Class: ISC XII **Subject: Maths** **Date:**

TIME: 1 Hr. 30 Minutes **M MARKS: 80**

General instructions:

Read the following instructions carefully and strictly follow them:

- There are 33 questions in this question paper.
- The Question paper consists of three sections A , B and c . Candidates are required to attempt all questions from Section a and all questions either from Section B OR Section C .
- There is no negative marking.
- Specific instructions related to each part and a subdivision (Sections) is mentioned clearly before the questions.
- Candidates should read them thoroughly and attempt accordingly.
- Fill **OMR sheet with the pencil** given along with the Question paper .

SECTION A [64 Marks] *(Answer all questions)*

Question 1 **[2]**

If A = {1 , 2 , 3} , B = {1 , 4 , 6 , 9} and R is a relation from A to B defined by R = $\{(x,y): x>y, x\in A, y\in B\}$ then range of R is

a) {1 , 4 , 6 , 9} b) {4 , 6 , 9} c) { 1 } d) ϕ

Question 2 **[2]**

The Principal value of $\tan^{-1}\left(2\cos\left(\frac{2\pi}{3}\right)\right)$ is

a) $\frac{\pi}{2}$ b) $\frac{-\pi}{2}$ c) $\frac{-\pi}{4}$ d) $\frac{\pi}{4}$

Question 3 **[2]**

The function $f: R\to R$ defined by $f(x)=x^2$ is

a) one – one but not onto b) many – one but onto c) one – one and onto d) many – one but not onto

Question 4 **[2]**

If $4\cos^{-1}x+\sin^{-1}x=\pi$ then value of x is

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

Question 5 **[2]**

The relation R = { (1 , 1) , (2 , 2) , (3 , 3) } on the set {1 , 2 , 3} is

a) symmetric only b) reflexive only c) an equivalence relation d) transitive only

Question 6 **[2]**

The value of $\sin\left\{\tan^{-1}\left(-\frac{7}{24}\right)\right\}$ is

a) $-\frac{7}{25}$ b) $-\frac{7}{24}$ c) $\frac{7}{24}$ d) $\frac{7}{25}$

Question 7 **[2]**

If $\begin{vmatrix} 2x & 5 \\ 8 & x \end{vmatrix} = \begin{vmatrix} 6 & -2 \\ 7 & 3 \end{vmatrix}$ then the value of x is

a) 3 b) ±3 c) ±6 d) 6

Question 8 **[2]**

If $A = \begin{bmatrix} 3 & x-1 \\ 2x+3 & x+2 \end{bmatrix}$ is a symmetric matrix then x is equal to

a) 4 b) 3 c) -4 d) -3

Question 9 **[2]**

If A is a singular matrix , then adj A is

a) non – singular b) singular c) symmetric d) not defined

Question 10 **[2]**

If $\begin{bmatrix} 1 & -1 & x \\ 1 & x & 1 \\ x & -1 & 1 \end{bmatrix}$ has no inverse, then the real value of x is

a) 2 b) 3 c) 0 d) 1

Question 11 **[2]**

If $A^2 - A + I = 0$, then A^{-1} is

a) A^{-2} b) $A + I$ c) $I - A$ d) $A - I$

Question 12 **[2]**

If the function $f(x) = \begin{cases} \frac{\sin 3x}{x}, & x \neq 0 \\ \frac{k}{2}, & x = 0 \end{cases}$ is continuous at $x = 0$ then k is equal to

a) 3 b) 6 c) 9 d) 12

Question 13 **[2]**

If $y = t - \frac{1}{t}$ and $x = t + \frac{1}{t}$ then $\frac{dy}{dx}$ is equal to

a) $\frac{t^2 - 1}{t^2 + 1}$ b) $\frac{1}{t^2 + 1}$ c) $\frac{t^2 + 1}{t^2 - 1}$ d) $\frac{1}{t^2 - 1}$

Question 14 **[2]**

If $x^y = e^{x-y}$ then $\frac{dy}{dx}$ is

a) $\frac{1+x}{1+\log x}$ b) $\frac{1-\log x}{1+\log x}$ c) not defined d) $\frac{\log x}{(1+\log x)^2}$

Question 15 **[2]**

If $y=\sqrt{\sin x + y}$ then $\frac{dy}{dx}$ is

a) $\frac{\sin x}{2y-1}$ b) $\frac{\sin x}{1-2y}$ c) $\frac{\cos x}{1-2y}$ d) $\frac{\cos x}{2y-1}$

Question 16 **[2]**

The point on the curve $y=12x-x^2$ where the slope of the tangent is zero will be

a) (0 , 0) b) (2 , 16) c) (3 , 9) d) (6 , 36)

Question 17 **[2]**

The values of x for which the matrix $A=\begin{bmatrix} x-1 & 1 & 1 \\ 1 & x-1 & 1 \\ 1 & 1 & x-1 \end{bmatrix}$ is singular is

a) 1,-2 b) -1,2 c) -1,-2 d) 1,2

Question 18 **[2]**

The value of $\lim_{x\to 0}\frac{1-\cos x}{x^2}$ is equal to

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

Question 19 **[2]**

If $y=(\sin^{-1}x)^2$ then $(1-x^2)\frac{d^2y}{dx^2}$ is equal to

a) $x\frac{dy}{dx}+2$ b) $x\frac{dy}{dx}-2$ c) $-x\frac{dy}{dx}+2$ d) $-x\frac{dy}{dx}-2$

Question 20 **[2]**

Derivative of $\tan^{-1}\left(\frac{2x}{1-x^2}\right)$ w . r . t $\sin^{-1}\left(\frac{2x}{1+x^2}\right)$ is

a) 1 b) 0 c) -1 d) none of these

Question 21 **[4 x 2]**

Let $A = R - \{3\}$ and $B = R - \{1\}$. Consider the function $f: A \to B$ defined by $f(x) = \frac{x-2}{x-3}$

(i) the domain of the function $f: A \to B$ is

a) $R - \{1\}$ b) $R - \{3\}$ c) $[0, \infty)$ d) $(0, \infty)$

(ii) Codomain of the function $f: A \to B$ is

a) $R - \{1\}$ b) $R - \{3\}$ c) R d) $[0, \infty)$

(iii) Range of the function $f: A \to B$ is

a) $R - \{1\}$ b) $R - \{3\}$ c) R d) $[0, \infty)$

(iv) the function is

a) many – one onto b) many – one into c) one – one into d) one – one onto

Question 22 **[4 x 2]**

An architect designs a building for a multi – national company . The windows have the shape of rectangle surmounted by an equilateral triangle . The perimeter of the window is 12 m as shown below :

(i) If x and y represent the length and breadth of the rectangular region respectively then the relation between the variable is

a) $2x + y = 12$ b) $3x + 2y = 12$ c) $2x + 3y = 12$ d) $x + y = 12$

(ii) The area of the region expressed as a function is

a) $2x - \left(\frac{3}{2} + \frac{\sqrt{3}}{16}\right)x^2$ b) $3x - \left(\frac{3}{2} + \frac{\sqrt{3}}{4}\right)x^2$ c) $6x - \left(\frac{3}{2} - \frac{\sqrt{3}}{4}\right)x^2$ d) $6x - \left(\frac{1}{2} + \frac{\sqrt{3}}{4}\right)x^2$

(iii) Area is maximum when x is equal to

a) $\frac{6+\sqrt{5}}{11}$ b) $2\left(\frac{6-\sqrt{3}}{11}\right)$ c) $3\left(\frac{6+\sqrt{5}}{21}\right)$ d) $4\left(\frac{6+\sqrt{3}}{11}\right)$

(iv) Area is maximum when the breadth is

a) $6\left(\frac{5-\sqrt{3}}{11}\right)$ b) $5\left(\frac{6+\sqrt{5}}{21}\right)$ c) $4\left(\frac{6+\sqrt{3}}{11}\right)$ d) $6\left(\frac{5+\sqrt{3}}{11}\right)$

Question 23 **[4 x 2]**

If the matrix $A=\begin{bmatrix}4 & 2 & 3\\ 1 & 1 & 1\\ 3 & 1 & -2\end{bmatrix}$ and the system of equation is

$4x+2y+3z=2$, $x+y+z=1$ and $3x+y-2z=5$ then

(i) $|A|$ is equal to

a) 0 b) – 8 c) – 20 d) – 24

(ii) which is true about the above given condition :

a) the system is consistent and has infinite solution

b) the system is inconsistent and has no solution

c) the system is consistent and it has a unique solution

d) the system has trivial solution

(iii) $Adj\ A$ is equal to

a) $\begin{bmatrix}-3 & 5 & -2\\ 7 & -17 & 2\\ -1 & -1 & 2\end{bmatrix}$ b) $\begin{bmatrix}-3 & 7 & -1\\ 5 & -17 & -1\\ -2 & 2 & 2\end{bmatrix}$ c) $\begin{bmatrix}3 & -5 & 2\\ -7 & 17 & -2\\ 1 & 1 & -2\end{bmatrix}$ d) $\begin{bmatrix}3 & -7 & 1\\ -5 & 17 & 1\\ 2 & -2 & -2\end{bmatrix}$

(iv) The solution of the given system of equation is

a) $x=0$, $y=0$, $z=0$ b) no solution c) $x=\frac{1}{2}$, $y=\frac{3}{2}$, $z=-1$ d) $x=\frac{-1}{2}$, $y=\frac{-3}{2}$, $z=1$

SECTION B [16 Marks] *(Answer all questions)*

Question 24 **[2]**

The direction cosines of the line joining (1, -1, 1) and (-1, 1, 1) are

a) < 2, -2, 0 > b) < 1/√2, – 1/√2 , 0 > c) < -1/√2, 1/√2, 0 > d) < √2, – √2, 0 >

Question 25 **[2]**

The equation of the line passing through the point (-1, 3, -2)and perpendicular to the lines $\frac{x}{1}=\frac{y}{2}=\frac{z}{3}$ and $\frac{x+2}{-3}=\frac{y-1}{-2}=\frac{z+1}{5}$ is

a) $\frac{x+1}{2}=\frac{y-3}{-7}=\frac{z+2}{4}$ b) $\frac{x+1}{2}=\frac{y-3}{7}=\frac{z+2}{4}$ c) $\frac{x+1}{-2}=\frac{y-3}{-7}=\frac{z+2}{4}$ d) $\frac{x-1}{2}=\frac{y-3}{-7}=\frac{z-2}{4}$

Question 26 **[2]**

The acute angle between the lines $\frac{x+1}{2}=\frac{y+3}{2}=\frac{z-4}{-1}$ and $\frac{x-4}{1}=\frac{y+4}{2}=\frac{z+1}{2}$ is

a) $cos^{-1}(\frac{1}{9})$ b) $cos^{-1}(\frac{2}{9})$ c) $cos^{-1}(\frac{1}{3})$ d) $cos^{-1}(\frac{4}{9})$

Question 27 **[2]**

Find the value of p for which the vector $\vec{a} = 3\hat{\imath} + 2\hat{\jmath} + 9\hat{k}$ and $\vec{b} = \hat{\imath} + p\hat{\jmath} + 3\hat{k}$ are parallel

a) 6 b) $\frac{3}{2}$ c) $\frac{2}{3}$ d) $\frac{1}{3}$

Question 28 **[4 × 2]**

Let $\vec{a} = 2\hat{\imath} + 5\hat{\jmath} - 3\hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ are the two vectors.

(i) Find the projection of $\vec{a}$ on $\vec{b}$

(a) $\frac{1}{\sqrt{14}}$ b) $\frac{3}{\sqrt{14}}$ c) $\frac{17}{\sqrt{14}}$ d) $\frac{-17}{\sqrt{14}}$

(ii) The vector in the direction of the vector $\vec{a} = 2\hat{\imath} + 5\hat{\jmath} - 3\hat{k}$ that has magnitude 19 units is ..

(a) $\frac{1}{?\sqrt{19}}(2\hat{\imath} + 5\hat{\jmath} - 3\hat{k})$ b) $\frac{19}{\sqrt{38}}(2\hat{\imath} + 5\hat{\jmath} - 3\hat{k})$ c) $\frac{1}{\sqrt{?}}(2\hat{\imath} + 5\hat{\jmath} - 3\hat{k})$ d) $\frac{19}{\sqrt{?}}(2\hat{\imath} + 5\hat{\jmath} - 3\hat{k})$

(iii) Find $2\vec{a} - \vec{b}$

(a) $3\hat{\imath} + 12\hat{\jmath} + 9\hat{k}$ b) $3\hat{\imath} + 8\hat{\jmath} - 3\hat{k}$ c) $3\hat{\imath} + 8\hat{\jmath} + 3\hat{k}$ d) $3\hat{\imath} + 12\hat{\jmath} - 9\hat{k}$

(iv) The area of the parallelogram whose adjacent sides are $\vec{a} = 2\hat{\imath} + 5\hat{\jmath} - 3\hat{k}$ and $\vec{b} = \hat{\imath} - 2\hat{\jmath} + 3\hat{k}$ is given by

a) $\sqrt{3}$ b) $3\sqrt{3}$ c) $9\sqrt{3}$ d) 9

SECTION C [16 Marks] *(Answer all questions)*

Question 29 **[2]**

Suppose the cost to produce some commodity is a linear function of output . Find cost as a function of output , if costs are Rs. 4000 for 250 units and Rs. 5000 for 350 units.

a) $C(x) = 10x + 1500$ b) $C(x) = 10x + 1000$ c) $C(x) = 10x + 9000$ d) $C(x) = 100x + 1500$

Question 30 **[2]**

The total cost and total revenue functions of a commodity are given by $C(x) = x + 40$ and $R(x) = 10x - 0.2x^2$. Then the break – even point(s) .

a) 5 b) 40 c) 5 and 40 both d) Either 5 or 40

Question 31 **[2]**

A manufacturer can sell x items of a commodity at price of Rs. $(330-x)$ each . If the cost of producing x items is Rs. $(x^2+10x+12)$then the profit function will be

a) $330x+12-2x^2$ b) $330x-12-2x^2$ c) $320x+12-2x^2$ d) $320x-12-2x^2$

Question 32 **[2]**

The demand function of monopolist is given by $p=100-x-x^2$, then the marginal revenue function is

a) $MR=100+2x+3x^2$ b) $MR=100-2x+3x^2$ c) $MR=100-2x-3x^2$ d) $MR=100+2x-3x^2$

Question 33 **[4 x 2]**

The total revenue received from the sale of x units of a product is given by $R(x)=36x+3x^2+5$. Then

(i) the average revenue is

a) $36+3x+5x^2$ b) $36x^2+3x^3+5x$ c) $36+3x+\frac{5}{x}$ d) $36+\frac{3}{x}+\frac{5}{x^2}$

(ii) the marginal revenue is

a) $36+6x$ b) $36+6x+x^2$ c) $36+3x$ d) $36x+6x^2$

(iii) the marginal revenue when $x=5$ is

a) 51 b) 66 c) 330 d) 91

(iv) the actual revenue from selling 5^{th} item is

a) Rs. 260 b) Rs. 197 c) Rs. 457 d) Rs. 63