



Code Number:

**A**

# Aakash

**Medical | IIT-JEE | Foundations**

**Corp. Office:** Aakash Educational Services Limited, 3rd Floor, Incuspaze Campus- 2, Plot No. 13,  
Sector- 18, Udyog Vihar, Gurugram, Haryana - 122015

Time: 2 hrs.

**Mock Test Paper for Class-XII**

Max. Marks: 60

## MATHEMATICS

Roll No.

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

### GENERAL INSTRUCTIONS

Read the following instructions carefully and follow them:

1. There is a 'Cool-off time' of 15 minutes in addition to the writing time.
2. Use the 'Cool-off time' to get familiar with questions and to plan your answers.
3. Read questions carefully before answering.
4. Read the instructions carefully.
5. Calculations, figures and graphs should be shown in the answer sheet itself.
6. Give equations wherever necessary.
7. Electronic devices except non-programmable calculators are not allowed in the examination Hall.

Questions from 1 to 8 carries 3 scores each. Answer any 6 questions.

(6x3=18)

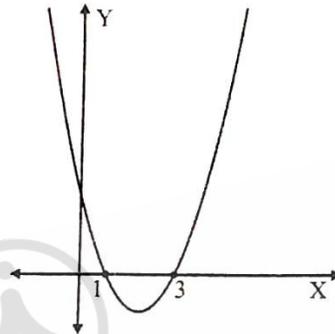
1. Express the matrix  $A = \begin{bmatrix} 3 & 2 & 1 \\ 0 & 4 & -1 \\ -2 & 1 & 3 \end{bmatrix}$  as the sum of a symmetric and skew symmetric matrix.

2. (i) Find the principal value of  $\sin^{-1}\left(-\frac{1}{2}\right)$ . (1)

(ii) Find the principal value of  $\cos^{-1}\left(\cos\frac{7\pi}{6}\right)$ . (2)

3. Discuss the continuity of the function  $f(x) = \begin{cases} x^2 - 1 & , x < 2 \\ 4 & , x = 2 \\ 2x - 1 & , x > 2 \end{cases}$

4. Consider the third degree polynomial function  $f(x)$ . The figure given below is the graph of  $f'(x)$ .



(i) Find the intervals on which the function is increasing and decreasing. (2)

(ii) Identify the point of local maxima and minima. (1)

5. Evaluate  $\int \frac{x-1}{x^2-4x-5} dx$

6. (i) If A (1,5,3) and B (4,5,7) be two points, then find vector  $\overline{AB}$ . (1)

(ii) Find a unit vector in the direction of  $\overline{AB}$ . (1)

(iii) Which of the following is a vector perpendicular to  $\overline{AB}$ ? (1)

(a)  $15\hat{i} + 20\hat{k}$

(b)  $15\hat{i} - 20\hat{k}$

(c)  $-5\hat{j}$

(d)  $5\hat{k}$

7. (i) Let  $f = \mathbb{N} \rightarrow \mathbb{N}$  be a function defined by  $f(x) = \begin{cases} 1 & , x = 1 \\ x - 1 & , x > 1 \end{cases}$ . Choose the correct answer. (1)

(a)  $f$  is one-one and onto.

(b)  $f$  is many-one and onto.

(c)  $f$  is one-one but not onto.

(d)  $f$  is neither one-one nor onto.

(ii) Show that the function  $f: \mathbb{R} \rightarrow \mathbb{R}$  defined by  $f(x) = 4x$  is invertible and hence write the inverse function. (2)

8. A die is thrown and the sum of numbers appearing is observed to be 9. What is the conditional probability that the number 5 has appeared at least once?

Questions from 9 to 16 carries 4 scores each. Answer any 6 questions.

(6 x 4 = 24)

9. Consider the relation  $R = \{(1,3), (1,1), (2,2), (3,3), (3,1)\}$  defined on set  $A = \{1,2,3\}$ .
- (i) Show that  $R$  is an equivalence relation. (3)
- (ii) Find the equivalence classes. (1)
10. (i) Find the value of  $x$  and  $y$ , if  $\begin{bmatrix} x & 3 \\ -2 & 4 \end{bmatrix} - \begin{bmatrix} 1 & 3 \\ 2 & -2 \end{bmatrix} = 2 \begin{bmatrix} 1 & 0 \\ y & 3 \end{bmatrix}$ . (2)
- (ii) If  $A = \begin{bmatrix} 5 \\ -2 \\ 3 \end{bmatrix}$  and  $B = [2 - 1 - 3]$  be two matrices, then find  $AB$ . (2)
11. (i) Find the volume of a cube is increasing at a rate of  $24 \text{ cm}^3/\text{s}$ . How fast is the surface area increasing when the length of an edge is  $6 \text{ cm}$ . (3)
- (ii) Find the local minimum value of the function  $f(x) = |x| - 2, x \in \mathbb{R}$ . (1)
12. Find the area enclosed by the ellipse  $\frac{x^2}{25} + \frac{y^2}{9} = 1$  using integration.
13. (i) Which of the following is a solution of the differential equation  $y'' - y' = 0$ ? (1)
- (a)  $y = e^x + 1$
- (b)  $y = e^{-x+1}$
- (c)  $y = \sin x + 1$
- (d)  $y = \sin(x + 1)$
- (ii) Find the general solution of the differential equation  $\frac{dy}{dx} = \frac{\sqrt{9-y^2}}{x}$ . (3)
14. (i) Find the projection of vector  $\vec{a} = 2\hat{i} + \hat{j}$  on the vector  $\vec{b} = 2\vec{a}$ . (1)
- (ii) Find the area of the parallelogram whose adjacent sides are given by the vectors  $3\hat{i} + \hat{j} + 4\hat{k}$  and  $\hat{i} - \hat{j} + \hat{k}$ . (3)
15. Find the shortest distance between the skew lines  $\frac{x-1}{2} = \frac{y-1}{-1} = \frac{z}{2}$  and  $\frac{x-2}{3} = \frac{y-1}{-5} = \frac{z+1}{2}$
16. (i) If  $A$  and  $B$  are independent events with  $P(A)=0.4$  and  $P(B)=0.5$ , then find  $P(\text{neither } A \text{ nor } B)$  (1)
- (ii) A man is known to speak truth 4 out of 5 times. He throws a die and reports that it is 5. Find the probability that it is actually a five. (3)

Questions from 17 to 20 carries 6 scores each. Answer any 3 questions.

(3 x 6 = 18)

17. Solve the system of linear equations using matrix method:

$$x + 2y + z = 18$$

$$2x + y + z = 5$$

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

18. Find  $\frac{dy}{dx}$  of the following:

(i)  $y = \sqrt{\sin x}$  (1)

(ii)  $x = a(t - \sin t), y = a(1 + \cos t)$  (3)

(iii)  $y = x^x$  (2)

19. Evaluate the following

(i)  $\int e^x \sin x \, dx$  (3)

(ii)  $\int_0^{\pi/2} \frac{\sin^3 x}{\sin^3 x + \cos^3 x} \, dx$  (3)

20. Solve the linear programming problem graphically:

Maximize:  $z = 3x + 7y$

Subject to the constraints:

$$3x + 4y \leq 60$$

$$x + y \geq 10$$

$$x - 3y \leq -6$$

$$x \geq 0$$



**Aakash**  
Medical | IIT-JEE | Foundations