

D 133592

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Name.....

Reg. No.....

**FIRST SEMESTER (CUFYUGP) DEGREE EXAMINATION
NOVEMBER 2025**

Mathematics

MAT 1FM 105 (1)—MATRICES AND BASICS OF PROBABILITY THEORY

(2024 Admission onwards)

Time : One Hour and a Half

Maximum : 50 Marks

Section A

Answer all questions.

Each question carries 2 marks.

Ceiling 16 marks.

1. If $A = \begin{pmatrix} 3 & 1 \\ 2 & 2 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 0 \\ 9 & 3 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & 2 \\ 5 & 4 \end{pmatrix}$, then show that $A \times (B - C) = -(A \times C - A \times B)$.

2. Find the inverse of $A = \begin{pmatrix} 1 & 4 \\ 7 & 9 \end{pmatrix}$.

3. Find A^{-1} if $A = \begin{pmatrix} 3 & 9 \\ 2 & 6 \end{pmatrix}$.

4. Solve the following linear equations.

$$2x - y = 5$$

$$3x + 2y = 32.$$

5. Write a short note on frequency polygon.

6. Find the mode of the weights listed below.

71	12	5	13	8	10	5	12	10	7
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7. You toss a coin and randomly select a number from 0 to 9. What is the probability of tossing tails and selecting a 3?

Turn over

8. A card is picked at random from a standard deck of 52 playing cards. Find the odds that it is a spade and it is not a spade.
9. You select a card from a standard deck of 52 playing cards. Find the probability that the card is a 4 or an ace.
10. From a pool of 30 candidates, the offices of president, vice president, secretary, and treasurer will be filled. In how many different ways can the offices be filled ?

Section B

All questions can be answered.

Each question carries 6 marks.

Ceiling 24 marks.

11. Find the inverse of $\begin{pmatrix} 1 & 0 & 8 \\ -3 & 7 & 2 \\ 5 & -5 & -4 \end{pmatrix}$.

12. Using Cramer's rule solve :

$$x + y + z = 3$$

$$x + 2y + 3z = 4$$

$$x + 4y + 9z = 6.$$

13. The scores and their percents of the final grade for a statistics student are shown below. What is the student's mean score ?

	Score	Percent of final grade
Homework	85	5 %
Quizzes	80	35 %
Project	100	20 %
Speech	90	15 %
Final exam	93	25 %

14. Find the range, mean, variance, and standard deviation of the following data :

277	291	295	280	268	278	291	277	282	279	296	285	269	293
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15. A coin is tossed and a die is rolled. Find the probability of tossing a tail and then rolling a number greater than 2.

Section C

*Answer any **one** question.
The question carries 10 marks.*

16. The tensions, T_1 , T_2 and T_3 in a simple framework are given by the equations :

$$5T_1 + 5T_2 + 5T_3 = 7.0$$

$$T_1 + 2T_2 + 4T_3 = 2.4$$

$$4T_1 + 2T_2 = 4.0.$$

Determine T_1 , T_2 and T_3 using Gaussian elimination.

17. You roll a die. Find each probability :

- (a) Rolling a 5 or a number greater than 3.
- (b) Rolling a number less than 4 or an even number.
- (c) Rolling a 2 or an odd number.

(1 × 10 = 10 marks)

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Section A

All questions can be answered.

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(ceiling 16 marks)

1. If $A = \begin{pmatrix} 3 & 2 \\ 7 & 8 \end{pmatrix}$, $B = \begin{pmatrix} 1 & 6 \\ 3 & 3 \end{pmatrix}$ and $C = \begin{pmatrix} 2 & 6 \\ 6 & 2 \end{pmatrix}$, then show that $A \times (B + C) = A \times B + A \times C$.

2. If $A = \begin{pmatrix} 2 & 4 \\ 7 & 8 \end{pmatrix}$ and $B = \begin{pmatrix} 2 & 6 \\ 9 & 3 \end{pmatrix}$, then show that $|AB| = |A| |B|$.

3. Find the value of x such that $\begin{vmatrix} x-1 & 2 \\ 3 & 4 \end{vmatrix} = 0$.

4. Solve the following linear equations :

$$\begin{aligned} x + 3y &= 5 \\ 5x - y &= 9. \end{aligned}$$

5. Explain the term class width.

6. The weights for a sample of adults before starting a weight loss study are given by 274, 235, 223, 268, 290, 285 and 235. What is the median of weight of the adults ?

7. Find variance and standard deviation of the following data :

21	32	35	43	28
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8. A laptop has 3 choices for a processor, 3 choices for a graphics card, 4 choices for memory, 6 choices for a hard drive, and 2 choices for a battery. How many ways can you customize the laptop ?

Turn over

9. Two cards are selected, without replacing the first card, from a standard deck of 52 playing cards. Find the probability of selecting a king and then selecting a queen.
10. A die is rolled. Find the probability of rolling a 6 or an odd number.

Section B

*All questions can be answered.
Each question carries 6 marks.
(ceiling 24 marks)*

11. Find the inverse of $\begin{pmatrix} 4 & -7 & 6 \\ -2 & 4 & 0 \\ 5 & 7 & -4 \end{pmatrix}$.

12. Find a solution to the given system using Cramer's Rule :

$$\begin{aligned} x + y + z &= 4 \\ 3x - 2y + z &= 3 \\ x + 3y - 2z &= 0 \end{aligned}$$

13. The number of days 20 patients remained hospitalized are given by 6, 9, 7, 14, 4, 5, 6, 8, 4, 11, 10, 6, 8, 6, 5, 7, 6, 6, 3 and 11. Construct a frequency distribution and a frequency histogram for the data set with 5 number of classes.
14. Find the range, mean, variance and standard deviation of the following data :

173	175	200	173	160	185	195	230	190	180
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15. The probability that a particular rotator cuff surgery is successful is 0.9.
- (a) Find the probability that three rotator cuff surgeries are successful.
- (b) Find the probability that none of the three rotator cuff surgeries are successful.
- (c) Find the probability that atleast one of the three rotator cuff surgeries are successful.

Section C

*Answer any one question.
The question carries 10 marks.*

16. Solve the system of linear equations by Gaussian elimination method :

$$\begin{aligned} 2x + y - 2z &= 6 \\ 3x - 4y + z &= 2 \\ x - 5y - z &= -8 \end{aligned}$$

17. (a) Of the cartons produced by a company, 5 % have a puncture, 8 % have a smashed corner, and 0.4 % have both a puncture and a smashed corner. Find the probability that a randomly selected carton has a puncture or has a smashed corner.
- (b) Find the number of ways of forming four-digit codes in which no digit is repeated.
(1 × 10 = 10 marks)