

<b>Name:</b>	<b>Roll Number:</b>

**Midterm (Set B)**  
 SIAS, Krea University (AY 2025-26)  
 Mathematical Methods for Economics (Course Code: **ECON211**)  
 18 August 2025

**Maximum Points:** 30

**Duration:** 90 minutes

**Instructions and Advice:**

- This is a closed book exam.
- This exam accounts for 30% of your grades.
- You need to answer 10 questions in all.
- 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.
  - To aid computation, some values are provided at the end of the question paper (see Appendix ).
  - Please use reasonable approximations for all calculations.
- 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

- (2 points) Sketch the graph of the function  $y = 2x - 3$  in the following domain:  $[-5, 5]$ .
- (2 points) Netflix ran a survey on customer preferences on genre. 1,500 customers responded to the survey revealing that 600 preferred romance ( $R$ ), 450 preferred drama ( $D$ ), and 350 preferred action ( $A$ ). The survey also showed that 200 customers preferred both romance and drama, 150 preferred romance and action, and 100 preferred both drama and action movies. How many preferred action but not romance?
- (2 points) A sweet shop in Madurai sells *palkova*, *jangiri*, and *badusha*. The sweet shop generously shared some sample data (for three customers) with us.

Customer→	Dilli	Malar	Definite
<i>palkova</i> (kg)	6	2	4
<i>jangiri</i> (kg)	7	1	1
<i>badusha</i> (kg)	9	2	1

The per kg prices of *palkova*, *jangiri*, and *badusha* are ₹500, ₹200, and ₹200 respectively (these prices remain stable over the given period). Create two matrices, one for quantities (call it  $A$ ) and one for prices (call it  $B$ ). Compute and interpret  $AB$ .

- (2 points) Compute  $\sum_{k=4}^{k=7} (2k^2 - 2k + 1)$ .

## Short Answer Questions-II

- (3 points) Consider two matrices  $A = \begin{bmatrix} 3 & -1 \\ 2 & 4 \end{bmatrix}$  and  $I = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$ .  
Find a matrix  $B$  such that  $(A - 3I)B = I$ .
- (3 points) The value of a machine depreciates continuously at the annual rate of 5%. How many years will it take for the value of the machine to become 25% of its original value?
- (3 points) There is a store called *The Revolver Club* in Bandra that sells vinyl records or, simply, vinyls.
  - (2 points) If the store sells  $Q$  vinyls, the price received per vinyl sold is  $P = 100 - \frac{1}{5}Q$ . The price it has to pay per vinyl is  $P = 30 + \frac{2}{3}Q$ . In addition, it has to incur transportation cost of ₹5 per vinyl. Express this store's profit  $\pi$  as a function of  $Q$ . Find the profit-maximizing quantity.
  - (1 point) Suppose the government imposes a tax on the store's product of ₹2 per vinyl. Find the new expression for the store's profit.
- (3 points) Let the universal set  $\mathbb{U}$  be the set of all students at a particular university. Moreover, let  $F$  denote the set of female students,  $E$  the set of all economics students,  $C$  the set of students in the university choir,  $P$  the set of all psychology students, and  $T$  the set of all students who play tennis. Describe the members of the following sets:  $\mathbb{U} \setminus P, T \cup C, E \cap F' \cap T$ . No calculation is needed.

## Long Answer Questions

9. (5 points) This question tests your knowledge and understanding of present value and interest rates. Assume compounding of the interest rate.
- (a) (1 point) A sum of ₹20,000 is invested at 6% annual interest. What will this amount have grown to after 20 years?
  - (b) (2 points) Which terms are preferable for a borrower: (i) an annual interest rate of 20.5%, with interest paid yearly; or (ii) an annual interest rate of 18%, with interest paid monthly?
  - (c) (2 points) An account has been dormant for many years earning interest at the constant rate of 8% per year, with interest being compounded every quarter. Now the amount is ₹240,000. How much was in the account 6 years ago?
10. (5 points) Calculate the domain and the range of the following functions:

- (a) (2 points)

$$f(x) = \frac{5x + 2}{x - 4}$$

- (b) (3 points)

$$g(x) = \frac{4}{\sqrt{x^2 - 4}}$$

## Appendix

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$\ln(4)$	$\approx$	1.3863
$\ln\left(\frac{1}{4}\right)$	$\approx$	-1.3863
$(1.06)^{20}$	$\approx$	3.204
$(1.6)^{20}$	$\approx$	12089.26
$(1.015)^{12}$	$\approx$	1.1956
$(1.2)^{12}$	$\approx$	8.916
$(1.08)^6$	$\approx$	1.6
$(1.02)^6$	$\approx$	1.1
$(1.02)^{24}$	$\approx$	1.6

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