

**B-7-Y**

[Total No. of Questions]

[Total No. of Questions : 30]

[Total No. of Printed Pages : 8]

**12<sup>th</sup>ARM(SZ)JKUT2024**

**1107-Y**

**MATHEMATICS**

Time : 3 Hours]

[Maximum Marks : 80

**SECTION-A**

**(OBJECTIVE TYPE QUESTIONS/  
MULTIPLE CHOICE QUESTIONS)**

1 each

1. In determinant

$$\begin{vmatrix} -1 & 3 \\ 6 & 10 \end{vmatrix}$$

cofactor of 10 is

2. If matrix B is inverse of matrix A, then  $AB = BA = \dots\dots\dots$

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3. Order of differential equation

$$x^2 \frac{dy}{dx} = -y^5$$

is

- (A) 1
- (B) 2
- (C) 5
- (D) 0

4. Derivative of  $\cos (xe^x)$  is :

- (A)  $-e^x (x + 1) \sin (xe^x)$
- (B)  $e^x (x + 1) \sin (xe^x)$
- (C)  $-\sin (xe^x)$
- (D)  $\sin (xe^x)$

5. Number of points of discontinuity of the function  $f(x) = x + 5$  is :

- (A) 1
- (B) 2
- (C) 3
- (D) 0

6.  $\int \tan x \, dx$  is equal to  $\log \sec x + c$ . (True/False)

7. The function  $f(x) = x^2 + 2x + 3$  is decreasing for .....

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8. Direction cosines of y-axis are :

(A) 1, 0, 0

(B) 0, 1, 0

(C) 0, 0, 1

(D) 0, 0, 0

9. Unit vector along the direction of the vector  $\hat{i} + \hat{j} + \hat{k}$  is :

(A)  $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{3}}$

(B)  $\frac{\hat{i} + \hat{j} + \hat{k}}{\sqrt{2}}$

(C)  $\frac{\hat{i} + \hat{j} + \hat{k}}{3}$

(D)  $\frac{\hat{i} + \hat{j} + \hat{k}}{2}$

10. Define feasible region.

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## SECTION-B

(VERY SHORT ANSWER TYPE QUESTIONS) 2 ea.

11. Check the injectivity and subjectivity of the function  $f : \mathbb{R} \rightarrow \mathbb{R}$  given by  $f(x) = x^2$ .

12. Find the principal value of

$$\tan^{-1}(-\sqrt{3}).$$

13. Prove that the function  $f(x) = \log \cos x$  is decreasing for

$$\left(0, \frac{\pi}{2}\right).$$

14. Find the angle between two vectors  $\vec{a}$  and  $\vec{b}$  with magnitudes  $\sqrt{3}$  and 2 respectively having  $\vec{a} \cdot \vec{b} = \sqrt{6}$ .

15. Show that :

$$(\vec{a} - \vec{b}) \times (\vec{a} + \vec{b}) = 2(\vec{a} \times \vec{b}).$$

16. Find :

$$\int \frac{1}{x + x \log x} dx.$$

17. Evaluate :

$$\int_0^{\pi/2} \cos 2x dx.$$

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8. If

$$P(A) = \frac{3}{5}$$

and

$$P(B) = \frac{1}{5}$$

find  $P(A \cap B)$  if A and B are independent events

9. Evaluate  $P(A \cup B)$  if  $2P(A) = P(B) = \frac{5}{13}$  and  $P(A/B) = \frac{2}{5}$

10. Show that the matrix

$$A = \begin{bmatrix} 1 & -1 & 5 \\ -1 & 2 & 1 \\ 5 & 1 & 3 \end{bmatrix}$$

is a symmetric matrix.

### SECTION-C

(SHORT ANSWER TYPE QUESTIONS)

4 each

1. Find the general solution of the differential equation .

$$x \log x \frac{dy}{dx} + y = \frac{2}{x} \log x.$$

2. Evaluate :

$$\int_0^{\pi/2} \frac{\sqrt{\sin x}}{\sqrt{\sin x} + \sqrt{\cos x}} dx.$$

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23. If

$$x = \sqrt{a \sin^{-1} t}, y = \sqrt{a \cos^{-1} t}$$

show that :

$$\frac{dy}{dx} = -\frac{y}{x}$$

24. Find the shortest distance between the lines :

$$\vec{r} = (\hat{i} + 2\hat{j} + \hat{k}) + \lambda(\hat{i} - \hat{j} - \hat{k})$$

and

$$\vec{r} = (2\hat{i} - \hat{j} - \hat{k}) + \mu(2\hat{i} + \hat{j} + 2\hat{k}).$$

25. If

$$\vec{a} = 2\hat{i} + 2\hat{j} + 3\hat{k}, \vec{b} = -\hat{i} + 2\hat{j} + \hat{k}$$

and

$$\vec{c} = 3\hat{i} + \hat{j}$$

are such that :

$$\vec{a} + \lambda \vec{b}$$

is perpendicular to  $\vec{c}$ , then find the value of  $\lambda$ .

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26. Solve the linear programming problem graphically.

$$\text{Minimize } z = -3x + 4y$$

subject to :

$$x + 2y \leq 8,$$

$$3x + 2y \leq 12,$$

$$x \geq 0, y \geq 0.$$

27. Show that the relation  $R$  in the set  $Z$  of integers given by  $R = \{(a, b) : 2 \text{ divides } a - b\}$  is an equivalence relation.
28. A bag contains 4 red and 4 black balls, another bag contains 2 red and 6 black balls. One of the two bags is selected at random and a ball is drawn from the bag which is found to be red. Find the probability that the ball is drawn from the first bag.

### SECTION-D

(LONG ANSWER TYPE QUESTIONS)

6 each

29. If :

$$A = \begin{bmatrix} 1 & -1 & 2 \\ 3 & 0 & -2 \\ 1 & 0 & 3 \end{bmatrix}$$

verify  $A (\text{adj } A) = (\text{adj } A)A = |A| I$ .

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Or

Let

$$A = \begin{bmatrix} 3 & 7 \\ 2 & 5 \end{bmatrix} \text{ and } B = \begin{bmatrix} 6 & 8 \\ 7 & 9 \end{bmatrix}$$

verify  $(AB)^{-1} = B^{-1}.A^{-1}$ .

30. Evaluate :

$$\int_{-1}^1 5x^4 \sqrt{x^5 + 1} dx.$$

Or

Evaluate :

$$\int \frac{(3x - 1) dx}{(x - 1)(x - 2)(x - 3)}$$

31. If  $y = Ae^{mx} + Be^{nx}$ , show that :

$$\frac{d^2 y}{dx^2} - (m + n) \frac{dy}{dx} + mny = 0.$$

Or

Differentiate w.r.t.  $x$  :

$$(\log x)^x + x^{\log x}$$

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