

Mathematics (year 1)
Undergraduate programme of Management

Intermediate Test

02/11/2013

Time length: 1H 15m

Name:

(block letters, please)

Student Number:

Class: Gai.....

Lecturer:

- Justify all your answers.
 - Use no calculators.
 - Mobile phones must be switched off.
 - Ask no questions. Silence is essential.
 - Do not split off the test booklet.
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Marking

1) a)	
b)	
c)	
d)	
2)	
3)	
4) a)	
b)	
c)	

[6.5 valores] 1. Consider the system of linear equations in x, y and z , with a parameter $a \in \mathbb{R}$:

$$\begin{cases} -x - y + 3z = 0 \\ 2x + 2y + z = a \\ -2x - y + z = 1 \\ x - 2z = -1 \end{cases}$$

- (1.0) a) Write the system in the matrix form.
- (0.5) b) Present the augmented matrix.
- (3.5) c) Discuss the solution set based on the parameter a .
- (1.5) d) Solve the system by the Cramer's Rule, and replace a with a value that will provide a single solution.
(Attention: You may consider in alternative $a = 0$, and delete the first equation of the system)

[4.0 valores] 2. Compute the determinant of A . Please, use only the properties of the determinants.

$$A = \begin{bmatrix} a & 1 & 1 & 1 \\ a & a+1 & 2 & 2 \\ a & a+1 & a+2 & 3 \\ a & a+1 & a+2 & a+3 \end{bmatrix}$$

[3.5 valores] 3. Consider the matrix $\mathbf{A} = [a_{ij}]$, whose type is $m \times n$, and consider that you want to create a matrix $\mathbf{B} = [b_{ij}]$, of the same type, in which $b_{ij} = a_{ij} - k$, $i = 1, 2, \dots, m; j = 1, 2, \dots, n$, and $k \in \mathbb{R}$. Or in another words, the elements of the matrix \mathbf{B} are obtained from the corresponding elements of the matrix \mathbf{A} , subtracted of the scalar k as represented by the equation

$$\mathbf{B} = \mathbf{A} - \mathbf{K} \times \mathbf{U}$$

Being that \mathbf{K} is a matrix of type $m \times 1$, with all the elements equal to k . Determine the matrix \mathbf{U} in order to achieve the required result.

(Suggestion: Consider a matrix of type 3×2 to work out the exercise, and afterwards, you may generalize the result)

[6.0 valores] 4. Consider the unitary basis of the vector space \mathbb{R}^3 , and the following set of vectors

$$F = \{(0, -1, 0), (7, 4, 2), (-6, 0, -2)\}$$

- (1.0) a) Verify that F is a basis in \mathbb{R}^3 .
- (3.5) b) Determine the coordinates of the vector $\vec{x} = (3, 1, 1)$ in this basis.
- (1.5) c) Consider now the vector $\vec{y} = -\left(1, 0, \frac{1}{2}\right)$ written in the basis of F . Present the coordinates of the mentioned vector in the unitary basis of \mathbb{R}^3 . Present all your calculations and comment the final result.

