16 + 120t - 27t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=5$.

1) It oscillates between 200 and 198.

2) It oscillates between 181 and 184.

3) It oscillates between 164 and 196.

4) It oscillates between 191 and 192.

5) It oscillates between 184 and 184.

Exercise 3

Compute the area enclosed by the function $f(x) = x + x^2$ and the horizontal axis between the points $x = -3$ and $x = 5$.

1) $\frac{121}{2} = 60.5$

2) $\frac{148}{3} = 49.3333$

3) 63

4) 61

5) 59

6) $\frac{123}{2} = 61.5$

7) $\frac{149}{3} = 49.6667$

8) 62

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix}^{-1} . X - \begin{pmatrix} 3 & 1 \\ 2 & 1 \end{pmatrix} = \begin{pmatrix} -2 & -1 \\ 0 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -2 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m) x + y + z == 2$
$-5 x + 5 y + 3 z == 8$
$-3 x + 3 y + 2 z == 5$

has only a solution. For that solution compute the value of variable z

1) $z = -6$.

2) $z = 6$.

3) $z = 4$.

4) $z = -2$.

5) $z = 1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -7 & 4 \\ -9 & 5 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(\ -2\ \ 2\ )$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(\ 2\ \ 3\ )$.

3) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(\ -5\ \ -7\ )$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(\ 3\ \ -3\ )$.

5) The matrix is diagonalizable and $\lambda = 4$ is an eigenvalue with eigenvector $(\ 0\ \ 2\ )$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 65

Exercise 1

We have a bank account that initially offers a compound interes rate of 1% , and after 2 years the conditions are modified and then we obtain a compound interes rate of 10% . The initial deposit is 5000 euros. Compute the amount of money in the account after 2 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****0.***** euros.

3) We will have ****1.***** euros.

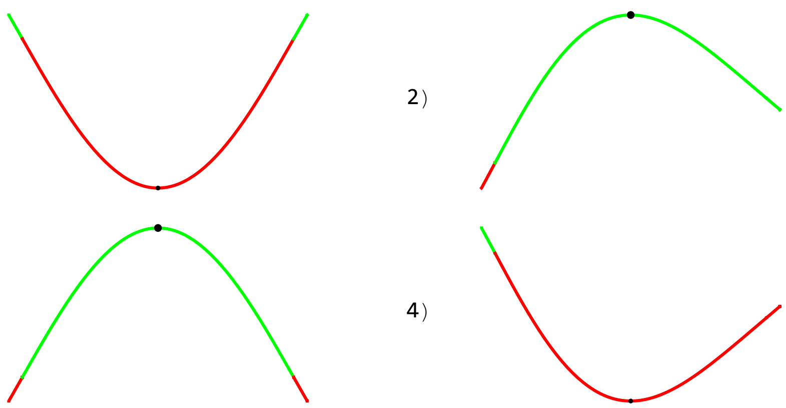
4) We will have ****6.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Study the shape properties of $f(x) = 4 - 12x^2 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 4 + 6x + 2x^2$ and the horizontal axis between the points $x = -2$ and $x = 5$.

1) $\frac{553}{3} = 184.3333$

2) $\frac{1103}{6} = 183.8333$

3) $\frac{1109}{6} = 184.8333$

4) $\frac{1091}{6} = 181.8333$

5) $\frac{541}{3} = 180.3333$

6) $\frac{556}{3} = 185.3333$

7) $\frac{1097}{6} = 182.8333$

8) $\frac{550}{3} = 183.3333$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 2 & -1 \\ 1 & 0 \end{pmatrix}\right) \cdot \begin{pmatrix} 1 & 0 \\ -4 & 1 \end{pmatrix} = \begin{pmatrix} -10 & 2 \\ -1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -1 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y + (1 - m) z == -2$
$x + 2 y - 2 z == 3$
$-x - y + 2 z == -2$

has only a solution. For that solution compute the value of variable y

1) $y = 8$.

2) $y = 6$.

3) $y = 2$.

4) $y = -1$.

5) $y = 1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 14 & 28 \\ -6 & -12 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2 \;\; 1)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2 \;\; 1)$.

3) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2 \;\; -2)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1 \;\; 0)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(0 \;\; -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 66

Exercise 1

We have one bank account that offers a periodic compound interes rate of 2% in 4 periods (compounding frequency) where we initially deposit 8000 euros. How long time is it necessary until the amount of money in the account reaches 14 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **8.***** years.

2) In **2.***** years.

3) In **0.***** years.

4) In **3.***** years.

5) In **9.***** years.

Exercise 2

Between the months $t=2$ and $t=6$, the true value of the shares of a company (in euros) are given by the function $C(t)=60+48t-18t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=2$ and $t=6$.

1) It oscillates between 90 and 122.

2) It oscillates between 92 and 100.

3) It oscillates between 88 and 138.

4) It oscillates between 99 and 124.

5) It oscillates between 92 and 132.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t)=\left(\frac{6+t}{100}\right)(\cos(2\pi t)+1) \quad \text{per-unit.}$$

The initial deposit in the account is 7000 euros. Compute the deposit after 2 years.

1) 8051.9166 euros

2) 8111.9166 euros

3) 8071.9166 euros

4) 8081.9166 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & 1 & -1 \\ -3 & 3 & -2 \\ 0 & 1 & 0 \end{pmatrix} . \left(X + \begin{pmatrix} -2 & -3 & -1 \\ 3 & 4 & 2 \\ -2 & -2 & -1 \end{pmatrix} \right) = \begin{pmatrix} 6 & 9 & 4 \\ 15 & 26 & 11 \\ 2 & 4 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1+m)\, x + 2\, y + 3\, z == 5 + 2\, m$
$x - z == 1$
$-2\, x + y + 2\, z == 0$

has only a solution.

1) We have unique solution for $m \neq -4$.

2) We have unique solution for $m \leq 1$.

3) We have unique solution for $m \geq -3$.

4) We have unique solution for $m \neq 1$.

5) We have unique solution for $m \neq -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (-1\ \ -3),\ (-2\ \ -7) \rangle$

1) $\begin{pmatrix} -3 & -1 \\ 3 & -3 \end{pmatrix}$ 2) $\begin{pmatrix} -2 & -1 \\ 1 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 0 \\ 0 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 0 \\ -3 & 1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 67

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 5% in 10 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a compound interes rate of 3%. The initial deposit is 14 000 euros. Compute the amount of money in the account after 2 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****8.***** euros.

3) We will have ****2.***** euros.

4) We will have ****1.***** euros.

5) We will have ****6.***** euros.

Exercise 2

Between the months $t=4$ and $t=11$, the true value of the shares of a company (in euros) are given by the function $C(t) = 1034 + 432\,t - 51\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t=9$ and $t=10$.

1) It oscillates between 2250 and 2245.

2) It oscillates between 2249 and 2254.

3) It oscillates between 2249 and 2250.

4) It oscillates between 2255 and 2245.

5) It oscillates between 2074 and 2277.

Exercise 3

Compute the area enclosed by the function $f(x) = 6 - 7x + x^3$ and the horizontal axis between the points $x = -1$ and $x = 2$.

1) $\frac{57}{4} = 14.25$

2) $\frac{65}{4} = 16.25$

3) $\frac{51}{4} = 12.75$

4) $\frac{69}{4} = 17.25$

5) $\frac{45}{4} = 11.25$

6) $\frac{67}{4} = 16.75$

7) $\frac{63}{4} = 15.75$

8) $\frac{59}{4} = 14.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & 0 \\ 6 & 3 & 2 \\ -9 & -5 & -3 \end{pmatrix} . X + \begin{pmatrix} 1 & 0 & 1 \\ -1 & 1 & 0 \\ -1 & 0 & 0 \end{pmatrix} = \begin{pmatrix} 2 & -1 & 2 \\ 4 & -4 & 7 \\ -8 & 7 & -11 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & 1 & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$m x + 2 y + z == 2 m$$
$$x + 2 y + z == 2$$
$$y + z == -1$$

has only a solution.

1) We have unique solution for $m \geq -1$.

2) We have unique solution for $m \neq 1$.

3) We have unique solution for $m \leq 5$.

4) We have unique solution for $m \neq 4$.

5) We have unique solution for $m \neq 3$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-1 \ \ -1), \ (2 \ \ 1) \rangle$

1) $\begin{pmatrix} -3 & -2 \\ 2 & -2 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -1 \\ 1 & 1 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & 3 \\ 3 & -2 \end{pmatrix}$ 4) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 3 \\ 3 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 68

Exercise 1

We have a bank account that initially offers a compound interes rate of 6% , and after 3 years the conditions are modified and then we obtain a periodic compound interes rate of 7% in 9 periods (compounding frequency) . The initial deposit is 8000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****5.***** euros.

2) We will have ****3.***** euros.

3) We will have ****2.***** euros.

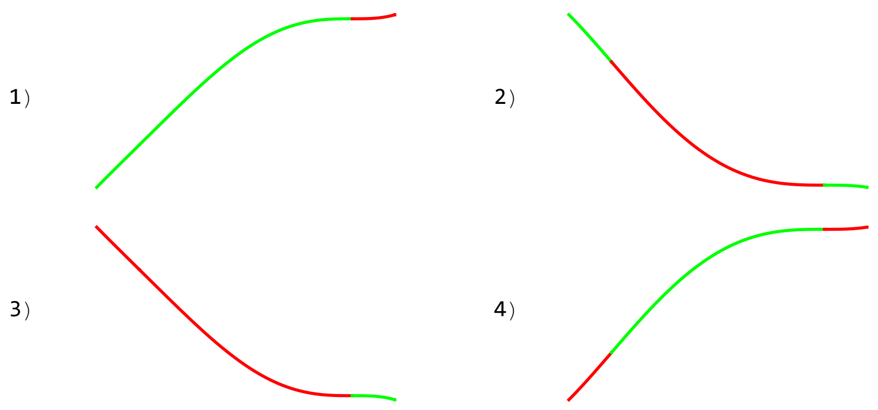
4) We will have ****4.***** euros.

5) We will have ****8.***** euros.

Exercise 2

Study the shape properties of $f(x) = 3 + x^3 + \frac{x^4}{2}$

to decide which amongst the following ones is the representation of the function.



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \frac{1}{15} e^{-3+3t} \text{ per-unit.}$$

The initial deposit in the account is 7000 euros. Compute the deposit after 1 year.

1) 7129.3825 euros

2) 7149.3825 euros

3) 7219.3825 euros

4) 7239.3825 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 & 0 \\ -4 & 4 & 1 \\ -1 & 0 & 1 \end{pmatrix} . \left(X + \begin{pmatrix} 0 & 1 & 0 \\ -1 & 1 & 0 \\ 0 & -2 & 1 \end{pmatrix} \right) = \begin{pmatrix} 3 & 0 & 0 \\ -12 & -1 & 2 \\ -1 & -3 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$(-3 + m)\, x - 2 y + 4 z == 5 - m$$
$$x + y - z == -1$$
$$-x - y + 2 z == 2$$

has only a solution.

1) We have unique solution for $m \geq -2$.

2) We have unique solution for $m \neq 0$.

3) We have unique solution for $m \neq 3$.

4) We have unique solution for $m \neq 1$.

5) We have unique solution for $m \leq 4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 0 & 4 & -5 \\ 5 & 19 & -25 \\ 4 & 16 & -21 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2\ 1\ -1)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1\ 1\ 1)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-3\ -2\ -1)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1\ -5\ -4)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(0\ -1\ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 69

Exercise 1

We have a bank account that initially offers a compound interes rate of 1% , and after 3 years the conditions are modified and then we obtain a periodic compound interes rate of 4% in 4 periods (compounding frequency) . The initial deposit is 10 000 euros. Compute the amount of money in the account after 7 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****1.***** euros.

3) We will have ****4.***** euros.

4) We will have ****3.***** euros.

5) We will have ****2.***** euros.

Exercise 2

Between the months $t = 2$ and $t = 8$, the true value of the shares of a company (in euros) are given by the function $C(t) = 38 + 144\,t - 33\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t = 4$ and $t = 6$.

1) It oscillates between 143 and 224.

2) It oscillates between 156 and 211.

3) It oscillates between 102 and 227.

4) It oscillates between 146 and 214.

5) It oscillates between 102 and 227.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10} \sin(-2 + 7\,t)$ per-unit.

The initial deposit in the account is 17 000 euros. Compute the deposit after $4\,\pi$ years.

1) 17 000 euros

2) 17 010 euros

3) 17 050 euros

4) 16 960 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 2 & 1 & 0 \\ 1 & 0 & 1 \\ 0 & -1 & 1 \end{pmatrix}\right) . \begin{pmatrix} 1 & 0 & -1 \\ -1 & 1 & 1 \\ -2 & 1 & 3 \end{pmatrix} = \begin{pmatrix} -2 & 0 & 2 \\ 3 & -2 & -5 \\ 2 & -1 & -3 \end{pmatrix}$$

1) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & * \\ 0 & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ 1 & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & 1 & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$m x - m y + z == -2 m$
$-2 x + 3 y - z == 5$
$2 x - 3 y + 2 z == -5$

has only a solution.

1) We have unique solution for $m \neq -3$.

2) We have unique solution for $m \leq 3$.

3) We have unique solution for $m \geq 1$.

4) We have unique solution for $m \leq 3$.

5) We have unique solution for $m \neq 1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -5 & -6 \\ 3 & 4 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(2\ \ -1)$.

2) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(2\ \ -1)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3\ \ 0)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2\ \ -1)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1\ \ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 70

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 8% in 5 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a compound interes rate of 5%. The initial deposit is 11 000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****4.***** euros.

3) We will have ****8.***** euros.

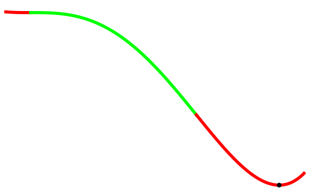
4) We will have ****7.***** euros.

5) We will have ****9.***** euros.

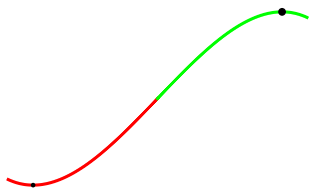
Exercise 2

Study the shape properties of the $f(x) = 5 + 24 x^2 + 16 x^3 + 3 x^4$ to decide which amongst the following ones is the representation of the function.

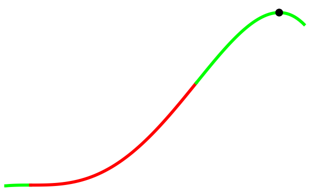
1)



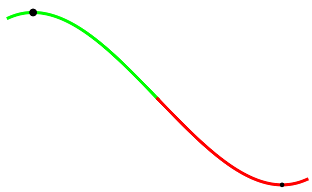
2)



3)



4)



● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}\,(6+8\,t)\right)(\sin(2\pi t)+1)$ per-unit.

The initial deposit in the account is 20000 euros. Compute the deposit after 2 years.

1) 25827.2393 euros

2) 25807.2393 euros

3) 25817.2393 euros

4) 25797.2393 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 \\ 1 & 3 \end{pmatrix}.X.\begin{pmatrix} 4 & 3 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} -3 & -2 \\ 5 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m\,x + m\,z == m$
$2\,x + y + z == 1$
$x + y + z == -1$

has only a solution. For that solution compute the value of variable y

1) $y = -8$.

2) $y = -2$.

3) $y = -5$.

4) $y = -7$.

5) $y = 6$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 8 & 2 & -5 \\ 5 & 1 & -3 \\ 16 & 4 & -10 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1\ 0\ 2)$.

2) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-2\ 1\ -1)$.

3) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(-2\ -1\ -4)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1\ 1\ 2)$.

5) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(3\ 2\ -1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 71

Exercise 1

We have one bank account that offers a continuous compound rate of 5% where we initially deposit 6000 euros. How long time is it necessary until the amount of money in the account reaches 15 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **7.***** years.

2) In **2.***** years.

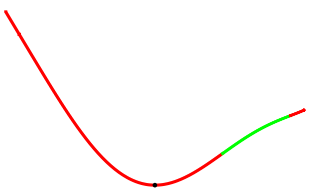
3) In **8.***** years.

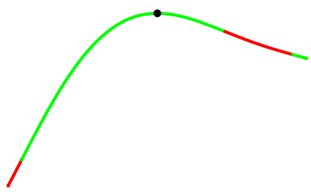
4) In **9.***** years.

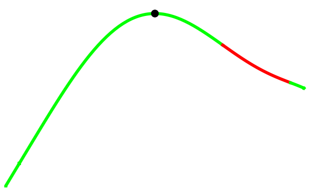
5) In **0.***** years.

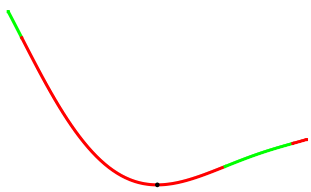
Exercise 2

Study the shape properties of $f(x) = 2 + 24x^2 - 8x^3 - x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1)


2)


3)


4)


Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = 12 + 2x - 8x^2 + 2x^3$ and the horizontal axis between the points $x = -3$ and $x = 3$.

1) 72

2) $\frac{239}{2} = 119.5$

3) 117

4) 119

5) 120

6) $\frac{237}{2} = 118.5$

7) $\frac{209}{3} = 69.6667$

8) $\frac{344}{3} = 114.6667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 3 & 2 \\ 1 & 1 \end{pmatrix} . \left(X + \begin{pmatrix} 0 & -1 \\ 1 & 2 \end{pmatrix} \right) = \begin{pmatrix} -3 & 3 \\ -1 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + 2 y + 2 z == 4 - m$
$-x - z == 0$
$x + y + z == 1$

has only a solution. For that solution compute the value of variable y

1) $y = 3$.

2) $y = -3$.

3) $y = -9$.

4) $y = 2$.

5) $y = 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2 \ \ -1) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-1 \ \ 1) \rangle$

1) $\begin{pmatrix} -2 & -2 \\ -2 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -4 \\ 2 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & -2 \\ 1 & 3 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & 2 \\ -4 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & 0 \\ -2 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 72

Exercise 1

We have one bank account that offers a compound interes rate of 3% where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 16 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **0.***** years.

2) In **7.***** years.

3) In **5.***** years.

4) In **3.***** years.

5) In **2.***** years.

Exercise 2

Between the months $t=0$ and $t=4$, the funds in certain account (in millions of euros) are given by the function $F(t) = -15 + 72t - 21t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=3$.

1) It oscillates between 71 and 73.

2) It oscillates between 65 and 66.

3) It oscillates between 62 and 60.

4) It oscillates between 61 and 66.

5) It oscillates between −15 and 66.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}\left(2 + 2t + 4t^2\right)\right)\log(t)$ per-unit.

In the year t=1 we deposint in the account 11 000 euros. Compute the deposit in the account after (with respect to t=1) 4 years.

1) 133364.2348 euros

2) 133284.2348 euros

3) 133264.2348 euros

4) 133354.2348 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -2 \\ 0 & -1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} 0 & -1 \\ 1 & 2 \end{pmatrix} \right) = \begin{pmatrix} 1 & -5 \\ 0 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x - y - z == 3$
$-x + y == -1$
$(1 + m)\, x + y + 2 z == -5$

has only a solution. For that solution compute the value of variable z

1) $z = 0$.

2) $z = -9$.

3) $z = 1$.

4) $z = -1$.

5) $z = -2$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (3 \ \ -1), \ (-8 \ \ 3) \rangle$

1) $\begin{pmatrix} -3 & -2 \\ 1 & -3 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 3 \\ -2 & 3 \end{pmatrix}$ 3) $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -3 \\ -3 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & 3 \\ 2 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 73

Exercise 1

We have a bank account that initially offers a continuous compound rate of 10% , and after 4 years the conditions are modified and then we obtain a continuous compound rate of 9% . The initial deposit is 13 000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****7.***** euros.

3) We will have ****9.***** euros.

4) We will have ****8.***** euros.

5) We will have ****6.***** euros.

Exercise 2

Between the months $t = 3$ and $t = 8$, the funds in certain account (in millions of euros) are given by the function $F(t) = -10 + 336\,t - 45\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t = 5$ and $t = 7$.

1) It oscillates between 795 and 823.

2) It oscillates between 647 and 823.

3) It oscillates between 786 and 820.

4) It oscillates between 786 and 829.

5) It oscillates between 822 and 823.

Exercise 3

Compute the area enclosed by the function $f(x) = 18 - 21\,x + 3\,x^3$ and the horizontal axis between the points $x = -4$ and $x = 2$.

1) $\frac{281}{2} = 140.5$

2) $\frac{267}{2} = 133.5$

3) 141

4) $\frac{283}{2} = 141.5$

5) 54

6) 138

7) 140

8) $\frac{117}{2} = 58.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 \\ 1 & 0 \end{pmatrix} . \left(X - \begin{pmatrix} -4 & 7 \\ -7 & 12 \end{pmatrix} \right) = \begin{pmatrix} -1 & 5 \\ 5 & -6 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1+m)\,x + y + 2\,z == 1 + m$
$x + 2\,y + 3\,z == 4$
$-x - y - z == -2$

has only a solution. For that solution compute the value of variable x

1) $x = -6$.

2) $x = 1$.

3) $x = 0$.

4) $x = 3$.

5) $x = -9$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-2 \;\; -1) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (3 \;\; 1) \rangle$

1) $\begin{pmatrix} 2 & -3 \\ 2 & -3 \end{pmatrix}$ 2) $\begin{pmatrix} 2 & 2 \\ -3 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & -1 \\ 2 & -1 \end{pmatrix}$ 4) $\begin{pmatrix} 2 & -6 \\ 1 & -3 \end{pmatrix}$ 5) $\begin{pmatrix} 2 & 1 \\ -6 & -3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 74

Exercise 1

We have a bank account that initially offers a continuous compound rate of 4% , and after 2 years the conditions are modified and then we obtain a periodic compound interes rate of 8% in 12 periods (compounding frequency) . The initial deposit is 7000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****1.***** euros.

2) We will have ****2.***** euros.

3) We will have ****7.***** euros.

4) We will have ****3.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Between the months $t=0$ and $t=5$, the funds in certain account (in millions of euros) are given by the function $F(t)=13-6t^2+2t^3$.

Determine the interval where the temperature oscillates between the months $t=2$ and $t=4$.

1) It oscillates between −4 and 35.

2) It oscillates between 5 and 13.

3) It oscillates between 5 and 45.

4) It oscillates between 5 and 113.

5) It oscillates between −2 and 35.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t)=\frac{1}{100}(1+2t)$ per-unit.

The initial deposit in the account is 12 000 euros. Compute the deposit after 2 years.

1) 12722.0386 euros

2) 12792.0386 euros

3) 12742.0386 euros

4) 12772.0386 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & -1 \\ 1 & -1 \end{pmatrix} . \left(X + \begin{pmatrix} -2 & 1 \\ -5 & 2 \end{pmatrix}\right) = \begin{pmatrix} 6 & -3 \\ 4 & -3 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-1 + m)\,x + y - 3\,z == -5 - m$
$-x + y - z == -1$
$x + z == 1$

has only a solution. For that solution compute the value of variable y

1) $y = 0$.

2) $y = 5$.

3) $y = -1$.

4) $y = 7$.

5) $y = -5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 2 & 4 & -3 \\ -15 & -17 & 12 \\ -16 & -16 & 11 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(0\ 3\ -3)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(1\ -1\ 0)$.

3) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-1\ 3\ 3)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-2\ 3\ 2)$.

5) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(1\ -1\ 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1),(0,1,1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by ⟨(2,1)⟩, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 75

Exercise 1

We have one bank account that offers a compound interes rate of 3% where we initially deposit 13 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **6.***** years.

2) In **8.***** years.

3) In **1.***** years.

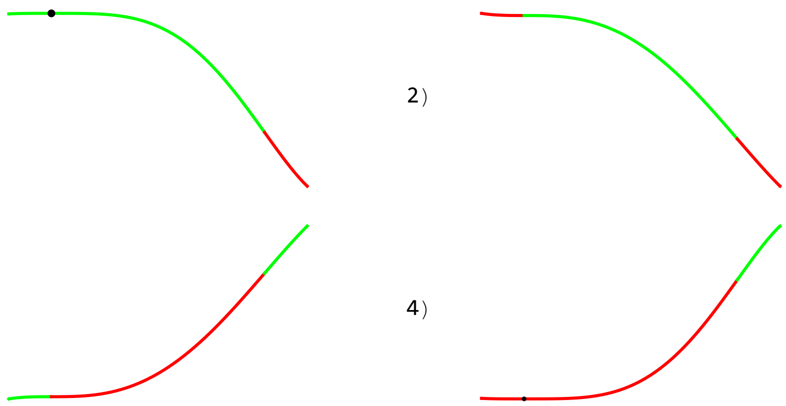
4) In **4.***** years.

5) In **0.***** years.

Exercise 2

Study the shape properties of $f(x) = 4 - x^3 + \frac{x^4}{2}$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(-5 + 2t)\right)\sin(8t)$ per-unit.

The initial deposit in the account is 18 000 euros. Compute the deposit after 2π years.

1) 17739.4657 euros

2) 17679.4657 euros

3) 17629.4657 euros

4) 17719.4657 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 5 & -2 \\ -7 & 3 \end{pmatrix} . \left(X - \begin{pmatrix} 0 & -1 \\ 1 & -1 \end{pmatrix}\right) = \begin{pmatrix} 9 & -4 \\ -13 & 6 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2 + m)x - 4y - z == -9 + m$
$x + 3y + z == 6$
$x + 2y + z == 4$

has only a solution. For that solution compute the value of variable z

1) $z = 3$.

2) $z = 4$.

3) $z = -1$.

4) $z = 7$.

5) $z = 5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 6 & -2 \\ 12 & -4 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1 \;\; 2)$.

2) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-3 \;\; 0)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-1 \;\; -2)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1 \;\; 1)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1 \;\; -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 76

Exercise 1

We have a bank account that initially offers a continuous compound rate of 7% , and after 4 years the conditions are modified and then we obtain a continuous compound rate of 5% . The initial deposit is 5000 euros. Compute the amount of money in the account after 10 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****8.***** euros.

3) We will have ****9.***** euros.

4) We will have ****2.***** euros.

5) We will have ****7.***** euros.

Exercise 2

Between the months $t=1$ and $t=5$, the true value of the shares of a company (in euros) are given by the function $C(t) = 10+36t-15t^2+2t^3$.

Determine the interval where the value oscillates between the months $t=1$ and $t=5$.

1) It oscillates between 33 and 65.

2) It oscillates between 34 and 62.

3) It oscillates between 37 and 38.

4) It oscillates between 27 and 63.

5) It oscillates between 26 and 66.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1-t}{14}\right) e^{-2+3t}$ per-unit.

The initial deposit in the account is 10000 euros. Compute the deposit after 1 year.

1) 10254.2742 euros

2) 10234.2742 euros

3) 10222.1752 euros

4) 10174.2742 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 & 0 \\ 0 & 0 & 1 \\ 0 & -1 & 1 \end{pmatrix} . X . \begin{pmatrix} 1 & 1 & 2 \\ 0 & 1 & 1 \\ 0 & -2 & -1 \end{pmatrix}^{-1} = \begin{pmatrix} 0 & 5 & 3 \\ -1 & 0 & -1 \\ 0 & -1 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ -1 & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ 1 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + 3 y - z == -5$
$(-1 - m) x - 2 y + z == 3$
$2 x - 3 y + z == 5$

has only a solution.

1) We have unique solution for $m \leq 2$.

2) We have unique solution for $m \neq -5$.

3) We have unique solution for $m \leq 1$.

4) We have unique solution for $m \neq -2$.

5) We have unique solution for $m \neq 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (4 \;\; 7) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-3 \;\; -5) \rangle$

1) $\begin{pmatrix} -3 & 3 \\ -2 & 0 \end{pmatrix}$ 2) $\begin{pmatrix} 41 & 70 \\ -24 & -41 \end{pmatrix}$ 3) $\begin{pmatrix} 41 & -30 \\ 56 & -41 \end{pmatrix}$ 4) $\begin{pmatrix} 41 & 56 \\ -30 & -41 \end{pmatrix}$ 5) $\begin{pmatrix} 41 & -24 \\ 70 & -41 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 77

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 10% in 5 periods (compounding frequency), and after 4 years the conditions are modified and then we obtain a continuous compound rate of 9%. The initial deposit is 6000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****0.***** euros.

2) We will have ****4.***** euros.

3) We will have ****6.***** euros.

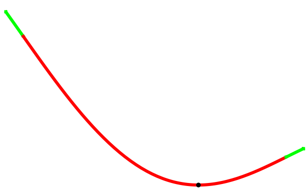
4) We will have ****9.***** euros.

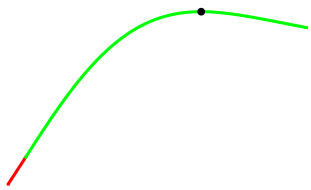
5) We will have ****5.***** euros.

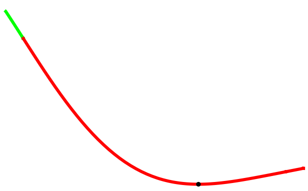
Exercise 2

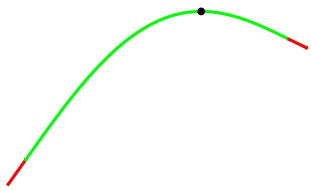
Study the shape properties of $f(x) = 2 + 12x^2 - 6x^3 + \frac{3x^5}{5}$

to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(-5 + 8t)\right)\cos(5t)$ per-unit.

The initial deposit in the account is 19 000 euros. Compute the deposit after 4π years.

1) 19 060 euros

2) 18 980 euros

3) 19 000 euros

4) 19 090 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 2 & 1 & -2 \\ 1 & 1 & -2 \\ 1 & 0 & 1 \end{pmatrix}\right) . \begin{pmatrix} 0 & 0 & -1 \\ 0 & 1 & 0 \\ 1 & -1 & 2 \end{pmatrix}^{-1} = \begin{pmatrix} -6 & -3 & -2 \\ -4 & -1 & -1 \\ 0 & -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-4 + m)\,x - y - 2z == 7 - 2m$
$2x + y + 2z == -3$
$x + z == -1$

has only a solution.

1) We have unique solution for $m \neq 1$.

2) We have unique solution for $m \leq 3$.

3) We have unique solution for $m \neq 2$.

4) We have unique solution for $m \neq 4$.

5) We have unique solution for $m \geq 0$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (1 \ \ -3) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (-2 \ \ 7) \rangle$

1) $\begin{pmatrix} -7 & 14 \\ -3 & 6 \end{pmatrix}$ 2) $\begin{pmatrix} -7 & 21 \\ -2 & 6 \end{pmatrix}$ 3) $\begin{pmatrix} -7 & -2 \\ 21 & 6 \end{pmatrix}$ 4) $\begin{pmatrix} -7 & -3 \\ 14 & 6 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & -1 \\ 3 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 78

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 9% in 12 periods (compounding frequency), and after 1 year the conditions are modified and then we obtain a compound interes rate of 7%. The initial deposit is 8000 euros. Compute the amount of money in the account after 5 years from the moment of the first deposit.

1) We will have ****1.***** euros.

2) We will have ****2.***** euros.

3) We will have ****5.***** euros.

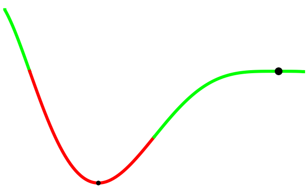
4) We will have ****3.***** euros.

5) We will have ****0.***** euros.

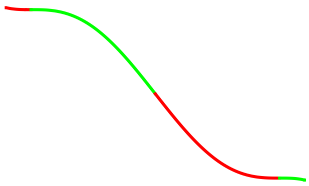
Exercise 2

Study the shape properties of $f(x) = 1 + 4x^3 + 3x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

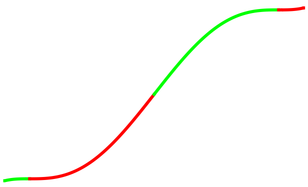
1)



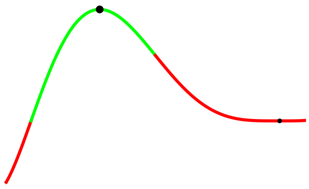
2)



3)



4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1+t}{100}\right) \sin(2t)$ per-unit.

The initial deposit in the account is 4000 euros. Compute the deposit after 3π years.

1) 3815.8768 euros

2) 3825.8768 euros

3) 3775.8768 euros

4) 3745.8768 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & 1 \\ -1 & 1 \end{pmatrix} . \left(X - \begin{pmatrix} 3 & 4 \\ -1 & -1 \end{pmatrix} \right) = \begin{pmatrix} 2 & 0 \\ 4 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$m x + m y == 3 m$
$x + 2 y + z == 7$
$x + 2 y + 2 z == 9$

has only a solution. For that solution compute the value of variable x

1) $x = 1$.

2) $x = -9$.

3) $x = -4$.

4) $x = -5$.

5) $x = 3$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -14 & -4 & -16 \\ 24 & 8 & 24 \\ 8 & 2 & 10 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(\,2\ \ -3\ \ -1\,)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(\,-1\ \ -1\ \ -3\,)$.

3) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(\,-1\ \ 0\ \ 1\,)$.

4) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(\,0\ \ -3\ \ 2\,)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(\,-2\ \ 0\ \ 0\,)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 79

Exercise 1

We have one bank account that offers a periodic compound interes rate of 3% in 10 periods (compounding frequency) where we initially deposit 7000 euros. How long time is it necessary until the amount of money in the account reaches 9000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **1.***** years.

2) In **8.***** years.

3) In **7.***** years.

4) In **4.***** years.

5) In **0.***** years.

Exercise 2

Between the months $t=1$ and $t=8$, the true value of the shares of a company (in euros) are given by the function $C(t)=213+288\,t-42\,t^2+2\,t^3$.

Determine the interval where the value oscillates between the months $t=1$ and $t=5$.

1) It oscillates between 465 and 858.

2) It oscillates between 461 and 853.

3) It oscillates between 461 and 861.

4) It oscillates between 853 and 861.

5) It oscillates between 464 and 862.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t)=\frac{1}{10}\cos(4+7\,t) \text{ per-unit.}$$

The initial deposit in the account is 3000 euros. Compute the deposit after 5π years.

1) 3145.5752 euros

2) 3045.5752 euros

3) 3065.5752 euros

4) 3075.5752 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 1 & 0 & 0 \\ -1 & 1 & 0 \\ -1 & 1 & 1 \end{pmatrix}\right) . \begin{pmatrix} -1 & 2 & -1 \\ 0 & 0 & 1 \\ -1 & 3 & -1 \end{pmatrix} = \begin{pmatrix} -1 & 3 & -1 \\ -1 & 3 & -1 \\ 0 & -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$2x - y + (-1 + m) z == -4 - 2m$
$-2x + y + 2z == 2$
$-x + z == 0$

has only a solution.

1) We have unique solution for $m \geq -3$.

2) We have unique solution for $m \neq 1$.

3) We have unique solution for $m \geq -5$.

4) We have unique solution for $m \neq -3$.

5) We have unique solution for $m \leq -4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -23 & 9 \\ -49 & 19 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2 \;\; 1)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3 \;\; -7)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(3 \;\; 0)$.

4) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1 \;\; 2)$.

5) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(0 \;\; 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 80

Exercise 1

We have a bank account that initially offers a continuous compound rate of 2% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 4% . The initial deposit is 9000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****9.***** euros.

2) We will have ****1.***** euros.

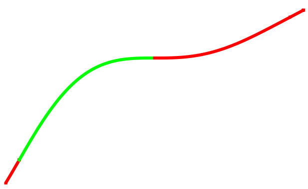
3) We will have ****7.***** euros.

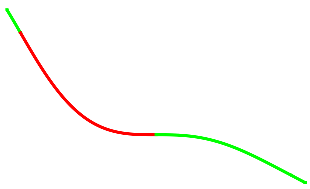
4) We will have ****8.***** euros.

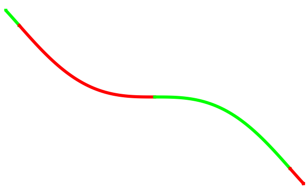
5) We will have ****2.***** euros.

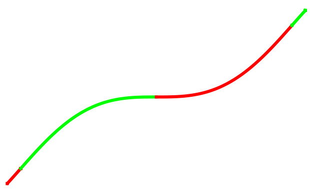
Exercise 2

Study the shape properties of $f(x) = 3 + 80\,x^3 - 20\,x^4 - 6\,x^5 + 2\,x^6$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -3 + x + 3x^2 - x^3$ and the horizontal axis between the points $x = -4$ and $x = 4$.

1) $\frac{217}{2} = 108.5$

2) $\frac{253}{2} = 126.5$

3) $\frac{255}{2} = 127.5$

4) 127

5) $\frac{233}{2} = 116.5$

6) $\frac{257}{2} = 128.5$

7) $\frac{249}{2} = 124.5$

8) 104

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & 0 & 0 \\ 1 & 1 & 0 \\ 1 & 1 & 1 \end{pmatrix}\right) . \begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ -1 & -4 & 1 \end{pmatrix}^{-1} = \begin{pmatrix} 2 & -3 & 0 \\ 2 & 4 & 1 \\ 0 & 1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ 0 & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & -1 & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$$(-11 + m)\, x + 3y - 4z == -19 + 2m$$
$$-9x + 3y - 4z == -15$$
$$6x - 2y + 3z == 10$$

has only a solution.

1) We have unique solution for $m \geq 6$.

2) We have unique solution for $m \neq 5$.

3) We have unique solution for $m \leq 4$.

4) We have unique solution for $m \neq -1$.

5) We have unique solution for $m \geq -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -7 & 4 \\ -9 & 5 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(2\ \ 3)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-3\ \ -2)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(2\ \ 3)$.

4) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(1\ \ 2)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2\ \ 2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 81

Exercise 1

We have a bank account that initially offers a continuous compound rate of 1% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 2% . The initial deposit is 6000 euros. Compute the amount of money in the account after 3 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****2.***** euros.

3) We will have ****5.***** euros.

4) We will have ****4.***** euros.

5) We will have ****1.***** euros.

Exercise 2

Between the months $t=2$ and $t=6$, the true value of the shares of a company (in euros) are given by the function $C(t) = 117 + 108\,t - 27\,t^2 + 2\,t^3$.

Determine the interval where the value oscillates between the months $t=2$ and $t=4$.

1) It oscillates between 225 and 252.

2) It oscillates between 238 and 245.

3) It oscillates between 241 and 252.

4) It oscillates between 225 and 252.

5) It oscillates between 242 and 252.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{12}\, e^{-6+2t}$ per-unit.

The initial deposit in the account is 6000 euros. Compute the deposit after 3 years.

1) 6334.6354 euros

2) 6254.6354 euros

3) 6264.6354 euros

4) 6324.6354 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 & 0 \\ 0 & 3 & -1 \\ 1 & -4 & 2 \end{pmatrix} . \left(X - \begin{pmatrix} -1 & 0 & 1 \\ 0 & 1 & 1 \\ -2 & -1 & 0 \end{pmatrix} \right) = \begin{pmatrix} 0 & -2 & -3 \\ -6 & -5 & -4 \\ 11 & 7 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x + y - m z == -1 - m$
$x + 2 y + z == -2$
$x + y + z == 0$

has only a solution.

1) We have unique solution for $m \leq -3$.

2) We have unique solution for $m \neq 2$.

3) We have unique solution for $m \leq 1$.

4) We have unique solution for $m \leq 3$.

5) We have unique solution for $m \neq 0$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 611 & 841 \\ -441 & -607 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1 \ -2)$.

2) The matrix is diagonalizable and $\lambda = 0$ is an eigenvalue with eigenvector $(-2 \ 2)$.

3) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2 \ 0)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-29 \ 21)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2 \ 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 82

Exercise 1

We have one bank account that offers a periodic compound interes rate of 5% in 10 periods (compounding frequency) where we initially deposit 11 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **1.***** years.

2) In **5.***** years.

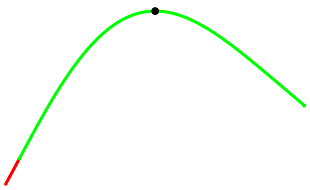
3) In **0.***** years.

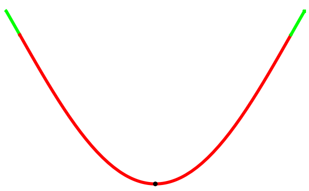
4) In **2.***** years.

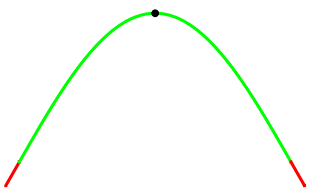
5) In **9.***** years.

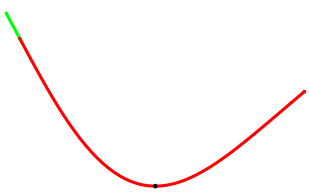
Exercise 2

Study the shape properties of $f(x) = 3 + 48x^2 - 8x^3 - 2x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity — Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(2t + t^3 + 2t^4\right)$ per-unit.

The initial deposit in the account is 3000 euros. Compute the deposit after 3 years.

1) 10633.9649 euros

2) 10623.9649 euros

3) 10625.1992 euros

4) 10613.9649 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 1 \\ 0 & 2 & 3 \end{pmatrix}\right) . \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{pmatrix} = \begin{pmatrix} -1 & 0 & -1 \\ -1 & -1 & -1 \\ -1 & -1 & -3 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$x + y - m z == 1$
$x + y + z == 1$
$2x + y + 2z == 0$

has only a solution.

1) We have unique solution for $m \neq -1$.

2) We have unique solution for $m \neq 2$.

3) We have unique solution for $m \leq 3$.

4) We have unique solution for $m \leq 2$.

5) We have unique solution for $m \neq -4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (-4 \;\; 3) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-11 \;\; 8) \rangle$

1) $\begin{pmatrix} 33 & -12 \\ 88 & -32 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -2 \\ 1 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} 33 & 88 \\ -12 & -32 \end{pmatrix}$ 4) $\begin{pmatrix} 33 & 44 \\ -24 & -32 \end{pmatrix}$ 5) $\begin{pmatrix} 33 & -24 \\ 44 & -32 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 83

Exercise 1

We have one bank account that offers a continuous compound rate of 6% where we initially deposit 15 000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **6.***** years.

3) In **4.***** years.

4) In **0.***** years.

5) In **2.***** years.

Exercise 2

Between the months $t = 0$ and $t = 5$, the funds in certain account (in millions of euros) are given by the function $F(t) = -10 - 3t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t = 1$ and $t = 3$.

1) It oscillates between −11 and −10.

2) It oscillates between −11 and 165.

3) It oscillates between −11 and 17.

4) It oscillates between −7 and 25.

5) It oscillates between −12 and 7.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{100}\left(2 + 2t^2 + t^3 + t^4\right)$ per-unit.

The initial deposit in the account is 4000 euros. Compute the deposit after 2 years.

1) 4962.6001 euros

2) 4912.6001 euros

3) 4872.6001 euros

4) 4942.6001 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -1 \\ 1 & 0 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & 1 \\ -2 & -1 \end{pmatrix} \right) = \begin{pmatrix} 1 & 2 \\ 2 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$-x + y + (2 + m) z == -m$
$y - z == 3$
$-x + z == -1$

has only a solution. For that solution compute the value of variable x

1) $x = 4$.

2) $x = 0$.

3) $x = -4$.

4) $x = 1$.

5) $x = -1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (5 \ \ -3) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (2 \ \ -1) \rangle$

1) $\begin{pmatrix} 6 & -15 \\ 2 & -5 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 1 \\ 2 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} 6 & 2 \\ -15 & -5 \end{pmatrix}$ 4) $\begin{pmatrix} 6 & -3 \\ 10 & -5 \end{pmatrix}$ 5) $\begin{pmatrix} 6 & 10 \\ -3 & -5 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 84

Exercise 1

We have one bank account that offers a
periodic compound interes rate of 3% in 10 periods (compounding frequency)
where we initially deposit 11 000
euros. How long time is it necessary until the amount of money in the account reaches
18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **6.***** years.

2) In **2.***** years.

3) In **0.***** years.

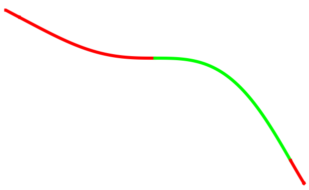
4) In **7.***** years.

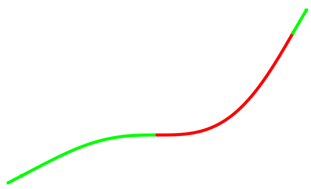
5) In **5.***** years.

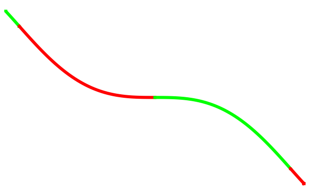
Exercise 2

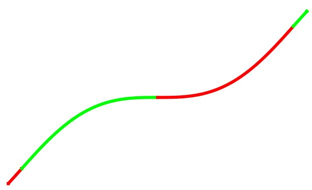
Study the shape properties of $f(x) = 1 - 8x^3 + \frac{3x^5}{5}$

to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -6 + x + x^2$ and the horizontal axis between the points $x = -4$ and $x = 2$.

1) $\frac{77}{3} = 25.6667$

2) $\frac{80}{3} = 26.6667$

3) 18

4) $\frac{157}{6} = 26.1667$

5) $\frac{86}{3} = 28.6667$

6) $\frac{83}{3} = 27.6667$

7) $\frac{71}{3} = 23.6667$

8) $\frac{163}{6} = 27.1667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & 1 & 1 \\ -1 & 1 & 0 \\ 2 & -2 & 1 \end{pmatrix}^{-1} . X - \begin{pmatrix} 1 & 0 & 0 \\ 2 & -1 & -2 \\ 1 & 1 & 1 \end{pmatrix} = \begin{pmatrix} -4 & 2 & 1 \\ -4 & 2 & 3 \\ 2 & -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + y - z == -3 - m$
$-x + z == 3$
$-x - y + z == 4$

has only a solution.

1) We have unique solution for $m \geq -3$.

2) We have unique solution for $m \geq -2$.

3) We have unique solution for $m \neq 4$.

4) We have unique solution for $m \neq 3$.

5) We have unique solution for $m \neq 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (2 \ \ -1) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (7 \ \ -3) \rangle$

1) $\begin{pmatrix} 13 & 28 \\ -6 & -13 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -2 \\ -3 & 0 \end{pmatrix}$ 3) $\begin{pmatrix} 13 & 42 \\ -4 & -13 \end{pmatrix}$ 4) $\begin{pmatrix} 13 & -6 \\ 28 & -13 \end{pmatrix}$ 5) $\begin{pmatrix} 13 & -4 \\ 42 & -13 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 85

Exercise 1

We have a bank account that initially offers a continuous compound rate of 10% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 2% . The initial deposit is 7000 euros. Compute the amount of money in the account after 6 years from the moment of the first deposit.

1) We will have ****1.***** euros.

2) We will have ****9.***** euros.

3) We will have ****2.***** euros.

4) We will have ****7.***** euros.

5) We will have ****4.***** euros.

Exercise 2

Between the months $t=1$ and $t=7$, the true value of the shares of a company (in euros) are given by the function $C(t) = 116 + 36t - 21t^2 + 2t^3$.

Determine the interval where the value oscillates between the months $t=2$ and $t=7$.

1) It oscillates between 10 and 111.

2) It oscillates between 8 and 133.

3) It oscillates between 12 and 113.

4) It oscillates between 8 and 120.

5) It oscillates between 8 and 133.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \left(\frac{1}{100}(5 + 9t)\right)(\cos(2\pi t) + 1) \quad \text{per-unit.}$$

The initial deposit in the account is 14 000 euros. Compute the deposit after 3 years.

1) 24437.1738 euros

2) 24407.1738 euros

3) 24447.1738 euros

4) 24387.1738 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 & 0 \\ 0 & 1 & 0 \\ 0 & 1 & 1 \end{pmatrix}^{-1} . \left(X - \begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & 0 \\ 2 & -3 & 1 \end{pmatrix} \right) = \begin{pmatrix} -1 & 1 & 0 \\ -1 & 0 & 0 \\ -2 & 4 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & 1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$m x + y - z == -1 + m$
$2 x + y - z == 1$
$-x + z == -2$

has only a solution.

1) We have unique solution for $m \neq 3$.

2) We have unique solution for $m \geq 6$.

3) We have unique solution for $m \neq 5$.

4) We have unique solution for $m \geq 1$.

5) We have unique solution for $m \geq -1$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 628 & 798 \\ -495 & -629 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3 \ \ 0)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-19 \ \ 15)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(0 \ \ -2)$.

4) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2 \ \ -2)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-14 \ \ 11)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle (1,1,-1) \rangle$ and $\lambda=3$ with eigenvectors $\langle (1,0,1) \rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle (1,1,-1), (0,1,1) \rangle$ and $\lambda=3$ with eigenvectors $\langle (1,0,1) \rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle (2,1) \rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 86

Exercise 1

We have one bank account that offers a periodic compound interes rate of 1% in 3 periods (compounding frequency) where we initially deposit 10 000 euros. How long time is it necessary until the amount of money in the account reaches 16 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **0.***** years.

2) In **5.***** years.

3) In **8.***** years.

4) In **7.***** years.

5) In **4.***** years.

Exercise 2

Between the months $t = 4$ and $t = 11$, the funds in certain account (in millions of euros) are given by the function $F(t) = 10 + 330\,t - 48\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t = 4$ and $t = 7$.

1) It oscillates between 654 and 710.

2) It oscillates between 659 and 704.

3) It oscillates between 494 and 710.

4) It oscillates between 650 and 713.

5) It oscillates between 494 and 710.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{-2 - 2\,t}{972360}\right) e^{3\,t}$ per-unit.

The initial deposit in the account is 16 000 euros. Compute the deposit after 3 years.

1) 15747.3751 euros

2) 15677.3751 euros

3) 15667.3751 euros

4) 15767.3751 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 2 \\ 2 & 5 \end{pmatrix}.X - \begin{pmatrix} -1 & 1 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} -1 & 0 \\ -3 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2+m)\,x - y - z == -1 + m$
$x + y + z == 0$
$2\,x + y + 2\,z == 1$

has only a solution. For that solution compute the value of variable y

1) $y = -1$.

2) $y = -5$.

3) $y = 8$.

4) $y = -8$.

5) $y = -4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (5\ \ 2) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (-3\ \ -1) \rangle$

1) $\begin{pmatrix} 5 & -3 \\ 10 & -6 \end{pmatrix}$ 2) $\begin{pmatrix} 5 & 10 \\ -3 & -6 \end{pmatrix}$ 3) $\begin{pmatrix} 5 & -15 \\ 2 & -6 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -3 \\ -3 & 1 \end{pmatrix}$ 5) $\begin{pmatrix} 5 & 2 \\ -15 & -6 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 87

Exercise 1

We have one bank account that offers a compound interes rate of 6% where we initially deposit 15 000 euros. How long time is it necessary until the amount of money in the account reaches 23 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In ∗∗2.∗∗∗∗∗ years.

2) In ∗∗9.∗∗∗∗∗ years.

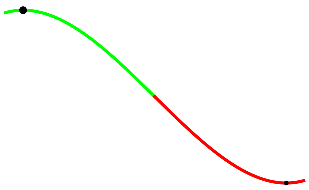
3) In ∗∗7.∗∗∗∗∗ years.

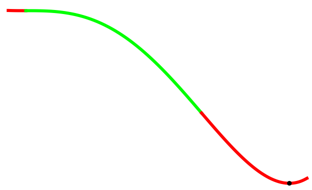
4) In ∗∗4.∗∗∗∗∗ years.

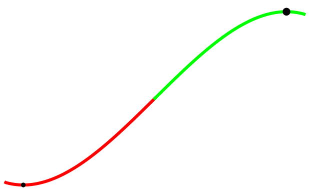
5) In ∗∗0.∗∗∗∗∗ years.

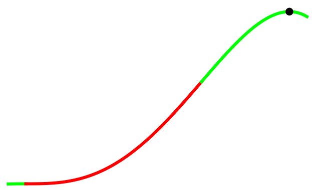
Exercise 2

Study the shape properties of the $f(x) = 5 - 48x + 12x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$$I(t) = \frac{1}{100}\left(1 + 2t + 2t^2 + t^3\right) \text{ per-unit.}$$

The initial deposit in the account is 11000 euros. Compute the deposit after 3 years.

1) 18211.3305 euros

2) 18161.3305 euros

3) 18181.3305 euros

4) 18221.3305 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -1 & -1 \\ 2 & 1 \end{pmatrix}^{-1} . X . \begin{pmatrix} -5 & -2 \\ 3 & 1 \end{pmatrix} = \begin{pmatrix} 8 & 3 \\ -11 & -4 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$4x + 2y + (-3 + m) z == -3 + m$
$2x + y - 2z == -2$
$x + y - z == -2$

has only a solution. For that solution compute the value of variable z

1) $z = 1$.

2) $z = -7$.

3) $z = -9$.

4) $z = -4$.

5) $z = -3$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (4 \ -5) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (13 \ -16) \rangle$

1) $\begin{pmatrix} 64 & -80 \\ 52 & -65 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 0 \\ -2 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} 64 & -20 \\ 208 & -65 \end{pmatrix}$ 4) $\begin{pmatrix} 64 & 208 \\ -20 & -65 \end{pmatrix}$ 5) $\begin{pmatrix} 64 & 52 \\ -80 & -65 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 88

Exercise 1

We have a bank account that initially offers a compound interes rate of 3% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 4% . The initial deposit is 5000 euros. Compute the amount of money in the account after 7 years from the moment of the first deposit.

1) We will have ****9.***** euros.

2) We will have ****0.***** euros.

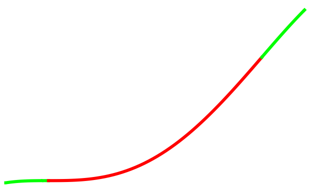
3) We will have ****3.***** euros.

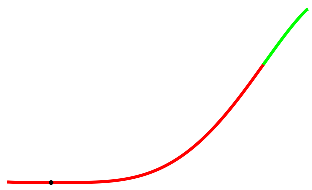
4) We will have ****6.***** euros.

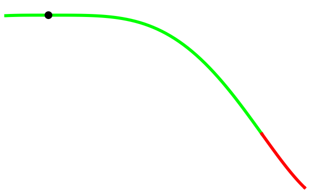
5) We will have ****4.***** euros.

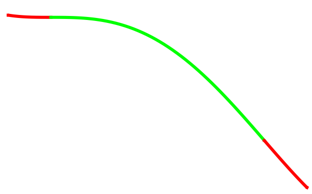
Exercise 2

Study the shape properties of $f(x) = 3 - x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Compute the area enclosed by the function $f(x) = -6 - 7x + x^3$ and the horizontal axis between the points $x = -5$ and $x = 0$.

1) $\frac{413}{4} = 103.25$

2) $\frac{411}{4} = 102.75$

3) $\frac{409}{4} = 102.25$

4) $\frac{373}{4} = 93.25$

5) $\frac{401}{4} = 100.25$

6) $\frac{395}{4} = 98.75$

7) $\frac{379}{4} = 94.75$

8) $\frac{415}{4} = 103.75$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & -1 \\ -5 & 3 \end{pmatrix}^{-1} . X . \begin{pmatrix} 3 & -8 \\ 2 & -5 \end{pmatrix} = \begin{pmatrix} 11 & -28 \\ 20 & -51 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * \\ -1 & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x + y - z == -1$
$-2x + 2y - z == -2$
$(-1 + m) x - y + z == -1 + m$

has only a solution. For that solution compute the value of variable x

1) $x = 1$.

2) $x = 6$.

3) $x = 4$.

4) $x = 3$.

5) $x = 2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 173 & 225 & -66 \\ -146 & -190 & 56 \\ -48 & -63 & 20 \end{pmatrix}$

and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(-12\ 10\ 3)$.

2) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(-1\ -1\ 0)$.

3) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(1\ 2\ 2)$.

4) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-12\ 10\ 3)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(0\ 3\ 0)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 89

Exercise 1

We have one bank account that offers a continuous compound rate of 1% where we initially deposit 12 000 euros. How long time is it necessary until the amount of money in the account reaches 14 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **9.***** years.

2) In **1.***** years.

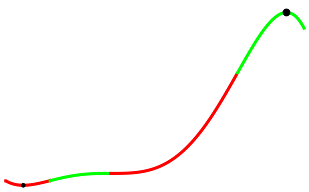
3) In **5.***** years.

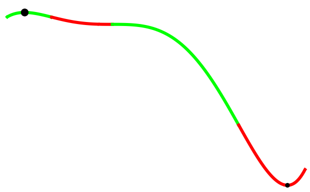
4) In **3.***** years.

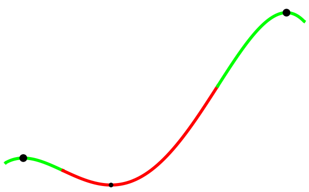
5) In **0.***** years.

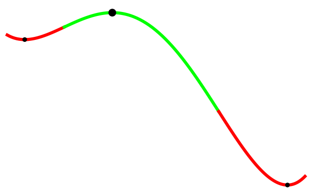
Exercise 2

Study the shape properties of the $f(x) = 2 - 120x - 90x^2 + 20x^3 + 45x^4 + 12x^5$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(-9-2t)\right)\cos(3t)$ per-unit.

The initial deposit in the account is 13 000 euros. Compute the deposit after 4π years.

1) 12 920 euros

2) 13 030 euros

3) 12 910 euros

4) 13 000 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & 0 \\ -5 & -2 & -3 \\ 2 & 1 & 1 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & -2 & 1 \end{pmatrix} \right) = \begin{pmatrix} 2 & -1 & 1 \\ -16 & 7 & -7 \\ 6 & -2 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ 0 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x + m y + m z == 3 m$
$-x - z == -3$
$(-1 + m) x + m y + m z == -2 + 3 m$

has only a solution.

1) We have unique solution for $m \neq 2$.

2) We have unique solution for $m \neq -3$.

3) We have unique solution for $m \leq 3$.

4) We have unique solution for $m \geq 3$.

5) We have unique solution for $m \leq 3$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (11 \;\; -8) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-4 \;\; 3) \rangle$

1) $\begin{pmatrix} -65 & 48 \\ -88 & 65 \end{pmatrix}$ 2) $\begin{pmatrix} -65 & -176 \\ 24 & 65 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & -3 \\ -1 & 0 \end{pmatrix}$ 4) $\begin{pmatrix} -65 & 24 \\ -176 & 65 \end{pmatrix}$ 5) $\begin{pmatrix} -65 & -88 \\ 48 & 65 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 90

Exercise 1

We have one bank account that offers a compound interes rate of 1% where we initially deposit 5000 euros. How long time is it necessary until the amount of money in the account reaches 14 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **4.***** years.

2) In **3.***** years.

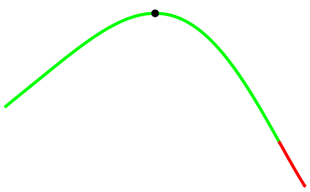
3) In **8.***** years.

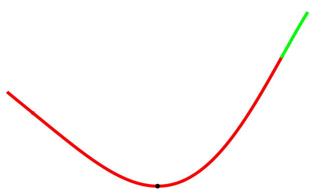
4) In **2.***** years.

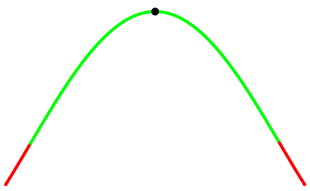
5) In **0.***** years.

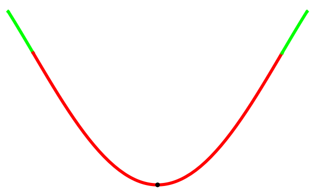
Exercise 2

Study the shape properties of $f(x) = 5 - 6x^2 - 2x^3 + x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points -2, -1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}\left(4 + 3t + 4t^2\right)\right)\log(5t)$ per-unit.

In the year t=1 we deposint in the account 14000 euros. Compute the deposit in the account after (with respect to t=1) 2 years.

1) 51355.8929 euros

2) 51435.8929 euros

3) 51365.8929 euros

4) 51425.8929 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 & 0 \\ 0 & 1 & -2 \\ 0 & 0 & 1 \end{pmatrix}.X + \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ -1 & 2 & 1 \end{pmatrix} = \begin{pmatrix} -1 & 1 & -1 \\ 3 & -2 & 2 \\ -2 & 3 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & -2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & -2 \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & -1 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$2x - 2y + (-4 + m)z == 0$
$-x + y + 3z == 0$
$-y - z == 2$

has only a solution.

1) We have unique solution for $m \leq 1$.

2) We have unique solution for $m \leq 1$.

3) We have unique solution for $m \neq -1$.

4) We have unique solution for $m \neq -1$.

5) We have unique solution for $m \neq -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -1 & 0 \\ 0 & -1 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-1\ \ 0)$.

2) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1\ \ 2)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1\ \ -3)$.

4) The matrix is diagonalizable and $\lambda = 5$ is an eigenvalue with eigenvector $(0\ \ 1)$.

5) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1\ \ -1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, $(1,1,-1)$ and $(1,0,1)$) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ($(1,1,-1)$, $(0,1,1)$ and $(1,0,1)$) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only $(2,1)$ but also the rest of its linear combinations (as $(4,2)=2(2,1)$, $(6,3)=3(2,1)$, etc.) although they are not independent with $(2,1)$.

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 91

Exercise 1

We have a bank account that initially offers a continuous compound rate of 2% , and after 2 years the conditions are modified and then we obtain a continuous compound rate of 7% . The initial deposit is 11 000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****7.***** euros.

2) We will have ****6.***** euros.

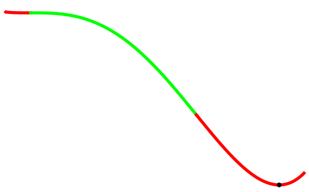
3) We will have ****9.***** euros.

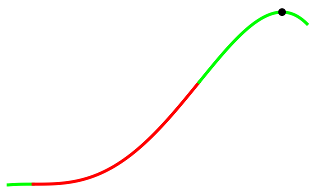
4) We will have ****2.***** euros.

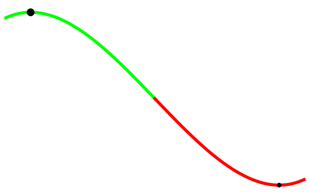
5) We will have ****8.***** euros.

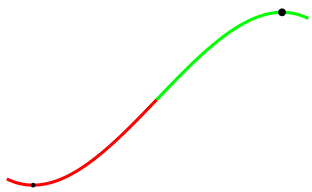
Exercise 2

Study the shape properties of the $f(x) = 4 - 8x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1)


2)


3)


4)


● Big point: maximum • Small point: minimum

Red line: convexity Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1+t}{20969}\right) e^{2t}$ per-unit.

The initial deposit in the account is 10000 euros. Compute the deposit after 3 years.

1) 10372.2965 euros

2) 10332.2965 euros

3) 10432.2965 euros

4) 10342.2965 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 1 & -1 & 1 \\ 1 & 1 & 0 \\ 3 & 0 & 2 \end{pmatrix}\right) . \begin{pmatrix} -1 & -1 & 1 \\ 1 & 1 & 0 \\ -2 & -1 & 1 \end{pmatrix} = \begin{pmatrix} -4 & -3 & 1 \\ -2 & -1 & 3 \\ -4 & -3 & 3 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$m x - y - m z == 2 + 3 m$
$2 x + y - z == 2$
$-x - y + z == -1$

has only a solution.

1) We have unique solution for $m \le 1$.

2) We have unique solution for $m \ne -2$.

3) We have unique solution for $m \le -5$.

4) We have unique solution for $m \le 3$.

5) We have unique solution for $m \ne -2$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 8 & 6 \\ -9 & -7 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-2 \;\; -3)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-1 \;\; -1)$.

3) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(2 \;\; -3)$.

4) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2 \;\; 2)$.

5) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2 \;\; -3)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle (1,1,-1) \rangle$ and $\lambda=3$ with eigenvectors $\langle (1,0,1) \rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle (1,1,-1),(0,1,1) \rangle$ and $\lambda=3$ with eigenvectors $\langle (1,0,1) \rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle (2,1) \rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 92

Exercise 1

We have a bank account that initially offers a continuous compound rate of 4% , and after 2 years the conditions are modified and then we obtain a compound interes rate of 10% . The initial deposit is 14 000 euros. Compute the amount of money in the account after 8 years from the moment of the first deposit.

1) We will have ****5.***** euros.

2) We will have ****2.***** euros.

3) We will have ****9.***** euros.

4) We will have ****3.***** euros.

5) We will have ****7.***** euros.

Exercise 2

Between the months $t=0$ and $t=5$, the funds in certain account (in millions of euros) are given by the function $F(t) = 19 + 90t - 24t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=0$ and $t=2$.

1) It oscillates between 29 and 126.

2) It oscillates between 19 and 119.

3) It oscillates between 119 and 127.

4) It oscillates between 19 and 127.

5) It oscillates between 24 and 120.

Exercise 3

Compute the area enclosed by the function $f(x) = -6x - 8x^2 - 2x^3$ and the horizontal axis between the points $x = -4$ and $x = 5$.

1) $\frac{4439}{6} = 739.8333$

2) $\frac{1431}{2} = 715.5$

3) $\frac{2218}{3} = 739.3333$

4) $\frac{4433}{6} = 738.8333$

5) $\frac{1449}{2} = 724.5$

6) $\frac{4421}{6} = 736.8333$

7) $\frac{2221}{3} = 740.3333$

8) $\frac{4411}{6} = 735.1667$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 0 & 1 \\ -1 & 2 \end{pmatrix} . X + \begin{pmatrix} 2 & -3 \\ 1 & -1 \end{pmatrix} = \begin{pmatrix} 3 & -3 \\ 4 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(2 + 2m)x - y + mz == -2 - 2m$
$x + y + z == 0$
$x + z == -2$

has only a solution. For that solution compute the value of variable y

1) $y = -6$.

2) $y = 2$.

3) $y = -5$.

4) $y = -2$.

5) $y = 7$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (1 \;\; -1) \rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle (-1 \;\; 2) \rangle$

1) $\begin{pmatrix} -1 & -1 \\ 2 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} -1 & 2 \\ -1 & 2 \end{pmatrix}$ 3) $\begin{pmatrix} -3 & -3 \\ -3 & -2 \end{pmatrix}$ 4) $\begin{pmatrix} -2 & 1 \\ 3 & 3 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & -1 \\ 3 & -2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 93

Exercise 1

We have a bank account that initially offers a compound interes rate of 4% , and after 2 years the conditions are modified and then we obtain a compound interes rate of 2% . The initial deposit is 5000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****9.***** euros.

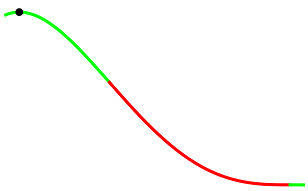
3) We will have ****8.***** euros.

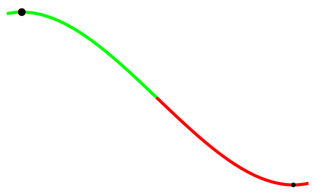
4) We will have ****6.***** euros.

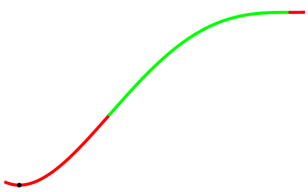
5) We will have ****3.***** euros.

Exercise 2

Study the shape properties of the $f(x) = 2 + 96x - 24x^2 - 8x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}(-8+6t)\right)\sin(9t)$ per-unit.

The initial deposit in the account is 7000 euros. Compute the deposit after 4π years.

1) 6487.4619 euros

2) 6467.4619 euros

3) 6437.4619 euros

4) 6507.4619 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & -1 & 2 \\ 0 & 0 & 1 \\ 1 & -2 & 2 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & 1 & -1 \\ 2 & 2 & -1 \\ -1 & -2 & 1 \end{pmatrix} \right) = \begin{pmatrix} -3 & -5 & 1 \\ 0 & -3 & 0 \\ -6 & -6 & 2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} -1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 0 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 2 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$$2x + 2y - z == 1$$
$$2x + y - z == -1$$
$$(5 - m)\, x + 5y - 3z == 3 + 2m$$

has only a solution.

1) We have unique solution for $m \neq -1$.

2) We have unique solution for $m \neq 1$.

3) We have unique solution for $m \neq -3$.

4) We have unique solution for $m \leq 2$.

5) We have unique solution for $m \geq -5$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -62 & -45 \\ 84 & 61 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(5 \;\; -7)$.

2) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(0 \;\; 3)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-1 \;\; -2)$.

4) The matrix is diagonalizable and $\lambda = -4$ is an eigenvalue with eigenvector $(5 \;\; -7)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-3 \;\; 4)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 94

Exercise 1

We have one bank account that offers a compound interes rate of 3% where we initially deposit 13 000 euros. How long time is it necessary until the amount of money in the account reaches 22 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **3.***** years.

2) In **5.***** years.

3) In **7.***** years.

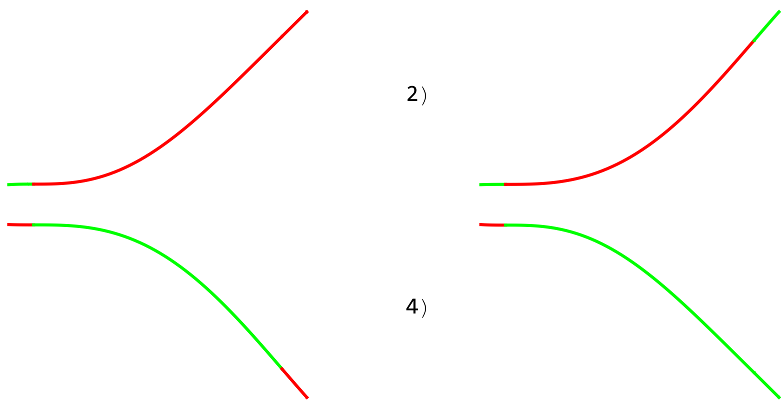
4) In **2.***** years.

5) In **0.***** years.

Exercise 2

Study the shape properties of $f(x) = 5 + 8x^3 - 4x^4 + \frac{3x^5}{5}$ to decide which amongst the following ones is the representation of the function.

1) 2) 3) 4)



Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To solve this exercise it is necessary to determine the concavity and convexity interval. To find the inflexion points separating the cancavity and convexity intervals, check (by means of Ruffini) with the points −2, −1, 0, 1, 2.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \left(\frac{1}{100}\,(2 + 3\,t)\right)\log(4\,t)$ per-unit.

In the year $t=1$ we deposint in the account 13 000 euros. Compute the deposit in the account after (with respect to $t=1$) 4 years.

1) 39652.6881 euros

2) 39692.6881 euros

3) 39602.6881 euros

4) 39622.6881 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 2 \end{pmatrix} . X . \begin{pmatrix} 1 & 0 & 0 \\ 2 & 0 & -1 \\ -4 & 1 & 1 \end{pmatrix} = \begin{pmatrix} 1 & -1 & 0 \\ -4 & 0 & 1 \\ -2 & -1 & 1 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ 0 & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(2 + m)\,x + 2\,y - z == -2 + m$
$-x + z == 1$
$-x - y + z == 2$

has only a solution.

1) We have unique solution for $m \le 2$.

2) We have unique solution for $m \ne -1$.

3) We have unique solution for $m \ne 2$.

4) We have unique solution for $m \ge -4$.

5) We have unique solution for $m \ne -4$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 107 & -180 \\ 63 & -106 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-3 \ -1)$.

2) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(-12 \ -7)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(-2 \ -1)$.

4) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(-12 \ -7)$.

5) The matrix is diagonalizable and $\lambda = -1$ is an eigenvalue with eigenvector $(3 \ -2)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, $\lambda=1$ with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and $\lambda=3$ with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 95

Exercise 1

We have one bank account that offers a periodic compound interes rate of 3% in 5 periods (compounding frequency) where we initially deposit 10 000 euros. How long time is it necessary until the amount of money in the account reaches 18 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **5.***** years.

2) In **1.***** years.

3) In **9.***** years.

4) In **2.***** years.

5) In **0.***** years.

Exercise 2

Between the months $t=1$ and $t=6$, the funds in certain account (in millions of euros) are given by the function $F(t) = 11 + 120\,t - 27\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t=4$ and $t=6$.

1) It oscillates between 190 and 189.

2) It oscillates between 106 and 191.

3) It oscillates between 186 and 191.

4) It oscillates between 186 and 194.

5) It oscillates between 186 and 187.

Exercise 3

Compute the area enclosed by the function $f(x) = -1 + x^2$ and the horizontal axis between the points $x = -5$ and $x = 4$.

1) $\frac{182}{3} = 60.6667$

2) $\frac{170}{3} = 56.6667$

3) 18

4) 54

5) $\frac{361}{6} = 60.1667$

6) $\frac{179}{3} = 59.6667$

7) $\frac{62}{3} = 20.6667$

8) $\frac{176}{3} = 58.6667$

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X - \begin{pmatrix} 2 & 1 \\ 3 & 2 \end{pmatrix}\right) . \begin{pmatrix} 1 & 0 \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} -1 & -2 \\ -1 & -2 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(6 + m)\, x - 4\, y + 3\, z == 9 + 2\, m$
$x - y + z == 1$
$4\, x - 4\, y + 3\, z == 5$

has only a solution. For that solution compute the value of variable x

1) $x = 1$.

2) $x = 2$.

3) $x = -3$.

4) $x = 8$.

5) $x = -5$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle\, (\,8 \;\; -3\,)\,\rangle$
- $\lambda_2 = 1$, with eigenvectors $V_2 = \langle\, (\,11 \;\; -4\,)\,\rangle$

1) $\begin{pmatrix} 33 & -24 \\ 44 & -32 \end{pmatrix}$ 2) $\begin{pmatrix} 33 & -12 \\ 88 & -32 \end{pmatrix}$ 3) $\begin{pmatrix} 33 & 44 \\ -24 & -32 \end{pmatrix}$ 4) $\begin{pmatrix} 33 & 88 \\ -12 & -32 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & -3 \\ -1 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 96

Exercise 1

We have a bank account that initially offers a compound interes rate of 2% , and after 1 year the conditions are modified and then we obtain a continuous compound rate of 7% . The initial deposit is 15 000 euros. Compute the amount of money in the account after 9 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****8.***** euros.

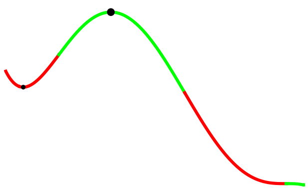
3) We will have ****7.***** euros.

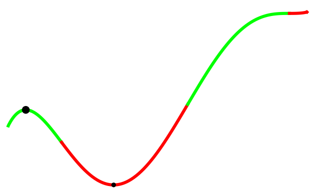
4) We will have ****5.***** euros.

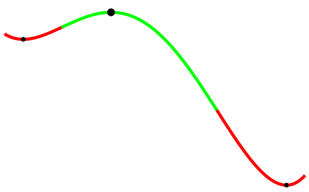
5) We will have ****4.***** euros.

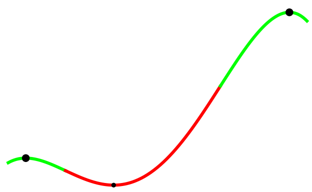
Exercise 2

Study the shape properties of the $f(x) = 4 - 12x^2 - 4x^3 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

● Big point: maximum

• Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -6x + 3x^2$ and the horizontal axis between the points $x = -2$ and $x = 4$.

1) 36

2) $\frac{93}{2} = 46.5$

3) 48

4) 50

5) 49

6) 44

7) 47

8) 4

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 2 & 2 & -1 \\ 0 & 1 & 0 \\ -1 & -1 & 1 \end{pmatrix}\right) . \begin{pmatrix} 1 & 0 & 0 \\ -1 & 0 & 1 \\ -2 & -1 & 1 \end{pmatrix} = \begin{pmatrix} 5 & 2 & 0 \\ -2 & -1 & 1 \\ -3 & -1 & 0 \end{pmatrix}$$

1) $\begin{pmatrix} 1 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} 2 & * & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & 2 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & 0 \\ * & * & * \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(1 + m)\, x - y + 2z == 3 + 2m$
$-x + y == -3$
$-x + z == -2$

has only a solution.

1) We have unique solution for $m \leq -5$.

2) We have unique solution for $m \neq -1$.

3) We have unique solution for $m \leq 0$.

4) We have unique solution for $m \geq -3$.

5) We have unique solution for $m \neq -4$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 0$, with eigenvectors $V_1 = \langle (-13 \;\; -5), \; (8 \;\; 3) \rangle$

1) $\begin{pmatrix} -2 & -2 \\ 0 & -1 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & 3 \\ 2 & -3 \end{pmatrix}$ 3) $\begin{pmatrix} -2 & -3 \\ 0 & 2 \end{pmatrix}$ 4) $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$ 5) $\begin{pmatrix} -2 & -2 \\ 2 & -1 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 97

Exercise 1

We have one bank account that offers a compound interes rate of 5% where we initially deposit 9000 euros. How long time is it necessary until the amount of money in the account reaches 17 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In **1.***** years.

2) In **3.***** years.

3) In **4.***** years.

4) In **0.***** years.

5) In **5.***** years.

Exercise 2

Between the months $t = 2$ and $t = 6$, the true value of the shares of a company (in euros) are given by the function $C(t) = 81 + 108t - 27t^2 + 2t^3$.

Determine the interval where the value oscillates between the months $t = 3$ and $t = 6$.

1) It oscillates between 180 and 223.

2) It oscillates between 185 and 224.

3) It oscillates between 183 and 218.

4) It oscillates between 184 and 220.

5) It oscillates between 189 and 216.

Exercise 3

Compute the area enclosed by the function $f(x) = 6x - 3x^2$ and the horizontal axis between the points $x = -3$ and $x = 4$.

1) 80

2) 81

3) 38

4) 78

5) 70

6) $\frac{161}{2} = 80.5$

7) $\frac{163}{2} = 81.5$

8) 30

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 2 & 0 & 3 \\ 3 & 1 & 3 \\ -1 & 0 & -1 \end{pmatrix} . \left(X - \begin{pmatrix} 1 & -1 & -1 \\ -1 & 1 & 0 \\ 1 & 0 & 0 \end{pmatrix} \right) = \begin{pmatrix} -5 & 5 & 3 \\ -4 & 5 & 3 \\ 2 & -2 & -1 \end{pmatrix}$$

1) $\begin{pmatrix} * & 1 & * \\ * & * & * \\ * & * & * \end{pmatrix}$ 2) $\begin{pmatrix} * & * & * \\ -2 & * & * \\ * & * & * \end{pmatrix}$ 3) $\begin{pmatrix} * & * & * \\ 2 & * & * \\ * & * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & * & * \\ * & 1 & * \\ * & * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & * & * \\ * & * & 0 \\ * & * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(3 + m)\, x + 2\, y + 3\, z == 6 + m$
$2\, x + 2\, y + 3\, z == 5$
$x + y + 2\, z == 3$

has only a solution.

1) We have unique solution for $m \neq 2$.

2) We have unique solution for $m \geq -5$.

3) We have unique solution for $m \geq 2$.

4) We have unique solution for $m \neq -2$.

5) We have unique solution for $m \leq 1$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = 1$, with eigenvectors $V_1 = \langle (-4\ \ -3),\ (11\ \ 8) \rangle$

1) $\begin{pmatrix} -3 & 0 \\ 0 & 2 \end{pmatrix}$ 2) $\begin{pmatrix} -3 & -2 \\ 3 & -2 \end{pmatrix}$ 3) $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$ 4) $\begin{pmatrix} -3 & -2 \\ -2 & -1 \end{pmatrix}$ 5) $\begin{pmatrix} -1 & -2 \\ 2 & 3 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 98

Exercise 1

We have a bank account that initially offers a continuous compound rate of 8%, and after 1 year the conditions are modified and then we obtain a compound interes rate of 6%. The initial deposit is 11 000 euros. Compute the amount of money in the account after 2 years from the moment of the first deposit.

1) We will have ****6.***** euros.

2) We will have ****8.***** euros.

3) We will have ****9.***** euros.

4) We will have ****1.***** euros.

5) We will have ****5.***** euros.

Exercise 2

Between the months $t=1$ and $t=5$, the funds in certain account (in millions of euros) are given by the function $F(t) = 2 + 18t - 12t^2 + 2t^3$.

Determine the interval where the temperature oscillates between the months $t=1$ and $t=2$.

1) It oscillates between 2 and 42.

2) It oscillates between 7 and 11.

3) It oscillates between 6 and 10.

4) It oscillates between 7 and 6.

5) It oscillates between 2 and 10.

Exercise 3

Compute the area enclosed by the function $f(x) = -12 + 22x - 12x^2 + 2x^3$ and the horizontal axis between the points $x=-4$ and $x=0$.

1) $\frac{1221}{2} = 610.5$

2) $\frac{1225}{2} = 612.5$

3) 613

4) $\frac{1219}{2} = 609.5$

5) 611

6) 608

7) 610

8) $\frac{1223}{2} = 611.5$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} -5 & -12 \\ 3 & 7 \end{pmatrix}^{-1} . X . \begin{pmatrix} 5 & 4 \\ 1 & 1 \end{pmatrix} = \begin{pmatrix} 48 & 36 \\ -20 & -15 \end{pmatrix}$$

1) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & -1 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter , m , for which the linear system

$(1 + m)\, x + y - z == -3 - m$
$-x + y - z == -1$
$2\, x - y + 2\, z == 1$

has only a solution. For that solution compute the value of variable y

1) $y = 3$.

2) $y = 0$.

3) $y = -8$.

4) $y = -1$.

5) $y = 6$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} -11 & -18 \\ 6 & 10 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(-3 \;\; 2)$.

2) The matrix is diagonalizable and $\lambda = -3$ is an eigenvalue with eigenvector $(-2 \;\; -2)$.

3) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(3 \;\; 0)$.

4) The matrix is diagonalizable and $\lambda = 1$ is an eigenvalue with eigenvector $(2 \;\; -1)$.

5) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(1 \;\; 1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors $\langle(1,1,-1),(0,1,1)\rangle$ and λ=3 with eigenvectors $\langle(1,0,1)\rangle$, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by $\langle(2,1)\rangle$, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 99

Exercise 1

We have a bank account that initially offers a periodic compound interes rate of 2% in 8 periods (compounding frequency), and after 2 years the conditions are modified and then we obtain a compound interes rate of 9%. The initial deposit is 14 000 euros. Compute the amount of money in the account after 4 years from the moment of the first deposit.

1) We will have ****4.***** euros.

2) We will have ****6.***** euros.

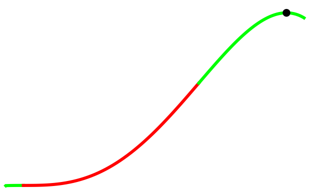
3) We will have ****1.***** euros.

4) We will have ****0.***** euros.

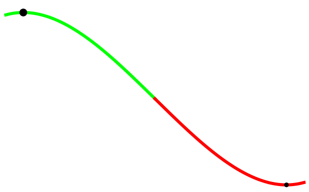
5) We will have ****7.***** euros.

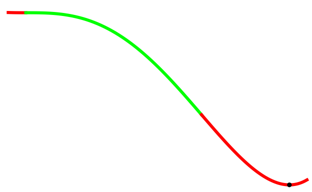
Exercise 2

Study the shape properties of the $f(x) = 5 - 24x - 18x^2 + 3x^4$ to decide which amongst the following ones is the representation of the function.

1) 

2) 

3) 

4) 

Big point: maximum

Small point: minimum

Red line: convexity

Green line: concavity

Indication: To find the maximun and minimum points of the function, try (with Ruffini) the points -2, -1, 0, 1, 2. To solve this exercise it is necessary to determine the increasing and decreasing intervals.

Exercise 3

Compute the area enclosed by the function $f(x) = -18x - 3x^2 + 3x^3$ and the horizontal axis between the points $x = -5$ and $x = -2$.

1) $\frac{1549}{4} = 387.25$

2) $\frac{1555}{4} = 388.75$

3) $\frac{1547}{4} = 386.75$

4) $\frac{1545}{4} = 386.25$

5) $\frac{1551}{4} = 387.75$

6) $\frac{1539}{4} = 384.75$

7) $\frac{1557}{4} = 389.25$

8) $\frac{1553}{4} = 388.25$

Exercise 4

Solve for the matrix X in the following equation:

$$\begin{pmatrix} 1 & 1 \\ 0 & 1 \end{pmatrix} . \left(X + \begin{pmatrix} 1 & 2 \\ 1 & 3 \end{pmatrix} \right) = \begin{pmatrix} 2 & 5 \\ 1 & 4 \end{pmatrix}$$

1) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 1 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} * & -2 \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$-x - z == -1$
$x + y - z == 1$
$(2 + 2m)\, x + y + m z == 2 + 2m$

has only a solution. For that solution compute the value of variable y

1) $y = 6$.

2) $y = -6$.

3) $y = 1$.

4) $y = -4$.

5) $y = 0$.

Exercise 6

Compute a matrix with the following eigenvalues and eigenvectors:

- $\lambda_1 = -1$, with eigenvectors $V_1 = \langle (-2 \quad -1) \rangle$
- $\lambda_2 = 0$, with eigenvectors $V_2 = \langle (-7 \quad -4) \rangle$

1) $\begin{pmatrix} -8 & -28 \\ 2 & 7 \end{pmatrix}$ 2) $\begin{pmatrix} -8 & 2 \\ -28 & 7 \end{pmatrix}$ 3) $\begin{pmatrix} -8 & 14 \\ -4 & 7 \end{pmatrix}$ 4) $\begin{pmatrix} -8 & -4 \\ 14 & 7 \end{pmatrix}$ 5) $\begin{pmatrix} -3 & -3 \\ 3 & 2 \end{pmatrix}$

Matemáticas 1 - ADE - 2023/2024
Training exam, call - Extraordinaria II, for serial number: 100

Exercise 1

We have one bank account that offers a compound interes rate of 6% where we initially deposit 9000 euros. How long time is it necessary until the amount of money in the account reaches 16 000 euros?

Remark: To obtain a correct answer it is necessary to work with at least 5 decimal digits.

1) In ∗∗1.∗∗∗∗∗ years.

2) In ∗∗8.∗∗∗∗∗ years.

3) In ∗∗0.∗∗∗∗∗ years.

4) In ∗∗3.∗∗∗∗∗ years.

5) In ∗∗9.∗∗∗∗∗ years.

Exercise 2

Between the months $t = 2$ and $t = 7$, the funds in certain account (in millions of euros) are given by the function $F(t) = 14 + 108\,t - 27\,t^2 + 2\,t^3$.

Determine the interval where the temperature oscillates between the months $t = 3$ and $t = 4$.

1) It oscillates between 122 and 149.

2) It oscillates between 139 and 152.

3) It oscillates between 138 and 154.

4) It oscillates between 122 and 149.

5) It oscillates between 142 and 149.

Exercise 3

Certain bank account offers a variable continuous compound interes rate. The interest rate for each year is given by the function

$I(t) = \frac{1}{10}\cos(8 + 6\,t)$ per-unit.

The initial deposit in the account is 6000 euros. Compute the deposit after 3π years.

1) 6020 euros

2) 6040 euros

3) 6000 euros

4) 5910 euros

Exercise 4

Solve for the matrix X in the following equation:

$$\left(X + \begin{pmatrix} 4 & 5 \\ 3 & 4 \end{pmatrix}\right) . \begin{pmatrix} -2 & 1 \\ -5 & 2 \end{pmatrix} = \begin{pmatrix} -26 & 11 \\ -23 & 10 \end{pmatrix}$$

1) $\begin{pmatrix} -2 & * \\ * & * \end{pmatrix}$ 2) $\begin{pmatrix} 0 & * \\ * & * \end{pmatrix}$ 3) $\begin{pmatrix} -1 & * \\ * & * \end{pmatrix}$ 4) $\begin{pmatrix} 2 & * \\ * & * \end{pmatrix}$ 5) $\begin{pmatrix} * & 0 \\ * & * \end{pmatrix}$

Exercise 5

Determine the values of the parameter, m, for which the linear system

$(-2 + 2m)x - y + mz == 3 - 4m$
$5x + y + 3z == -9$
$x + z == -2$

has only a solution. For that solution compute the value of variable z

1) $z = 0$.

2) $z = -8$.

3) $z = -3$.

4) $z = -4$.

5) $z = 7$.

Exercise 6

Diagonalize the matrix $\begin{pmatrix} 52 & 2 & 36 \\ 12 & -2 & 8 \\ -75 & -3 & -52 \end{pmatrix}$ and select the correct option amongst the ones below:

1) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(2\ 0\ -3)$.

2) The matrix is diagonalizable and $\lambda = 2$ is an eigenvalue with eigenvector $(3\ 0\ -3)$.

3) The matrix is diagonalizable and $\lambda = -2$ is an eigenvalue with eigenvector $(3\ 0\ -2)$.

4) The matrix is diagonalizable and $\lambda = -5$ is an eigenvalue with eigenvector $(2\ 0\ -3)$.

5) The matrix is diagonalizable and $\lambda = 3$ is an eigenvalue with eigenvector $(-1\ 2\ -1)$.

6) The matrix is not diagonalizable.

Remark: TO GIVE AN ANSWER FOR THE EXERCISE, THE FIRST THING TO CHECK IS WHETHER THE MATRIX IS DIAGONALIZABLE or not (a matrix is diagonalizable whenever the total number of independent eigenvectors obtained for all the eigenvalues is equal to the size of the matrix). For instance, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we would have only two independent eigenvectors (namely, (1,1,-1) and (1,0,1)) and the matrix is not diagonalizable. For example, consider a matrix of size 3x3 with only two eigenvalues, λ=1 with eigenvectors ⟨(1,1,-1),(0,1,1)⟩ and λ=3 with eigenvectors ⟨(1,0,1)⟩, then we have three independet eigenvectors ((1,1,-1),(0,1,1) and (1,0,1)) for a matrix of size 3 and therefore this matrix is diagonalizable. On the other hand, it is necessary to recall that every eigenvalue has infinity asociated eigenvectors. For instance, if the eigenvectors for certain eigenvalue are given by ⟨(2,1)⟩, we will have as eigenvector not only (2,1) but also the rest of its linear combinations (as (4,2)=2(2,1), (6,3)=3(2,1), etc.) although they are not independent with (2,1).