MM: 20 **Class Test XII** **Determinants** Time: 40 min

Q 1 carry 2 marks, Q 2-4 each carry 4 marks and Q 5 carry 6 marks.

1. Find the value of x if $\begin{vmatrix} x-2 & -3 \\ 3x & 2x \end{vmatrix} = 3$

2. Using elementary transformations, find inverse of $A = \begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$

3. Using properties of determinants show that:

$$\begin{vmatrix} 1 & a & a^2+bc \\ 1 & b & b^2+ca \\ 1 & c & c^2+ab \end{vmatrix} = 2(a-b)(b-c)(c-a)$$

4. Using properties of determinants, solve for x: $\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix} = 0$

MM: 20 **Class Test XII Class MATRICES** Time: 40 min

Each question carries 4 marks.

1. If $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, then find λ, μ so that $A^2 = \lambda A + \mu I$.

2. $A = \begin{bmatrix} 2 & 3 \\ 1 & 2 \end{bmatrix}$, prove that $A^3 - 4A^2 + A = 0$

3. Express the given matrix as the sum of symmetric and a skew-symmetric matrix:

4. If $A = \begin{bmatrix} 3 & -4 \\ 1 & -1 \end{bmatrix}$, then prove by mathematical induction that $A^n = \begin{bmatrix} 1+2n & -4n \\ n & 1-2n \end{bmatrix}$

5. Find the value of x if $\begin{bmatrix} 1 & x & 1 \end{bmatrix} \begin{bmatrix} 1 & 3 & 2 \\ 2 & 5 & 1 \\ 15 & 3 & 2 \end{bmatrix} \begin{bmatrix} 1 \\ 2 \\ x \end{bmatrix} = 0$

MM: 20 **Class Test XII Class** Time: 45 min

Q 1-4 carry 1 mark, Q 5-8 carry 4 marks .

1. Write the points of discontinuity of $f(x) = [x]$.
2. If $y = \tan^{-1}\left(\cot x^2\right)$, write value of dy/dx .
3. Is Rolle's theorem applicable to $f(x) = x^2 - 4$ for $x \in [1, 2]$?
4. If $f(1) = 4, f'(1) = 2$ find the value of the derivative of $\log f(e^x)$ at $x = 0$.
5. Show $f(x) = \begin{cases} x-1 & if\ x<2 \\ 2x-3 & if\ x \geq 2 \end{cases}$ is not differentiable at $x = 2$.
6. If $y = \tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$, find $\frac{dy}{dx}$.
7. If $y = x^{\log x} + \cos x^{\sin x}$, find dy/dx .
8. If $x = a(\cos\theta + \theta\sin\theta)$ and $y = b(\sin\theta - \theta\cos\theta)$, find d^2y/dx^2 .

MM: 20 **Class Test XII Relation/ Function** Time: 40 min

Each question carries 5 marks.

1. Show that relation R in set $A = \{x \in Z : 0 \leq x \leq 12\}$ given by $R = \{(a,b) : |a-b| \text{ is a multiple of } 4\}$ is equivalence relation.

2. Let $f : R - \{2\} \to R - \{1\}$ is a mapping defined by $f(x) = \frac{x-1}{x-2}$, show that f is bijective.

3. Consider $f : \mathrm{R}_+ \to [4, \infty)$ given by $f(x) = x^2 + 4$. Show that f is invertible with the inverse f^{-1} of f given by $f^{-1}(y) = \sqrt{y - 4}$, where R_+ is the set of all non-negative real numbers.

4. Let A be a set of all real numbers i.e. $A = R - \{-1\}$. Let $*$ be defined on A as $a * b = a + b + ab$.

Prove that: (*i*) $*$ is a binary operation on A.
(*ii*) $*$ is commutative and associative
(*iii*) 0 is the identity element. (*iv*) $-a/(1+a)$ is inverse of a.

MM: 20 **Class Test XII Class** Time: 45 min

Q 1-4 carry 1 mark, Q 5-8 carry 4 marks .

1. Write the points of discontinuity of $f(x)=[x]$.

2. If $y=\tan^{-1}\left(\cot x^2\right)$, write value of dy/dx .

3. Is Rolle's theorem applicable to $f(x)=x^2-4$ for $x\in[1,2]$?

4. If $f(1)=4,\ f'(1)=2$ find the value of the derivative of $\log f(e^x)$ at $x=0$.

5. Show $f(x)=\begin{cases} x-1 & if\ x<2 \\ 2x-3 & if\ x\geq 2 \end{cases}$ is not differentiable at $x=2$.

6. If $y=\tan^{-1}\left(\frac{\sqrt{1+x^2}-1}{x}\right)$, find $\frac{dy}{dx}$.

MM: 20 **Class Test XII Class** Time: 40 min

Each question carries 4 marks.

1. Evaluate the following:

(i) $\tan\left(2\tan^{-1}\left(\frac{1}{5}\right)-\frac{\pi}{4}\right)$ (ii) $\cos^{-1}\left(\cos\frac{5\pi}{4}\right)$

2. Find the value of

$$4\left[2\sin^{-1}\left(-\frac{1}{2}\right)+5\tan^{-1}1-3\cos^{-1}\frac{1}{2}\right]+\frac{1}{2}\cos^{-1}\left(-\frac{\sqrt{3}}{2}\right)$$

3. Prove that: $\sin^{-1}\frac{5}{13}+\cos^{-1}\frac{3}{5}=\tan^{-1}\frac{63}{16}$

4. Write the following in the simplest form:

$$\tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right)$$

5. Solve the following equation:

$$\tan^{-1}(x+1)+\tan^{-1}(x-1)=\tan^{-1}\frac{6}{17}$$

MM: 20 **Class Test XII** **Determinants** Time: 40 min

Q 1 carry 2 marks, Q 2-4 each carry 4 marks and Q 5 carry 6 marks.

1. Find the value of x if $\begin{vmatrix} x-2 & -3 \\ 3x & 2x \end{vmatrix}=3$

2. Using elementary transformations, find inverse of $A=\begin{bmatrix} 2 & -3 \\ 3 & 4 \end{bmatrix}$

3. Using properties of determinants show that:

$$\begin{vmatrix} 1 & a & a^2+bc \\ 1 & b & b^2+ca \\ 1 & c & c^2+ab \end{vmatrix}=2(a-b)(b-c)(c-a)$$

4. Using properties of determinants, solve for x:

$$\begin{vmatrix} a+x & a-x & a-x \\ a-x & a+x & a-x \\ a-x & a-x & a+x \end{vmatrix}=0$$

5. Using matrix method, solve the following system of linear equation:

$$x+y-z=1,\ 3x+y-2z=3,\ x-y-z=-1$$

MM: 30 **Class Test XII Class** Time: 45 min

Relation Function & Inverse Trigonometry

Q 1-6 each carries 4 marks and Q 7 carry 6 marks.

1. Show that relation R in set $A=\{x\in Z:0\leq x\leq 12\}$ given by $R=\{(a,b):|a-b| \text{ is a multiple of } 4\}$ is equivalence relation.

2. Let $f:R-\{2\}\to R-\{1\}$ is a mapping defined by $f(x)=\frac{x-1}{x-2}$, show that f is bijective.

3. Let A be a set of all real numbers i.e. $A=R-\{-1\}$.
Let $*$ be defined on A as $a*b=a+b+ab$.
Prove that: (i) $*$ is commutative and associative
(ii) 0 is the identity element.
(iii) $-a/(1+a)$ is inverse of a.

4. Prove that: $\sin^{-1}\frac{5}{13}+\cos^{-1}\frac{3}{5}=\tan^{-1}\frac{63}{16}$

5. Write the following in the simplest form:

$$\tan^{-1}\left(\frac{\sqrt{1+x^2}+\sqrt{1-x^2}}{\sqrt{1+x^2}-\sqrt{1-x^2}}\right)$$

6. Solve the following equation:

$$\tan^{-1}(x+1)+\tan^{-1}(x-1)=\tan^{-1}\frac{8}{31}$$

7. Let $f:N\to R$ be a function defined as $f(x)=4x^2+12x+15$. Show that $f:N\to R_f$ is invertible. Also find the inverse of f.

MM: 20 **Class Test XII Class MATRICES** Time: 30 min

Each question carries 5 marks.

1. If $A=\begin{bmatrix}2 & 3\\ 1 & 2\end{bmatrix}$, then find λ, μ so that $A^2=\lambda A+\mu I$.

2. Express the given matrix as the sum of $\begin{bmatrix}1 & 3 & 5\\ -6 & 8 & 3\\ -4 & 6 & 5\end{bmatrix}$ symmetric and a skew-symmetric matrix:

3. If $A=\begin{bmatrix}3 & -4\\ 1 & -1\end{bmatrix}$, then prove by mathematical induction that $A^n=\begin{bmatrix}1+2n & -4n\\ n & 1-2n\end{bmatrix}$

4. Find the value of x if $\begin{bmatrix}1 & x & 1\end{bmatrix}\begin{bmatrix}1 & 3 & 2\\ 2 & 5 & 1\\ 15 & 3 & 2\end{bmatrix}\begin{bmatrix}1\\ 2\\ x\end{bmatrix}=0$

MM: 30 **Home Test Class XII Matrix/Determinant** Time: 1 hr

Q1 carry 2 marks, Q 2-5 carry 4 marks each and Q6-7 carry 6 marks each.

1. Find the equation of the line joining $A(1,3)$ and $B(0,0)$ using determinants and find k if $D(k,0)$ is a point such that $ar(\Delta ABD)$ is 3 sq. units.

2. Using properties of determinants show that:

$$\begin{vmatrix}a+b+c & -c & -b\\ -c & a+b+c & -a\\ -b & -a & a+b+c\end{vmatrix}=2(a+b)(b+c)(c+a)$$

3. If $A=\begin{bmatrix}1 & 2 & 2\\ 2 & 1 & 2\\ 2 & 2 & 1\end{bmatrix}$, prove that $A^2-4A-5I=0$. Hence find A^{-1}.

4. Using elementary transformations, find the inverse of:

$$A=\begin{bmatrix}2 & -6\\ 1 & -2\end{bmatrix}$$

5. If $A=\begin{bmatrix}1 & 1 & 1\\ 0 & 1 & 1\\ 0 & 0 & 1\end{bmatrix}$, prove $A^n=\begin{bmatrix}1 & n & \frac{n(n+1)}{2}\\ 0 & 1 & n\\ 0 & 0 & 1\end{bmatrix}, n\in N$

6. If $A=\begin{bmatrix}2 & -1 & 1\\ -1 & 2 & -1\\ 1 & -1 & 2\end{bmatrix}$ and $B=\begin{bmatrix}3 & 1 & -1\\ 1 & 3 & 1\\ -1 & 1 & 3\end{bmatrix}$, find AB and use this result to

MM: 20 **Class Test XII Relation/ Function** Time: 40 min

Each question carries 5 marks.

1. Show that relation R in set $A=\{x\in Z: 0\le x\le 12\}$ given by $R=\{(a,b): |a-b| \text{ is a multiple of } 4\}$ is equivalence relation.

2. Let $f: R-\{2\}\to R-\{1\}$ is a mapping defined by $f(x)=\frac{x-1}{x-2}$, show that f is bijective.

3. Consider $f: R_+ \to [4,\infty)$ given by $f(x)=x^2+4$. Show that f is invertible with the inverse f^{-1} of f given by $f^{-1}(y)=\sqrt{y-4}$, where R_+ is the set of all non-negative real numbers.

4. Let A be a set of all real numbers i.e. $A=R-\{-1\}$. Let $*$ be defined on A as $a*b=a+b+ab$.

Prove that: (*i*) $*$ is a binary operation on A.

(*ii*) $*$ is commutative and associative

(*iii*) 0 is the identity element. (*iv*) $-a/(1+a)$ is inverse of a.

MM: 15 **Class Test XII A** Time: 30 min

Each question carries 5 marks.

Attempt any three:

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

2. Show that the semi-vertical angle of the cone of the maximum volume and of given slant height is $\tan^{-1}\sqrt{2}$.

3. Show that the height of the cylinder of maximum volume that can be inscribed in a sphere of radius R is $\frac{2R}{\sqrt{3}}$. Also find maximum volume.

4. Find the point on the curve $y^2=4x$ which is nearest to the point $(2,1)$.

MM: 15 **Class Test XII A** Time: 30 min

Q 1-3 carry 1 mark, Q 4-6 carry 4 marks.

1. Write the points of discontinuity of $f(x)=[x]$.

2. If $y=\cos^{-1}(4x^3-3x)$, write value of dy/dx .

3. Is Rolle's Theorem applicable to $f(x)=x^2-4 \text{ for } x\in[1,2]$?

4. If $\log\left(\sqrt{x^2+y^2}\right)=\tan^{-1}\frac{y}{x}$, prove that $\frac{dy}{dx}=\frac{x+y}{x-y}$.

OR

If $x\sqrt{1+y}+y\sqrt{1+x}=0 \text{ for} -1<x<1$ prove that $\frac{dy}{dx}=-\frac{1}{(1+x)^2}$

MM: 15 **Class Test XII C** Time: 30 min

Q 1-3 carry 1 mark, Q 4-6 carry 4 marks.

1. Justify is $\sin|x^2|$ continuous or not?

2. If $y=\cos^{-1}\left(\frac{2x}{1+x^2}\right)$, write value of dy/dx .

3. Is Rolle's Theorem applicable to $f(x)=[x] on [-1,1]$? Justify.

4. If $y\log x=x-y$, prove that $\frac{dy}{dx}=\frac{\log x}{(1+\log x)^2}$.

OR

If $x\sqrt{1+y}+y\sqrt{1+x}=0 \text{ for} -1<x<1$ prove that $\frac{dy}{dx}=-\frac{1}{\ }$

MM: 15 **Class Test XII B** Time: 30 min

Q 1-3 carry 1 mark, Q 4-6 carry 4 marks .

1. Write the point(s) of discontinuity of $f(x)=|3x-8|$.

2. If $y=\sin^{-1}\left(2x\sqrt{1-x^2}\right)$, write value of dy/dx .

3. Is Rolle's theorem applicable to $f(x)=[x] on [-1,1]$?

4. If $y\sqrt{x^2+1}=\log\left(\sqrt{x^2+1}-x\right)$, show $(x^2+1)\frac{dy}{dx}+xy+1=0$.

OR

If $\cos y=x\cos(a+y)$; $\cos a\neq\pm1$, prove that

$dy \quad \cos^2(a+y)$

MM: 20 **Class Test XII A** Time: 30 min

Each Question Carries 5 marks

Q1. The surface area of a spherical bubble is increasing at the rate of $2cm^2/\sec$. Find the rate at which the volume of the bubble is increasing at the instant its radius is 6 cm.

Q2. Prove that $y=\frac{4\sin\theta}{(2+\cos\theta)}-\theta$ is an increasing function of θ in $\left[0,\frac{\pi}{2}\right]$.

Q3. Find the equation of the tangent to the curve $y=\sqrt{3x-2}$ which is parallel to the $4x-2y+5=0$.

Q4. Using differentials, find the approximate value of $(81.5)^{1/4}$.

MM: 20 **Class Test XII B** Time: 30 min

Each Question Carries 5 marks

Q1. The volume of spherical balloon is increasing at the rate of $25 cm^3/\sec$. Find the rate of change of its surface area at the instant when its radius is 5 cm.

Q2. Show that $y = \log(x+1) - \frac{2x}{2+x}$; $x > -1$ is an increasing function of *x* throughout its domain.

Q3. Find the equation of the tangent line to the curve $y = x^2 - 2x + 7$ which is perpendicular to the line $5y - 15x = 13$.

Q4. Using differentials, find the approximate value of $(15)^{1/4}$.

MM: 15 **Class Test XII B** Time: 30 min

Each question carries 5 marks.

Attempt any three:

1. Prove that the volume of the largest cone that can be inscribed in a sphere of radius R is $\frac{8}{27}$ of the volume of the sphere.
2. Of all the closed cylindrical cans of a given volume of 100 cm^3, find the dimensions of the can which has the minimum surface area?
3. The sum of the perimeter of a circle and square is *k*, where *k* is some constant. Prove that the sum of their areas is least when the side of square is double the radius of the circle.
4. Find the largest possible area of a right angled triangle whose hypotenuse is 5 cm long.

MM: 15 **Class Test XII Class** Time: 30 min

Q 1-3 carry 1 mark, Q 4-6 carry 4 marks.

1. Find $\int \left(e^{x\log a} + e^{a\log a}\right) dx$

2. Find $\int \cos 2x \cos 4x \, dx$

3. Evaluate $\int \left(\frac{x+1}{x}\right)(x + \log x)^2 \, dx$

4. Evaluate $\int \frac{1}{1+\cot x} dx$

5. Evaluate $\int \frac{1}{\sin(x-a)\cos(x-b)} dx$

MM: 20 **Class Test XII C** Time: 30 min

Each Question Carries 5 marks

Q1. Sand is pouring from a pipe at the rate of 12 cm^3/s. The falling sand forms a cone on the ground in such a way that the height of the cone is always one-sixth of the radius of the base. How fast is the height of the sand cone increasing when the height is 4 cm?

Q2. Find intervals on which $f(x) = 5 + 36x + 3x^2 - 2x^3$ is (i) increasing (ii) decreasing:

Q3. Find the equation of the normals to the curve $y = x^3 + 2x + 6$ which are parallel to the line $x + 14y + 4 = 0$.

Q4. Using differentials, find the approximate value of $(29)^{1/3}$.

MM: 15 **Class Test XII C** Time: 30 min

Each question carries 5 marks.

Attempt any three:

1. A window is in the form of a rectangle surmounted by a semicircular opening. The total perimeter of the window is 10 m. Find the dimensions of the window to admit maximum light through the whole opening.
2. A wire of length 28 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into a circle. What should be the length of the two pieces so that the combined area of the square and the circle is minimum?
3. Show that the right circular cone of least curved surface and given volume has an altitude equal to $\sqrt{2}$ time the radius of the base.
4. Show that maximum volume of cylinder which can be inscribed in the sphere of radius $5\sqrt{3}\, cm$ is $500\pi \, cm^3$.