Name:	Roll Number:

Midterm (Practice)

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 quiz 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.
- There is plenty of time. Use it wisely, do not rush.
- Show all your work. Answers that skip steps will receive penalty.
- All the best!

Short Answer Questions-I

1. (2 points) Uber ran a survey on their services in India. 2000 customers responded to the survey revealing that 1500 have used Uber Go (G), 800 have used Uber Sedan (S), and 250 have used Uber Premier (P). The survey also showed that 600 customers used both Go and Sedan, 50 used both Go and Premier, and 100 used both Sedan and Premier. 20 customers had reported to have used all three services. How many used Go but neither Sedan nor Premier?

2. (2 points) Sketch the graph of the function $y = |5 - |x||$ in the following domain: $[-10, 10]$.

3. (2 points) Pick five distinct positive integers and verify that:

$$\sum_{i=1}^{i=5}(x_i - m_x) = 0$$

and

$$\sum_{i=1}^{i=5}(x_i - m_x)^2 = \sum_{i=1}^{i=5}(x_i^2) - nm_x^2$$

where m_x is the average of the five chosen numbers and $n = 5$.

4. (2 points) The Hungarian Pastry Shop in New York sells *strudel*, *croissant*, and *carrot cake*. The shop generously shared some sample data with us. The table below shows the number of slices sold and the total cost for select days of the week.

Day	*strudel*	*croissant*	*carrot cake*	Total Cost (in $)
Monday	20	25	50	300
Wednesday	20	50	75	300
Saturday	40	100	150	700
Sunday	40	100	200	700

The per slice prices of *strudel*, *croissant*, and *carrot cake* are \$5, \$6, and \$8 respectively. Create three matrices, one for quantities (call it A), one for prices (call it B), and one for total cost (call it C). Compute and interpret $AB - C$.

Short Answer Questions-II

5. (3 points) Let $A = \{1, 5, 7, 9\}$, $B = \{3, 5, 7, 10, 12\}$, $C = \{1, 7, 10, 18, 20\}$, $D = \{3, 10, 18, 24, 27\}$, and $\mathbb{U} = \{x \in Z^+ : 1 \leq x \leq 40\}$.

   Show, on a Venn diagram, the following:

   (a) (1 point) $A \cap B' \cap D$

   (b) (1 point) $A \setminus C \cap D$

   (c) (1 point) $B \cap C' \cup D$

6. (3 points) Find real numbers a, b, and x such that:

$$\begin{pmatrix} a & b \\ x & 0 \end{pmatrix} \times \begin{pmatrix} 2 & 1 \\ 1 & 1 \end{pmatrix} - \begin{pmatrix} 1 & 0 \\ 2 & 1 \end{pmatrix} \times \begin{pmatrix} a & b \\ x & 0 \end{pmatrix} = \begin{pmatrix} 2 & 1 \\ 4 & 4 \end{pmatrix}$$

7. (3 points) The GDP of a country named *La La Land* grows at the annual rate of 5%. How many years will it take for the value of the GDP to double?

8. (3 points) For each of the following quadratic functions, calculate the maximum or the minimum value of the function.

   (a) (1 point) $f(x) = -3x^2 + 24x + 60$

   (b) (1 point) $f(x) = 4x^2 + 96x + 200$

   (c) (1 point) $f(x) = 6x^2 - 36x$

Long Answer Questions

9. (5 points) Calculate the domain and the range of the following functions:
   (a) (2 points)
   $$f(x) = \sqrt{x^2 - 4x + 3}$$
   (b) (3 points)
   $$g(x) = \frac{1}{\sqrt{6 - |x|}}$$
10. (5 points) This question tests your knowledge and understanding of present value and interest rates.
   (a) (2 points) An amount of 2000 euros is invested at 7% per year. What is the balance in the account after (i) 2 years; (ii) 10 years?
   (b) (2 points) Calculate the effective annual interest rate for the following: (i) an annual interest rate of 11.5%, with interest paid half-yearly; or (ii) an annual interest rate of 10%, with interest paid monthly?
   (c) (1 point) What is the maximum amount of compound interest that can be earned at an annual rate of 25%? Assume that the principal is ₹100.