

Name:	Roll Number:

## Endterm (Practice)

SIAS, Krea University (AY 2025-26)

Mathematical Methods for Economics (Course Code: ECON211)

25 September 2025

**Maximum Points:** 30

**Duration:** 100 minutes

### Instructions and Advice:

- This is a closed book exam.
- This exam accounts for 30% of your grades.
- You need to answer 14 questions in all.
  - The first section contains 8 questions, each carrying 1 point.
  - The second section contains 4 questions, each carrying 3 points.
  - The third section contains 2 questions, each carrying 5 points.
- All questions are compulsory. Points for each question are mentioned in parentheses.
- At no point during the exam, you are allowed to ask clarificatory questions. Make reasonable assumptions if you have doubts and proceed to answer the question.
- You are not permitted to use any electronic device including calculators.
- There is plenty of time. Use it wisely, do not rush.
- Show all your work. Answers that skip steps will receive penalty.
- Please highlight your main answer(s).
- All the best!

## Short Answer Questions-I

1. (1 point) Is the function  $f(x) = \begin{cases} x^2 - 2 & x \leq 0 \\ -x^2 & 0 < x < 1 \\ x^2 + 2 & x \geq 1 \end{cases}$  continuous at  $x = 0$ ? Explain briefly.
2. (1 point) Let  $f(x) = \frac{x^2 - 1}{x^2 + 1}$ . Find  $f^{-1}(x)$ .
3. (1 point) Let  $f(x) = x^{(x^x)}$ . Find  $f'(x)$ .
4. (1 point) Identify the interval in which the function  $f(x) = |x^3 - 3x|$  is decreasing.
5. (1 point) Suppose that  $\frac{xy}{x^2 + y^2} = 5$ . Find  $\frac{dy}{dx}$ .
6. (1 point) Let  $f(x) = x^3 - 4x + 3$  and  $g(x) = xf^{-1}(x)$ . Find  $g'(0)$ .
7. (1 point) The average present value of a capital is given by:  $\frac{K}{T} \int_0^T e^{-\alpha t} dt$ , where  $K, T$ , and  $\alpha$  are positive constants. Evaluate the integral.
8. (1 point) Compute:  $\int \frac{1}{x(x+1)} dx$

## Short Answer Questions-II

9. (3 points) Given the demand function for R&B music on *Spotify*:  $p = e^{-q/2}$ ,
  - (a) ( $\frac{1}{2}$  points) Compute the total revenue.
  - (b) ( $\frac{1}{2}$  points) Compute the marginal revenue.
  - (c) (2 points) Compute the revenue-maximizing price and quantity.
10. (2+1 points) Find the minimum value of the function:  $f(x) = 20 + 6x + \frac{6}{x}$ . Show all the necessary and sufficient conditions.
11. (3 points) Let  $f(x, y) = (ax + by)^3$ .
  - (a) (1 point) Find  $xf_x + yf_y$ , where  $f_x = \frac{\partial f}{\partial x}$  and  $f_y = \frac{\partial f}{\partial y}$ .
  - (b) (2 points) Compute all first and second order partial derivatives.
12. (1+1+1 points) Let  $Y = [2\sqrt{K} + 3\sqrt{L}]^2$ . Compute the marginal products and the marginal rate of technical substitution.

## Long Answer Questions

13. (5 points) Consider  $f(x, y) = x^4 + y^4 - 4xy$ . Find and classify all stationary points.
14. (5 points) The demand for *imarti* in a fictional city named *Allahabad* is given by  $q = 130 - 2p - 0.1p^2$  and the supply is given by  $q = 60 + 3p + 0.1p^2$ .
  - (a) (1 point) Compute the equilibrium price and quantity.
  - (b) (1+1 points) Compute the consumer surplus and producer surplus.
  - (c) (1+1 points) Now, suppose that the government announces a price floor of ₹20. Compute the new consumer surplus and producer surplus.