Bhavan's Tripura Vidyamandir

Pre-Board Test : (2024 - 2025)

Class :-12 **Subject : Mathematics**

Time : - 3 Hours Total :- 80 Marks

Name of the student : Roll Stream

General Instructions:

- This Question paper contains 5 sections A, B, C, D and E
- section A contains 18 MCQ and 2 assertion and reason based question each carries 1 mark.
- Section B contains 5 VSA type questions each carries 2 mark.
- Section C contains 6 questions each carries 3 mark.
- Section D contains 4 questions each carries5 mark.
- Section E contains 3 case based question each carries 4 mark, having sub parts. (1+1+2), (1+1+2) and (2+2).

SECTION-A **1X20=20**

1) A matrix having n elements, where n is prime can be

(a) a square matrix. (b) a row matrix

(c) a column matrix (d) a row or a column matrix.

2) If A is a square matrix of order 3 such that $|A|$= - 5then $|3A|$ is

(a) - 15 (b) -135

(c) 135 (d) -45

3) If $\begin{bmatrix} x & y \\ 3y & x \end{bmatrix}\begin{bmatrix} 1 \\ 2 \end{bmatrix} = \begin{bmatrix} 3 \\ 5 \end{bmatrix}$, then

(a) x=1 , y= 2 (b) x=2 , y=1

(c) x=1 , y=1 (d) x=0 , y=5

4) Find the value of k for which

$f(x) = \begin{cases} \frac{sin2x}{tan5x}, & where\ x \neq 0 \\ k, & where\ x = 0 \end{cases}$ is continuous at x=0, then the value of k is

(a) $\frac{5}{2}$ (b) $\frac{2}{5}$

(c) $\frac{2}{15}$ (d) $\frac{6}{5}$

5) If $\vec{a}$ =3$\hat{\imath}$ +2$\hat{\jmath}$ - 5$\hat{k}$ and $\vec{b}$ = -5$\hat{\jmath}$ + $\lambda\hat{k}$ are perpendicular then the value of λ is

(a) 2 (b) 0

(c) -2 (d) 1

6) The direction ratio of two lines are a,b,c and (b-c), (c-a), (a-b) respectively. The angle between these line is

(a) $\frac{\pi}{3}$ (b) $\frac{\pi}{2}$

(c) $\frac{\pi}{4}$ (d) $\frac{3\pi}{4}$

7) If the lines $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$are perpendicular to each other then k=?

(a) $\frac{-5}{7}$ (b) $\frac{5}{7}$

(c) $\frac{10}{7}$ (d) $\frac{-10}{7}$

8) The degree of the differential equation $(\frac{d^2y}{dx^2})^2 = \sqrt{\frac{dy}{dx} + x}$ is

(a)1 (b) 3 (c) 4 (d) 5

9) The corner points of the bounded feasible region determined by a system of linear constraints are (0,3), (1,1) and (3,0). Let Z= $px + qy$, where p,q>0. The condition on p and q so that the minimum of z occurs at (3,0) and (1,1) is

(a) p=2q (b) p= $\frac{q}{2}$ (c) p= 3q (d) p=q

10) The area bounded by the curve $y = x$, the x-axis and between $x = 1$ to $x = 2$ is

(a) 4 sq. unit (b) $\frac{3}{2}$ sq. unit

(c) 1 sq. unit (d) 2 sq. unit

11) If P(A)=$\frac{1}{2}$, P(B) = 0, then P(A/B) is

(a) 0 (b) $\frac{1}{2}$

(c) not defined (d) 1

12) The absolute maximum value of $y = x^3 - 3x + 2$ in $0 \leq x \leq 2$ is

(a) 4 (b) 6 (c) 2 (d) 0

13)$\int \frac{e^{\sqrt{x}}}{\sqrt{x}}\ dx$ equals to

(a)$2e^{\sqrt{x}} + c$ (b) $\frac{1}{\sqrt{x}} + c$ (c) $2\sqrt{x + c}$ (d) $e^{\sqrt{x}} + c$

14) A die is rolled; the outcome is an even number. What is the probability that it is prime?

(a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{3}{4}$

15) $\int \frac{xe^x}{(x+1)^2}\ dx$ is equal to

(a))$\frac{e^x}{x+1} + c$ (b) $e^x(x + 1) + c$

(c) $-\frac{e^x}{(x+1)^2} + c$ (d) $\frac{e^x}{x^2+1} + c$

16) The distance of point (2,5,7) from the x axis is

(a) 2 (b) $\sqrt{74}$ (c) $\sqrt{29}$ (d)$\sqrt{53}$

17) The integrating factor of differential equation $\frac{dy}{dx} = x + y$ is

(a) -1 (b) 1 (c) e^{-x} (d) e^{-y}

18) If the rate of change of volume of a sphere is equal to the rate of change of its radius then the radius equal to-

(a) 2√π (b) √π (c) $\frac{1}{2\sqrt{\pi}}$ (d) π

ASSERTION AND**-REASON BASED QUESTIONS**

In the following questions , a statement of Assertion(A) is followed by a statement of Reason(R). Choose the correct answer out of the following choices.

a. Both A and R true and R is the correct explanation of A.
b. Both A and R true but R is not the correct explanation of A.
c. A is true but R is false.
d. A is false but R is true

19) Assertion (A) : Two coins are tossed simultaneously. The probability of getting two heads if it is known that at least one head comes up is $\frac{1}{3}$.

Reason (R) : Let E and F be two events with a random experiment, then P(E/F)= $\frac{P(E\cap F)}{P(F)}$

20) Assertion : The area of a parallelogram with diagonals $\vec{a}$ and $\vec{b}$ is $\frac{1}{2}(\vec{a}\times\vec{b})$

Reason (R) : If $\vec{a}$ and $\vec{b}$ represent the adjacent sides of a triangle then the area of triangle can be obtained by evaluating $|\vec{a}\times\vec{b}|$.

SECTION : B **2X5=10**

21) Find the principal value of $sin^{-1}(-1)$

Or,

Find the domain of $sin^{-1}(x^2-4)$

22) The radius of a square sheet of metal is increasing at 3 centimeters per minute. At what rate is the area increasing when the side is 10 cm long.

Or,

Find the intervals in which the given function f is increasing where, $f(x)=2x^2-3x$

23) If the vectors $\vec{a}$ and $\vec{b}$ are such that $|\vec{a}|=3, |\vec{b}|=\frac{2}{3}$ and $\vec{a}\times\vec{b}$ is unit vector then find the angle between $\vec{a}$ and $\vec{b}$.

24) If $y=cos^{-1}x$, then find $\frac{d^2y}{dx^2}$ in terms of y

25) Find the equation of a straight line passing through the point P (3,-8,1) and parallel to the line $\frac{x-3}{3}=\frac{y+7}{-1}=\frac{z+2}{5}$.

SECTION:C **3X6=18**

26) In a bolt factory, three machines A,B,C manufacture 25%,35% and 40% of the total production respectively, Of their respective outputs 5%,4% and 2% are defective. A bolt is drawn at random from the total product and it is found to be defective. Find the probability that it was manufactured by the machine C.

27) Evaluate $\int\frac{dx}{\sqrt{16-x^2}}$.

28) Solve the differential equation, $(x^2+1)\frac{dy}{dx}+y=tan^{-1}x$

Or,

$$\left(1+e^{\frac{x}{y}}\right)dx+e^{\frac{x}{y}}\left(1-\frac{x}{y}\right)dy=0$$

29) Solve the linear programming problem in graphically:

Maximize $z=7x+7y$

Subject to the constraints

$$x\geq 0;\quad y\geq 0\quad ;\quad x+y\geq 2\quad and\quad 2x+3y\leq 6$$

30) Solve $\int_{-2}^{2}|x+1|\,dx$

Or, Evaluate $\int_0^{\frac{\pi}{2}}\frac{\sqrt{sinx}}{\sqrt{sinx}+\sqrt{cosx}}\,dx$

31) If $y=3e^{2x}+2e^{3x}$ then, prove that $\frac{d^2y}{dx^2}-5\frac{dy}{dx}+6y=0$

OR

Find the intervals in which the function $f(x)=\frac{1}{4}x^4+\frac{2}{3}x^3-2x^2-8x$ is increasing.

SECTION : D 5X4=20

32) Solve the following system of equations by matrix method:

$$3x - 2y + 3z = 8$$
$$2x + y - z = 1$$
$$4x - 3y + 2z = 4$$

33) Find the area bounded by the curves $y^2 = x$; the x axis and the line $x = -1,\ x = 2$ (using integration)

34) Find the shortest distance between the skew lines whose vector equations are

$\vec{r} = (\vec{\imath} + 2\vec{\jmath} + 3\vec{k}) + \lambda(\vec{\imath} - 3\vec{\jmath} + 2\vec{k})$ and $\vec{r} = (4\vec{\imath} + 5\vec{\jmath} + 6\vec{k}) + \mu(2\vec{\imath} + 3\vec{\jmath} + \vec{k})$

35) Show that the relation R in R defined as R= $\{(a, b): a \leq b\}$ is reflexive and transitive but not symmetric.

SECTION : E 4X3=12

(This section comprises of 3 case study / passage based question of 4 marks each with two sub parts. First two case study questions have three sub parts (i), (ii), (iii) of marks 1, 1, 2 respectively The third case study question has two sub parts of 2 marks each)

36) Case: 1 Read the following passage and answer the questions given below.

Companies are very alert regarding expenditure, profit, loss and other issues related to the company and at equal interval they keep on evaluating the performance. In one such case the profit of the company is p(x) = $-10x^2$+ 4000x + 37000 where x represents the number of units

(1) What is critical point of profit function?

(ii) What is maximum profit?

(iii) For what units, profit function is increasing?

OR

(iii) What is marginal profit when x = 75 ?

37) Case: 2 Ramesh, the owner of a sweet selling shop, purchased some rectangular card board sheets of dimensions 25cm by 40cm to make container packets without top. Let x cm be the length of the side of the square to be cut out from each corner to give that sheet the shape of the container by folding up the flaps.

Based on the above information answer the following questions.

(i) Express the volume (V) of each container as function of x only. 1

(ii) Find $\frac{dV}{dx}$ 1

(iii) For what value of x, the volume of each container is maximum?

Or, 2

(iii) Check whether V has a point of inflection at $x = \frac{65}{6}$ or not?

38) Case:3 Read the following passage and answer the questions given below.

As board examinations are approaching near, students are working hard to score well and they all study together but independently. For one particular problem the probability of solving it correctly by students A, B and C are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{5}$ respectively. If all the three try, then

(i) what is the probability that exactly two will solve the problem?

(ii) what is the probability that problem will be solved? 2