

B-7-X

Roll No.

Total No. of Questions : 31]

[Total No. of Printed Pages : 8

12thARM(SZ)JKUT2024

1107-X

MATHEMATICS

Time : 3 Hours]

[Maximum Marks : 80

SECTION-A

(OBJECTIVE TYPE QUESTIONS/

MULTIPLE CHOICE QUESTIONS)

1 each

1. In determinant

$$\begin{vmatrix} 3 & 6 \\ -2 & 5 \end{vmatrix}$$

cofactor of -2 is :

(A) 6

(B) 3

(C) 5

(D) -6

2. For a square matrix A. $A(\text{adj } A) = (\text{adj } A) A = \dots\dots\dots$

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3. Order of differential equation :

$$\left[1 + \left(\frac{dy}{dx} \right)^2 \right]^{3/2} = \frac{d^2y}{dx^2}$$

is :

- (A) 3
- (B) 2
- (C) 1
- (D) 4

4. Derivative of $e^{\log \sin x}$ is :

- (A) $\sin x$
- (B) $\cos x$
- (C) $\sec x$
- (D) $\tan x$

5. Number of points of discontinuity of the function :

$$f(x) = \frac{1}{x-5}, x \neq 5$$

is :

- (A) 1
- (B) 2
- (C) 3
- (D) 5

6. $\int x e^{x^2} dx$ is equal to $\frac{e^{x^2}}{x} + c$. (True/False)

7. The function $f(x) = 3x + 5$ is increasing for

8. Direction cosines of x-axis are :

(A) 1, 0, 0

(B) 0, 1, 0

(C) 0, 0, 1

(D) 0, 0, 0

9. Magnitude of Vector $\hat{i} + 2\hat{j} + 3\hat{k}$ is :

(A) $\frac{1}{\sqrt{14}}$

(B) $\sqrt{14}$

(C) 1

(D) 10

10. Define objective function.

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SECTION-B**(VERY SHORT ANSWER TYPE QUESTIONS)** 2 each

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

$$\sin^{-1}\left(-\frac{1}{2}\right).$$

13. Prove that the logarithmic function is strictly increasing on $(0, \infty)$.

14. Find the projection of the vector $\hat{i} + 3\hat{j} + 7\hat{k}$ on the vector $7\hat{i} - \hat{j} + 8\hat{k}$. <https://www.jkboseonline.com>

15. Find a unit vector perpendicular to each of the vector $\vec{a} + \vec{b}$ and $\vec{a} - \vec{b}$, where $\vec{a} = 3\hat{i} + 2\hat{j} + 2\hat{k}$ and $\vec{b} = \hat{i} + 2\hat{j} - 2\hat{k}$.

16. Find :

$$\int \frac{(\log x)^2}{x} dx.$$

17. Evaluate :

$$\int_0^1 \frac{dx}{\sqrt{1-x^2}}.$$

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(5)

18. If

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

and

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

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

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

20. 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

21. Find the general solution of the differential equation :

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

22. 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 λ .

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

Turn Over

(8)

Or

Let :

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

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

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 :

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

Or

Differentiate w.r.t. x :

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

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