STD: XII   **MARKS: 100**

SUBJECT: MATHEMATICS   **TIME : 3 hrs**

General Instructions

1. All questions are compulsory.

2. The question paper consists of **26** questions divided into three sections A, B and C.

   Section A comprises of **6** questions of **one mark** each,

   Section B comprises of **13** questions of **four marks** each and

   Section C comprises of **7** questions of **six marks** each

   This question paper contains **3 printed pages.**

SECTION – A

1. If $f(x) = 8x^3$ and $g(x) = x^{\frac{1}{3}}$. Find fog.

2. Find the value of $\sin^{-1}(\sin\frac{3\pi}{5})$.

3. Find the value of x for which $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$.

4. If $y = \sec(\tan(\sqrt{x}))$. Find $\frac{dy}{dx}$.

5. The total revenue in Rupees received from the sale of x units of a product is given by $R(x) = 3x^2 + 36x + 5$. Find the marginal revenue, when x = 5 .

6. Find the direction cosines of the vector $\hat{i} + 2\hat{j} + 3\hat{k}$.

SECTION – B

7. Verify that the relation R in the set $A = \{ x \in Z : 0 \le x \le 12 \}$, given by

   $R = \{ (a, b) : |a - b| \text{ is a multiple of 4 } \}$ is an equivalence relation.

8. Prove that $\tan^{-1}\left(\frac{\sqrt{1+x} - \sqrt{1-x}}{\sqrt{1+x} + \sqrt{1-x}} \right) = \frac{\pi}{4} - \frac{1}{2}\cos^{-1} x, , -\frac{1}{\sqrt{2}} \le x \le 1.$

   (or)

   Prove that $\cot^{-1} 7 + \cot^{-1} 8 + \cot^{-1} 18 = \cot^{-1} 3.$

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eterminants prove that $\begin{vmatrix} 1 & x & x^2 \\ x^2 & 1 & x \\ x & x^2 & 1 \end{vmatrix} = (1-x^3)^2$.

$\begin{bmatrix} 0 & 1 \\ 1 & 3 \\ -1 & 0 \end{bmatrix}$,

11. Find the value of k so that the function f(x) = $\begin{cases} \dfrac{k\cos x}{\pi - 2x}, & if\ x \neq \dfrac{\pi}{2} \\ \\ 3, & if\ x = \dfrac{\pi}{2} \end{cases}$

is continuous at $x = \dfrac{\pi}{2}$.

12. If $x\sqrt{1+y} + y\sqrt{1+x} = 0$. Prove that $\dfrac{dy}{dx} = \dfrac{-1}{(1+x)^2}$.

(or)

Differentiate $\tan^{-1}\left(\dfrac{\sqrt{1+x^2}-1}{x} \right)$ with respect to $\tan^{-1} x,\ when\ x \neq 0$.

13. Prove that the curves $x = y^2$ and $xy = k$ cut at right angles if $8k^2 = 1$.

14. Using differentials find the approximate value of $f(2.01)$ where $f(x) = 4x^2 + 5x + 2$.

15. Verify Mean Value Theorem for the function $f(x) = x^3 - 5x^2 - 3x$ in the interval $[1,3]$.

16. The scalar product of the vector $\hat{i} + \hat{j} + \hat{k}$ with a unit vector along the sum of vectors $2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\lambda\hat{i} + 2\hat{j} + 3\hat{k}$ is equal to one. Find the value of λ.

(or)

Show that the vectors $\vec{a}$, $\vec{b}$, $\vec{c}$ are coplanar if and only if $\vec{a} + \vec{b}$, $\vec{b} + \vec{c}$ and $\vec{c} + \vec{a}$ are coplanar.

17. Find the angle between the line $\dfrac{x+1}{2} = \dfrac{y}{3} = \dfrac{z-3}{6}$ and the plane 10x +2y- 11z = 3.

18. Find the equation of the plane through the intersection of the planes 3x - y +2z - 4=0 and x + y +z - 2 =0 and through the point (2,2,1).

19. Find the mean number of heads in three tosses of a fair coin.

(or)

A die is thrown again and again until three sixes are obtained .Find the probability of obtaining the third six in the sixth throw of the die .

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SECTION - C

20. The cost of 4 kg of onion, 3 kg wheat and 2 kg rice is Rs 60. The cost of 2 kg onion, 4 kg wheat and 6 kg rice is Rs 90. The cost of 6 kg onion 2 kg wheat and 3 kg rice is Rs 70. Find cost of each item per kg by matrix method.

21. If $x^y + y^x = 1$ Find $\dfrac{dy}{dx}$.

22. Show that the right circular cylinder of given surface and maximum volume is such that its height is equal to diameter of the base.

(or)

Show that the right circular cone of least curved surface and given volume has an altitude equal to $\sqrt{2}$ times the radius of the base.

23. Find the intervals in which the function $f(x) = \dfrac{3}{10}x^4 - \dfrac{4}{5}x^3 - 3x^2 + \dfrac{36}{5}x + 11$ is

    (a) strictly increasing   (b) strictly decreasing.

24. Find the equation of the plane that contains the point (1,-1,2) and is perpendicular to both the planes $2x + 3y -2z = 5$ and $x + 2y -3z = 8$. Hence find the distance of point P(-2, 5, 5) from the plane obtained above.

(or)

Find the distance of the point P(-1, -5, -10) from the point of intersection of the line joining the points A(2, -1, 2) and B(5, 3, 4) with the plane $x - y + z = 5$.

25. An aero plane can carry a maximum of 200 passengers. A profit of Rs.1000 is made on each executive class ticket and a profit of Rs. 600 is made on each economy class ticket. The airline reserves at least 20 seats for executive class, however , at least 4 times as many passengers prefer to travel by economy class than by executive class . Determine how many tickets of each types must be sold in order to maximize the profit for the airline .what is the maximum profit ?

26. Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls .One ball is transferred from Bag I to Bag II and then a ball is drawn from Bag II .The ball so drawn is found to be red in colour. Find the probability that the transferred ball is black.

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