Universidad de Navarra | SCHOOL OF ECONOMICS & BUSINESS

Practice Admission Examination

Instructions

- The examination consists of 15 multiple-choice questions.
- Each question has a single correct answer.
- The use of calculators or electronic devices is not permitted.
- The use of notes, textbooks, or any reference materials is not permitted.
- Recommended time: 25 minutes.

Question 1.
Let A and B be matrices such that the product AB is defined. Which of the following statements about the transpose is always true?

A. $(AB)^T = A^TB^T$
B. $(AB)^T = B^TA^T$
C. $(AB)^T = (BA)^T$
D. $(AB)^T = AB^T$

Question 2.
Let

$$A = (1, 3 ; 2, 0) \qquad B = (4, -1 ; 0, 5)$$

What is the result of $2A - B$?

A. (2, 7 ; 4, 5)
B. (−2, 5 ; 4, −5)
C. (−2, 7 ; 4, −5)
D. (−2, 7 ; 4, 5)

Question 3.
Let A =

$$\begin{pmatrix} 2 & 1 \\ 5 & 3 \end{pmatrix}$$

What is the inverse matrix of A?

A. (2, −1 ; −5, 3)
B. (3, 1 ; 5, 2)
C. (3, −1 ; 5, −2)
D. (3, −1 ; −5, 2)

Question 4.
Solve the system Ax = b using the inverse matrix method, where

$$A = (2, 1 ; 1, 1) \qquad b = (5, 3)$$

What is the solution (x, y) of the system?

A. (1, 2)
B. (2, 1)
C. (−2, 1)
D. (3, 0)

Question 5.
A shop blends type A coffee (€6/kg) with type B coffee (€9/kg) to obtain 10 kg of blend priced at €7.5/kg. How many kilograms of type A coffee are used?

A. 3 kg
B. 6 kg
C. 5 kg
D. 4 kg

Question 6.
What is the domain of the function $f(x) = (x + 3) / (x^2 - 9)$?

A. $\mathbb{R} \setminus \{3\}$
B. $\mathbb{R}$ (all real numbers)
C. $\mathbb{R} \setminus \{-3\}$
D. $\mathbb{R} \setminus \{-3, 3\}$

Question 7.
Solve the equation $3^{x-1} = 27$. What is the value of x?

A. 3
B. 4
C. 2
D. 5

Question 8.
What is the derivative of the function $f(x) = x / (x + 1)$?

A. $f'(x) = -1 / (x + 1)^2$
B. $f'(x) = x / (x + 1)^2$
C. $f'(x) = 1 / (x + 1)^2$
D. $f'(x) = 1 / (x + 1)$

Question 9.
Let $f(x) = x^3 - 3x^2$. On which interval is the function concave (concave down)?

A. $(0, \infty)$
B. $(-\infty, 1)$
C. $(1, \infty)$
D. $(-\infty, 0)$

Question 10.
Let $f(x) = x^3 - 3x$. At which point does the function have a local minimum?

A. $x = -1$
B. $x = 3$
C. $x = 0$
D. $x = 1$

Question 11. Evaluate:

$$\int_0^1 e^x \, dx$$

A. e
B. e − 1
C. 1
D. e + 1

Question 12.
Evaluate:

$$\int (1/x) \, dx$$

A. $1/x^2 + C$
B. $\ln|x| + C$
C. $x \cdot \ln(x) - x + C$
D. $-1/x^2 + C$

Question 13.
A fair die is rolled. Let A be the event "getting an even number" and B the event "getting a 5." What is $P(A \cup B)$?

A. 1/2
B. 1/6
C. 2/3
D. 5/6

Question 14.
Let X be a normally distributed random variable with mean 50 and standard deviation 10. What is the standard score (z-score) corresponding to X = 65?

A. 5
B. 0.65
C. 1.5
D. 15

Question 15.
Consider the following linear programming problem:

$$\text{Minimize } C = 3x + 5y \text{ subject to:}$$

$$x + y \geq 4$$

$$x \geq 1$$

$$y \geq 0$$

What is the minimum value of C?

A. 18
B. 20
C. 15
D. 12

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Answer Key

1. B
$(AB)^T = B^T A^T$: the transpose of a product reverses the order of the factors.

2. C
2A = (2, 6 ; 4, 0); subtracting B gives (−2, 7 ; 4, −5).

3. D
det(A) = 2·3 − 1·5 = 1; A^{-1} = (1/1)·(3, −1 ; −5, 2) = (3, −1 ; −5, 2).

4. B
A^{-1} = (1, −1 ; −1, 2); x = A^{-1}b = (1·5 − 1·3, −1·5 + 2·3) = (2, 1).

5. C
From the system x + y = 10, 6x + 9y = 75, we obtain x = 5 kg.

6. D
$x^2 - 9 = (x - 3)(x + 3)$ vanishes at x = 3 and x = −3; those values are excluded from the domain.

7. B
$27 = 3^3$, so x − 1 = 3 and x = 4.

8. C
Quotient rule: $f'(x) = [(x + 1)\cdot 1 - x\cdot 1] / (x + 1)^2 = 1 / (x + 1)^2$.

9. B
f''(x) = 6x − 6, which is negative for x < 1; the function is concave on (−∞, 1).

10. D
$f'(x) = 3x^2 - 3 = 0 \rightarrow x = \pm 1$; f''(1) = 6 > 0, so there is a local minimum at x = 1.

11. B
$\int e^x\,dx = e^x$; evaluating between 0 and 1: $e^1 - e^0 = e - 1$.

12. B
$\int (1/x)\,dx = \ln|x| + C$.

13. C
P(A) = 3/6, P(B) = 1/6; since they are mutually exclusive, P(A ∪ B) = P(A) + P(B) = 4/6 = 2/3.

14. C
$z = (X - \mu)/\sigma = (65 - 50)/10 = 1.5$.

15. D
Feasible vertices (1, 3) and (4, 0): C(1,3) = 18, C