Vedanta's

SEE GURU-MANTRA

[OPT–I (Mathematics)]

Knowledge Level Questions

SEE Q.N. 1 (a)

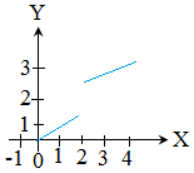
1. Identify the function which is defined by (i) f (x) = x (ii) f (x) = 10.
2. Under what condition, the inverse of a function is possible?
3. What do you mean by inverse function?
4. Define composite function.
5. Define trigonometric function. [SEE MODEL-2076]
6. Find the maximum and minimum values of (i) f (x) = sinx (ii) y = cosx
7. What is the period of the function (i) f (x) = cosx (ii) f (x) = sinx?
8. What is the remainder of polynomial f (x) when it is divided by (x – 3)?
9. State remainder theorem.
10. State factor theorem.

SEE Q.N. 1 (b)

1. What is the arithmetic mean between the numbers 'a' and 'b'? [SEE MODEL-2076]
2. If there are 'n' arithmetic means between the numbers 'a' and 'b', what will be the common difference (d)?
3. If an AS with n terms has the first term (a) and common difference (d), what is the sum of the series?
4. What is the geometric mean between the numbers 'a' and 'b'?
5. If there are 'n' Geometric means between the two numbers 'a' and 'b', find the formula to find the common ratio(r).
6. If a geometric series has n terms, first term (a) and common ratio (r), write the formula to find the sum of the series.
7. What is the coordinates of vertex of parabola $y= ax^2 + bx + c$, $a \neq 0$?
8. What is the vertex of parabola whose equation is $y = a(x – h)^2 + k$, $a \neq 0$?
9. For what value of 'a', the mouth of the graph of the quadratic equation $y = ax^2$, $a \neq 0$ faces upwards?
10. In which side, the mouth of the graph of the quadratic equation $y = ax^2$, $a \neq 0$ faces when $a > 0$?

SEE Q.N. 2 (a)

1. Write the set of numbers which is continuous in number line. [SEE MODEL-2076]
2. Express "$-1 \leq x \leq 2$ in interval form.
3. Under what condition the limit of a function f (x) exists at x = a?
4. Write the left hand limit of f (x) at x = 3 in notation.
5. Write the right hand limit of f (x) at x = 2 in notation.
6. Is the function continuous at x = 2? Give reason.
7. Express $\lim_{x \to 3^+} f(x)$ in sentence.



SEE Q.N. 2 (b)

1. Define singular matrix.

2. Under what condition the matrix becomes singular?
3. Write the necessary condition for the possibility of inverse of a matrix.
4. If A = [–5], what is the value of $|A|$?
5. If $A = \begin{pmatrix} p & q \\ r & s \end{pmatrix}$, what is the value of $|A|$? [SEE MODEL-2076]
6. Write the adjoint matrix of $A = \begin{pmatrix} a & b \\ c & d \end{pmatrix}$.
7. If D, D_1 and D_2 are given then what is formula to find the value of x by using Cramer's rule?

SEE Q.N. 3 (a)

1. If the slopes of two straight lines are m_1 and m_2 respectively and θ be the angle between them, write the formula for tanθ. [SEE MODEL-2076]
2. Write the formula to find the angle between the lines $y = m_1x + c_1$ and $y = m_2x + c_2$.
3. If two straight lines $y = m_1x + c_1$ and $y = m_2x + c_2$are parallel to each other, write the relation between m_1 and m_2.
4. If two straight lines $y = m_1x + c_1$ and $y = m_2x + c_2$are perpendicular (orthogonal) to each other, write the relation between m_1 and m_2.
5. If θ be the angles the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$, what is the value of tanθ?
6. If the pair of lines represented by $ax^2 + 2hxy + by^2 = 0$ are coincident to each other, write the relation between a, b and h.
7. Write the condition under which the pair of straight lines represented by $ax^2 + 2hxy + by^2 = 0$ are perpendicular to each other.

SEE Q.N. 3 (b)

1. Which geometrical figure will form if a plane intersects a cone parallel to its base? [SEE MODEL-2076]
2. Which geometrical figure will form if a plane intersects a cone parallel to its generator?
3. If the plane cuts the cone being parallel to its axis, what conic section will form?
4. Name the conic section so formed when an intersecting plane is neither parallel nor perpendicular to the base.
5. What is the equation of the circle having centre (a, b) and radius c units?
6. Write the equation of the circle having ends of a diameter are (x_1, x_2) and (y_1, y_2).
7. What will be the length of radius of a circle having centre (h, k) and touches the x–axis?

SEE Q.N. 4 (a)

1. Express sin2A in terms of tanA. [SEE MODEL-2076]
2. Express cos2θ in terms of (i) cosθ (ii) sinθ (iii) tanθ
3. Write sin3A in terms of sinA
4. Express cos3α in terms of cosα.
5. Write down the formula of tan2B in terms of tanB.
6. Write cosA in terms of (i) $\sin\frac{A}{2}$ (ii) $\cos\frac{A}{2}$ (iii) $\tan\frac{A}{2}$ (iv) $\cos\frac{A}{3}$
7. Write sinA in terms of (i) $\tan\frac{A}{2}$ (ii) $\sin\frac{A}{3}$

SEE Q.N. 4 (b)

1. Write down the product as the sum and difference of sine (i) 2sinA.cosB (ii) 2cosA.sinB
2. Write down the product as the sum and difference of cosine (i) 2cosA.cosB (ii) 2sinP.sinQ
3. Convert the sum as the product of sine or cosine. (i) sin C + sin D (ii) sin C – sin D
4. Convert cosA+ cosB in terms of product of cosine.
5. Convert cos X – cos Y in terms of product of sine.
6. Define trigonometric equation.
7. Define angle of elevation [SEE MODEL-2076]

SEE Q.N. 5 (a)

1. What is the scalar product of two vectors $\vec{a}$ and $\vec{b}$ if the angle between them is θ? [SEE MODEL-2076]

2. Under what the condition two vectors are perpendicular (orthogonal) to each other? Write in term of their scalar product.
3. If $\vec{i}$ the standard unit vector along x–axis, what is the value of $\vec{i}.\vec{i}$?
4. If $\vec{i}$ and $\vec{j}$ are the unit vectors along x–axis and y–axis respectively, what is the value of $\vec{i}.\vec{j}$?
5. The position vectors of vertices of a triangle ABC are $\vec{a}$, $\vec{b}$ and $\vec{c}$. What is the position vector of its centroid G?
6. The position vectors two points A and B are $\vec{a}$ and $\vec{b}$ respectively. What is the position vector of the mid-point M of the segment AB?
7. The position vectors two points A and B are $\vec{a}$ and $\vec{b}$ respectively. What is the position vector of the P which divides AB internally in the ratio m_1:m_2?

SEE Q.N. 5 (b)

1. In an inversion transformation, if P' is the image of the P and r is the radius of inversion circle with centre O, write the relation of OP, OP' and r. **[SEE MODEL-2076]**
2. If a point P is inside the inversion circle, where does its inverse lie?
3. If P' (x', y') is the inversion point of P (x, y) in the circle with centre origin and radius r, write down the formula of finding x' and y'.
4. What will be single transformation when a rotation through θ_1 about origin is followed by another rotation through θ_2 about origin?
5. What will be the image of a point P (x, y) if it is first reflected in x–axis and then rotated through $+90^0$ about origin?
6. To what transformation is the matrix $\begin{pmatrix} 2 & 0 \\ 0 & 2 \end{pmatrix}$ associated?
7. To what transformation is the matrix $\begin{pmatrix} 1 & -1 \\ 0 & 1 \end{pmatrix}$ associated?

Understanding Level Questions

SEE Q.N. 6 (a) and 6 (b)

FUNCTION

1. If f = {(a, 1), (b, 2), (c, 3)} and g = {(1, p), (2, q), (3, r)}, show the function gof in an arrow diagram and write it in ordered pair form. *Ans: {(a, p), (b, q), (c, r)}*
2. If f(x) = 2x – 1 and g (x) = 4x, find the value of gof (x). *Ans:8x – 4* **[SEE MODEL-2076]**
3. If f(x) = 3x + 2 and g (x) = 2x + 1, find fog (4). *Ans:29*
4. If g(x) = $\frac{x+1}{2}$ and h(x) = 2x – 1 are two functions, prove that hog (x) is an identity function.
5. If f: x $\rightarrow$3x + b and ff (2) = 12, find the value of b. *Ans:–3/2*
6. Find $f^{-1}(x)$ if f (x) = 4x + 5. **[SEE MODEL-2076]** *Ans (x –5) /4*
7. If f (x) = 2x – 3 is a one to one onto function, find the value of f^{-1} (5). *Ans:4*

POLYNOMIAL

1. If divisor d (x) is x – 1, the quotient is $x^2 - 8x - 1$and the remainder is – 4. What is the original polynomial? *Ans: $x^3 - 9x^2 + 7x - 3$*
2. By using synthetic division method, find the quotient and remainder when $5x^3 + 4x^2 - 8x - 1$ is divided by (x + 1). *Ans: $5x^2 - x - 6$, 5*
3. If $3x^3 + 4x^2 + 5x - 6 = (x + 2)\,Q(x) + R$, find Q (x) and R. *Ans: $3x^2 - 2x + 9$, –24*
4. If $x^3 + 6x^2 + kx + 10$ leaves the remainder 4 when divided by x + 2, find the value of k. Ans: 7
5. Given that the polynomial $f(x) = 2x^4 - 3x^3 + 6x + k$. If f (1) = 0, find the value of k. *Ans: –5*
6. Show that (x + 2) is a factor of the polynomial $x^3 - 3x^2 - 4x + 12$.
7. If (x + 3) is a factor of $x^3 - (k - 1)x^2 + kx + 54$, find the value of k. *Ans: 3*

SEE Q.N. 6 (c)

ARITHMETIC SEQUENCE/SERIES

1. Find the 10th term of an arithmetic sequence 7, 11, 15, … *Ans: 43*
2. If the nth term of the series 84 + 78 + 72 + ….is 0, find the value of n. *Ans: 15*
3. Which term of the series 2 + 5 + 8 + .. is 56? *Ans: 19th*
4. If 6, p, q, 18 are in an AP, find the values of p and q. *Ans: 10, 14*
5. Find the sum of the series: 3 + 7 + 11 + 15 + ….10 terms. *Ans: 210*
6. An arithmetic series has 20 terms and the last term is 50. If the first term is 4, find the sum of the series. *Ans: 540*
7. If the 3rd term of an arithmetic series is 13, find the sum of first 5 terms. *Ans: 65*

GEOMETRIC SEQUENCE/SERIES

1. The first and the second term of a GP are 9 and 18 respectively. What is the fifth term? *Ans:144*
2. How many terms are there in the geometric series $\frac{1}{4} + \frac{1}{2} + 1 + 2 + .. + 64$ *Ans:9*
3. If x – 1, x + 1, 3x – 1 are in a GS, find the value of x. *Ans:3*
4. If the third term of a G.P. is 2, find the product of first five terms. *Ans: 32*
5. Find the values of x, y and z from the given GP: $\frac{1}{8}$, x, y, 2 *Ans:1/4, 1/2, 1*
6. If the arithmetic mean between 2 and x is 5, find the geometric mean. *Ans:4*
7. Find the sum of the series 1 + 3 + 9 + …up to 6 terms *Ans: 364*

GRAPH

1. What will be the points of intersection of the curve $f(x) = x^2 - 1$ and $f(x) = 3$? **[SEE MODEL-2076]** *Ans: (–2, 3), (2, 3)*
2. Find the vertex of the parabola $y = x^2 - 2x - 3$. *Ans: (1, –4)*
3. Find the y–intercept of the parabola $y = x^2 - 3x - 4$. *Ans: –4*
4. Find the co-ordinates of points on *x*-axis at which graph of parabola $y = x^2 - 4x - 5$ cut off.

SEE Q.N. 7 (a) and 7 (b)

DETERMINANT and INVERSE MATRIX

1. If $A = \begin{pmatrix} 2 & 5 \\ 4 & 10 \end{pmatrix}$, find $|A|$. Is it a singular matrix? Given reason. *Ans:0, singular matrix*
2. If the matrix $\begin{pmatrix} 3 & 9 \\ x & 6 \end{pmatrix}$ is singular, find the value of x. *Ans:2*
3. If $M = \begin{pmatrix} 2 & 5 \\ 1 & 3 \end{pmatrix}$ and $N = \begin{pmatrix} -4 & -6 \\ 3 & 2 \end{pmatrix}$, find $|MN|$. *Ans:10*
4. If $A = \begin{pmatrix} 3 & 1 \\ 4 & 2 \end{pmatrix}$ and $B = \begin{pmatrix} 1 & 2 \\ 3 & 5 \end{pmatrix}$, find the determinant of 2A + B *Ans: 19*
5. If $A = \begin{pmatrix} 2 & -1 \\ 3 & 1 \end{pmatrix}$, find $|A|$ and write A^{-1} is defined or not. **[SEE MODEL-2076]**
6. Show that the matrices $A = \begin{pmatrix} 1 & 2 \\ 3 & 5 \end{pmatrix}$ and $B = \begin{pmatrix} -5 & 2 \\ 3 & -1 \end{pmatrix}$ are inverse to each other.
7. If the matrices $\begin{pmatrix} 2x & 7 \\ 5 & 9 \end{pmatrix}$ and $\begin{pmatrix} 9 & y \\ -5 & 4 \end{pmatrix}$ are inverse to each other, find the values of x and y. *Ans: 2 –7*

INVERSE MATRIX and CRAMER'S RULE

1. Find the inverse of the matrix $\begin{pmatrix} 1 & 2 \\ 3 & 4 \end{pmatrix}$ *Ans:* $\frac{-1}{2}\begin{pmatrix} 4 & -2 \\ -3 & 1 \end{pmatrix}$
2. For what value of x, the matrix has no inverse $\begin{pmatrix} 8 & 4 \\ x & 2 \end{pmatrix}$? *Ans: 4*
3. According to Cramer's rule, find the value of D_1 and D_2 for ax + by = c and px + qy = r. **[SEE M 2076]**
4. Using Cramer's rule, find the value of D_1 and D_2 for 3x + 2y = 8 and 4x – y = 7. *Ans: –22, –11*

SEE Q.N. 8 (a) and 8 (b)

ANGLE BETWEEN TWO STRAIGHT LINES

1. Find the slopes of two straight lines 3x + 4y + 5 = 0 and 6x + 8y + 7 = 0 and write the relation between them. **[SEE MODEL-2076]** *Ans: parallel*
2. Show that the line 3x – 2y = 5 and the line joining the points (2, 0) and (8, 4) are parallel to each other.

3. Find the value of k if the pair of straight lines $2x + ky = 3$ and $x + 3y - 2 = 0$ are parallel to each other. *Ans: 6*
4. If a line passing through the points $(4, -p)$ and $(-2, 6)$ is parallel to the line $2y + 3x = 4$, find the value of p. *Ans: 3*
5. If two straight lines $px + qy + r = 0$ and $lx + my + n = 0$ are perpendicular to each other, show that: $pl + qm = 0$.
6. what value of p, the lines $px + 7y = 1$ and $7x - 5y = 6$ are perpendicular to each other? *Ans:5*
7. Find the acute angle between the lines $4x - y + 7 = 0$ and $3x - 5y = 1$. *Ans: 45^0*

PAIR OF LINES

1. Find the single equation for the pair of straight lines represented by $3x + 2y = 0$ and $2x - 3y = 0$. **[SEE MODEL-2076]** *Ans: $6x^2 - 5xy - 6y^2 = 0$*
2. Find the separate equation of lines represented by $x^2 + 7xy + 6y^2 = 0$ *Ans: $x + 6y = 0, x + y = 0$*
3. Show that the pair of straight lines represented by $4x^2 + 12xy + 9y^2 = 0$ are coincident to each other.
4. A pair of lines represented by $px^2 - 12xy + 9y^2 = 0$ are coincident, find the value of p. *Ans:4*
5. If the pair of straight lines represented by $(k + 1)x^2 - 3xy - 5y^2 = 0$ are perpendicular to each other, find the value of k? *Ans: 4*
6. Find the acute angle between the lines represented by the equation $3x^2 + 7xy + 2y^2 = 0$ *Ans: 45^0*
7. Find the obtuse angle between the lines represented by the equation $\sqrt{3}\,x^2 + 4xy + \sqrt{3}\,y^2 = 0$. *Ans:$150^0$*

CIRCLE

1. Find the equation of circle with centre $(0, 3)$ and radius 4 units. *Ans: $x^2 + y^2 - 4y = 7$*
2. Find the equation of a circle with centre $(-6, 5)$ and tangent to x–axis. *Ans: $x^2 + y^2 + 12x - 10y + 36 = 0$*
3. Find the equation of a circle with radius 3 units, touching both the positive axes. *Ans: $x^2 + y^2 - 6x - 6y + 9 = 0$*
4. Find the equation of a circle whose ends of a diameter are $(2, 3)$ and $(-1, 4)$. *Ans: $x^2 + y^2 - x - 7y + 10 = 0$*
5. Find the equation of a circle with centre $(2, 3)$ and passes through the point $(-2, 0)$. *Ans: $x^2 + y^2 - 4x - 6y = 12$*
6. Find the coordinates of centre of a circle having equations of two diameters $x + y = 5$ and $2x - y = 1$ *Ans: (2, 3)*

SEE Q.N. 9 (a)

1. If $\sin A = \frac{3}{5}$, find the value of $\cos 2A$. *Ans: 7/25*
2. If $\tan A = \frac{3}{4}$, find the value of $\sin 2A$. *Ans: 24/25*
3. If $\cos\frac{A}{2} = \frac{4}{5}$, find the value of $\sin A$. *Ans: 24/25*
4. If $\cos\frac{A}{3} = \frac{1}{2}$, find the value of $\cos A$. *Ans: 0*
5. If $\cos A = \frac{1}{2}\left(a + \frac{1}{a}\right)$ then show that $\cos 2A = \frac{1}{2}\left(a^2 + \frac{1}{a^2}\right)$.
6. Given that $\cos 30^\circ = \frac{\sqrt{3}}{2}$ show that $\sin 15^\circ = \frac{1}{2}(\sqrt{2 - \sqrt{3}})$
7. Express in terms of tangent: (i) $\frac{\sin 2A}{1 + \cos 2A}$ (ii) $\frac{\sin\theta + \sin 2\theta}{1 + \cos\theta + \cos 2\theta}$
8. Prove that: (i) $\frac{\cos^3 A + \sin^3 A}{\cos A + \sin A} = 1 - \frac{1}{2}\sin 2A$ (ii) $\frac{\sin A - \sqrt{1 + \sin 2A}}{\cos A - \sqrt{1 + \sin 2A}} = \cot A$
9. Express $\frac{\sin A}{1 + \cos A}$ in terms of sub–multiple angle of tangent. **[SEE MODEL-2076]**
10. Express $\frac{2\sin\beta - \sin 2\beta}{2\sin\beta + \sin 2\beta}$ in terms of sub–multiple angle of tangent.
11. Prove that: (i) $\frac{\sin\alpha + \sin\frac{\alpha}{2}}{1 + \cos\alpha + \cos\frac{\alpha}{2}} = \tan\frac{\alpha}{2}$ (ii) $\tan\frac{\theta}{2} = \frac{1 + \sin\theta - \cos\theta}{1 + \sin\theta + \cos\theta}$

SEE Q.N. 9 (b)

1. Convert sin6A.cos4A into sum of difference of sine or cosine. **[SEE MODEL-2076]**
2. Convert cos9θ.cos5θ into sum of difference of sine or cosine.
3. Express sin8A + sin2A into product of sine or cosine. Ans: 2sin5A.cos3A
4. Express cos40A – cos60A into product of sine. Ans: 2sin50A.sin10A
5. Without using calculator, find the value of $\sin75^0 + \sin15^0$ *Ans:* $\sqrt{\frac{3}{2}}$
6. Without using calculator, find the value of $4\cos105^0.\cos15^0$ *Ans: –1*
7. Prove that: (i) $2\cos70^0.\cos20^0 = \cos50^0$ (ii) $2\cos(45^0 + A).\cos(45^0 - A) = \cos2A$
8. Prove that: (i) $10^0 + \cos110^0 + \cos130^0 = 0$ (ii) $\cos40^0 + \sin40^0 = \sqrt{2}\cos5^0$
9. Prove that: (i) $\frac{\sin A + \sin5A}{\cos A + \cos5A} = \tan3A$ (ii) $\frac{\cos A - \cos5A}{\sin5A - \sin A} = \tan3A$

SEE Q.N. 9 (c)

1. If $2\sin2\theta = \sqrt{3}$, find the value of θ $(0^0 \le \theta \le 180^0)$. **[SEE MODEL-2076]** *Ans: 30^0, 60^0*
2. If $\sqrt{3}\tan3A - 3 = 0$, find the value of θ. $(0^0 \le \theta \le 90^0)$ *Ans: 20^0 , 80^0*
3. If $\sin\theta = \cos\theta$, find the value of θ. $(0^0 \le \theta \le 180^0)$ *Ans: 45^0*
4. If $\cot^2\theta = 3$, find the value of θ. $(0^0 \le \theta \le 180^0)$ *Ans: 30^0,150^0*
5. If $4\sin\theta - 3\operatorname{cosec}\theta = 0$, find the value of θ. $(0^0 \le \theta \le 180^0)$ *Ans: 60^0,120^0*
6. If $4\cos^2A - 4\cos A + 1 = 0$, find A. $(0^0 \le A \le 180^0)$ *Ans: 60^0*
7. Solve: $\sqrt{3}\sec\theta - 2 = 0$ $(0^0 \le \theta \le 90^0)$ *Ans: 30^0*

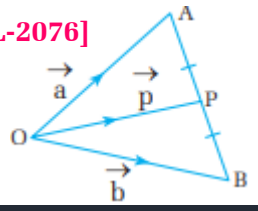
SEE Q.N. 10 (a)

1. If $|\vec{a}| = 4\sqrt{2}$, $|\vec{b}| = 6$ and angle between $\vec{a}$ and $\vec{b}$ is 45°, find the value of $\vec{a}.\vec{b}$ *Ans: 24*
2. If $|\vec{p}| = 6\sqrt{2}$, $\vec{p}.\vec{q} = 12$ and θ = 60°, find the value of $|\vec{q}|$ *Ans:5*
3. Find the angle between two vectors $\vec{a}$ and $\vec{b}$ if $|\vec{a}| = 2$, $|\vec{b}| = 12$ and $\vec{a}.\vec{b} = 12$ **[SEE MODEL-2076]** *Ans:* 60°
4. If $\vec{a} = 2\vec{i} + \vec{j}$ and $\vec{b} = \vec{i} + 3\vec{j}$ then find the angle between $\vec{a}$ and $\vec{b}$. *Ans:: 45^0*
5. If $\vec{a} = -\vec{i} + 2\vec{j}$ and $\vec{b} = 4\vec{i} + 2\vec{j}$, find the angle between $\vec{a}$ and $\vec{b}$. *Ans: 90^0*
6. If $\vec{a} + \vec{b} + \vec{c} = 0$, $|\vec{a}| = 3$, $|\vec{b}| = 5$ and $|\vec{c}| = 7$, find the angle between $\vec{a}$ and $\vec{b}$. *Ans:60^0*
7. Prove that the vectors $\vec{a} = 2\vec{i} - 5\vec{j}$ and $\vec{b} = 10\vec{i} + 4\vec{j}$ are orthogonal to each other.
8. If $\vec{OA} = \begin{pmatrix} -5 \\ 3 \end{pmatrix}$, $\vec{OB} = \begin{pmatrix} k \\ k+2 \end{pmatrix}$ and ∠AOB = 90°, find the value of *k*.
9. For what value of k, are the vectors $\vec{a} = 6\vec{i} - k\vec{j}$ and $\vec{b} = 2\vec{i} + 3\vec{j}$ are perpendicular to each other? *Ans:3*
10. If $\vec{a} + 2\vec{b}$ and $5\vec{a} - 4\vec{b}$ are perpendicular to each other and $\vec{a}$ and $\vec{b}$ are unit vectors, find the angle between $\vec{a}$ and $\vec{b}$. *Ans: 60^0*

SEE Q.N. 10 (b)

1. If the position vectors of A and B are $3\vec{i} + 4\vec{j}$ and $7\vec{i} + 8\vec{j}$ respectively, find the position vector of the mid–point of the line joining A and B. *Ans:5 $\vec{i}$ +6 $\vec{j}$*
2. If the position vectors of M and N are $7\vec{i} + 2\vec{j}$ and $\vec{i} + 4\vec{j}$. Find the position vector of a point P such that $\vec{MP} = \vec{PN}$ *Ans: $4\vec{i} + 3\vec{j}$*
3. The position vectors of A and B are $\vec{i} + 2\vec{j}$ and $6\vec{i} + 7\vec{j}$. Find the position vector of a point P which divides AB internally in the ratio 2:3. *Ans: $3\vec{i} + 4\vec{j}$*

4. The position vectors of A and B are $\vec{i} + \vec{j}$ and $2\vec{i} - \vec{j}$. Find the position vector of a point P which divides AB externally in the ratio 3:2. *Ans:* $4\vec{i} - \vec{j}$
5. If the position vectors of the vertices A, B, and C of ΔABC are respectively $(3\vec{i} + 5\vec{j})$, $(5\vec{i} - \vec{j})$, and $(\vec{i} + 8\vec{j})$, find the position vector of centroid of the triangle. *Ans:* $3\vec{i} + 4\vec{j}$
6. In the given figure; find $\vec{AP}$ and express $\vec{p}$ in terms of $\vec{a}$ and $\vec{b}$. **[SEE MODEL-2076]**



7. If $\vec{OA} = \vec{a}$ and $\vec{OB} = \vec{b}$ and $\vec{AC} = 3\vec{AB}$, find $\vec{OC}$ in terms of $\vec{a}$ and $\vec{b}$.

SEE Q.N. 10 (c)

1. In a continuous series, if the first quartile (Q_1) is 10 and the third quartile (Q_3) is 30, find the quartile deviation and its coefficient. *Ans:10, 0.25*
2. In a continuous series, the third quartile is two times the first quartile. If the first quartile is 24, find the third quartile and quartile deviation. *Ans:12, 0.33*
3. In a grouped data $\sum fm = 200$, $\sum f|m - \bar{x}| = 480$ and $N = 40$ then calculate the mean deviation and its coefficient. *Ans: 12, 3*
4. In a continuous data if $\sum f|m - M_{dn}| = 544$, $N = 40$ and median $(M_{dn}) = 37$ calculate the mean deviation and its coefficient from median. *Ans: 13.6, 0.3*
5. If the standard deviation of set of data is 0.25, find its variance. **[SEE MODEL-2076]** *Ans:0.0625*
6. In a continuous series, if $N = 50$, mean $(\bar{x}) = 20$ and $\sum f(m - \bar{x})^2 = 1250$, find the standard deviation and its coefficient. *Ans: 5, 0.25*
7. In a grouped data, $N = 100$, $\sum fm = 3100$ and $\sum fm^2 = 112800$, find the standard deviation and its coefficient. *Ans: 12.92, 0.416*

Application Level Questions

SEE Q.N. 11

FUNCTION

1. If $f: N \to N$: $f(x) = 2x$ and $g: N \to R$: $g(x) = 3x + 4$ are two functions, find the values of $(fog)(4)$ and $(gof)(3)$. Can $(gof)(-1)$ be defined? Ans: 32, 22, No
2. If $f(x) = 4x + 5$ and $(fog)(x) = 8x + 13$, find the value of x such that $(gof)(x) = 28$. *Ans:* 2
3. If $3.f(x) = 4x + 5$and $g(x) = 5x - 4$, find the value of $(f^{-1} og^{-1})(1)$. *Ans:* $-1/2$
4. If $f(x) = 3x + 4$ and $g(x) = 2(x + 1)$, prove that $(fog) = (gof)$ and find the value of $f^{-1}(2)$. *Ans:*$-2/3$
5. If $f(x) = 3x + a$ and $fof(6) = 10$, find the value of 'a' and $f^{-1}(4)$. *Ans:*$-11, 5$
6. If $f(x) = 2x - 1$, $g(x) = \frac{4x + 3}{5}$ and $fog^{-1}(x) = 5$, find the value of x. *Ans:* 3
7. If $f(x) = 4x - 17$, $g(x) = \frac{2x + 8}{5}$ and $ff(x) = g^{-1}(x)$, find the value of x. *Ans:* 6
8. If $f: R \to R$: $f(x) = \frac{3x + 10}{2}$ and $f: R \to R$: $g(x) = 3x - 5$ and $gg(x) = f^{-1}(x)$, find the value of x. *Ans:* 2
9. If $f(x) = 5x - 9$, $g(x) = 2x + k$ and $f^{-1}(6) = g^{-1}(9)$, find the value of k. *Ans:* 3

POLYNOMIAL

1. Factorize: $x^3 - 4x^2 - 7x + 10$ *Ans: (x– 1)(x + 2) (x –5)*
2. Solve: $x^3 - 3x^2 - 4x + 12 = 0$ **[SEE Model-2076]** *Ans:– 2, 2, 3*
3. Solve: $8x^3 - 2x^2 - 5x - 1 = 0$ *Ans:1, –1/4, –1/2*
4. Solve: $3x^3 - 13x^2 + 16 = 0$ *Ans:–1, 4, 4/3*
5. Solve: $y^3 - 19y - 30 = 0$ *Ans: – 3, – 2, 5*
6. Solve: $(x+1)(x^2 - 5x + 10) - 12 = 0$ *Ans: 1, 1, 2*
7. Solve: $y = x^3 - 4x^2 + x + 8$ and $y = 2$ *Ans: – 1, 2, 3*

SEE Q.N. 12

SEQUENCE AND SERIES

1. If fifth and tenth terms of arithmetic sequence are 14 and 29 respectively. Find the first term and the common difference. Also, find the 17th term. *Ans: 2, 3, 50*

2. If the third and eleventh terms of an arithmetic series are 8 and –8 respectively, find the sum of the first seven terms of the series. *Ans:*42
3. The sum of first eight terms of an arithmetic series is 180 and its fifth term is five times of the first term, find the sum of the first 10 terms. *Ans:*275
4. Three terms in an arithmetic progression have sum 21 and product 315. Find the terms. *Ans:*9, 7, 5 or, 5, 7, 9
5. There are n arithmetic means between 7 and 77. If the ratio of first mean to the last mean is 1:6, then find the number of arithmetic means. *Ans:13*
6. The sum of three consecutive terms in GP is 62 and their product is 1000, find the terms. *Ans:2, 10, 50 or 50, 10, 2*
7. Insert 4 geometric means between 2/3and 162. *Ans:2, 6, 18, 54*
8. There are some geometric means between 1/2and 16. If the third mean be 4, find the numbers of means. *Ans:4*
9. In a geometric series, if the sixth term is 16 times the second term and the sum of the first seven terms is 127/4, find positive common ratio and the first term. *Ans:2, ¼*
10. The sum of first four terms is 40 and the sum of the first two terms is 4 of a geometric series whose common ratio is positive, find the sum of first 8 terms the series. *Ans:3280*
11. If the arithmetic mean and geometric mean of two numbers are 5 and 4 respectively, find the numbers. *Ans:2 and 8 or 8 and 2*

LINEAR PROGRAMMING

1. Maximize the objective function $P = 3x + 5y$ subject to the constraints $x + y \le 6, x - y \le 4, x \ge 0, y \ge 0$ Ans: $P_{Max} = 30$ at (0, 6)
2. Maximize the objective function $P = 5x + 3y$ subject to the constraints $2y \ge x - 1, x + y \le 4, x \ge 0, y \ge 0$ Ans: $P_{Max} = 10$ at (3, 1)
3. Minimize the objective function $Z = 5x + 3y$ subject to the constraints $2x + y \le 20, 2x + 3y \ge 24, x \ge 0, y \ge 0$ Ans: $Z_{Min} = 0$ at (0, 0)
4. Minimize the objective function $Z = 3x + 2y$ subject to the constraints $x + y \ge 0, x - y \le 0, x \ge -1, y \le 2$ Ans: $Z_{Min} = -8$ at (–1, 2)
5. Optimize the given objective function $P = 5x + 4y$ subject to the constraints $x - 2y \le 1, x + y \le 4, x \ge 0, y \ge 0$ Ans: $P_{Max} = 19$at (3, 1), $P_{Min} = 0$ at (0, 0)
6. Optimize the given objective function $F = 2x + 3y$ subject to the constraints $x - 2y \le 2, x + y \le 5, x \ge 0, y \ge 0$ **[SEE MODEL-2076]** Ans: $F_{Max} = 15$ at (0, 5), $F_{Min} = 0$ at (0, 0)

GRAPH OF QUADRATIC FUNCTION

1. Solve graphically: $x^2 + 2x - 3 = 0$ *Ans: x = –3, 1*
2. Solve graphically: $x^2 - 3x - 4 = 0$ *Ans: x = –1, 4*
3. Solve graphically: $x^2 - 3x = 10$ *Ans: x = –2, 5*
4. Solve graphically: $y = x^2$ and $y = 2 - x$ *Ans: x = (1, 1), (–2, 4)*
5. Solve graphically: $y = x^2$ and $y = 2x + 8$ *Ans: x = (4, 16), (–2, 4)*

SEE Q.N. 13

1. For a real valued function f (x) = x +3.
   (i) Find the values of f (x) at x = 1.9, 1.99, 1.999, 1.9999, 2, 2.1, 2.01, 2.001, 2.0001
   (ii) Find $\lim_{x \to 2^-} f(x)$ and $\lim_{x \to 2^+} f(x)$ and f (2).
   (iii) Is this function continuous at x = 2?
2. For a real valued function f (x) = 2x +1.
   (b) Find the values of f (x) at x = 3.9, 3.99, 3.999, 3.9999, 4, 4.1, 4.01, 4.001, 4.0001
   (ii) Find $\lim_{x \to 4^-} f(x)$ and $\lim_{x \to 4^+} f(x)$ and f (4).
   (iii) Is this function continuous at x = 4?
3. For a real valued function f(x) = 2x + 3
   (i) Find the values of f(2.95), f(2.99), f(3.01), f(3.05) and f(3).
   (ii) Is this function continuous at x = 3? **[SEE MODEL-2076]**
4. For a real valued function f(x) = 6x + 1
   (i) Find the values of f(1.9), f(1.99), f(2.01), f(2.05) and f(2).
   (ii) Is this function continuous at x = 2?

5. Examine whether a function $f(x) = \begin{cases} x + 2 & \text{for } x \le 2 \\ 3x - 2 & \text{for } x > 2 \end{cases}$ is continuous or not at $x = 2$.

SEE Q.N. 14

Solve the given system of equations by matrix method:

1. $3x + 5y = 11, 2x - 3y = 1$ **[SEE MODEL-2076]** *Ans: $x = 2, y = 1$*
2. $x = \frac{2}{3}y, 4x - 3y = 1$ *Ans: $x = -2, y = -3$*
3. $\frac{3x + 5y}{8} = \frac{5x - 2y}{3} = 3$ *Ans : $x = y = 3$*
4. $3x + \frac{4}{y} = 10, x + \frac{1}{y} = 3$ *Ans: $x = 2, y = 1$*
5. $\frac{2}{x} + \frac{6}{y} = 3, \frac{10}{x} - \frac{9}{y} = 2$ *Ans:$x = 2, y = 3$*

Solve the following system of equations by Cramer's rule.

6. $9x - 8y = 12, 2x + 3y = 17$ *Ans:$x = 4, y = 3$*
7. $\frac{3}{2}x + 2y = 1, \frac{x}{3} - \frac{y}{3} = 1$ *Ans:$x = 2, y = -1$*

SEE Q.N. 15

ANGLE BETWEEN TWO STRAIGHT LINES

1. Find the equation of a straight line passing through the point (4, 1) and parallel to the line $2x + 5y = 3$. *Ans: $2x + 5y - 13 = 0$*
2. Find the equation of a straight line which is parallel to the line $2x + y - 4 = 0$ and making an intercept of length 2 units along y –axis. *Ans: $2x + y = 2$*
3. A (0, 3), B (1, –1) and C (5, –5) are the vertices of Δ ABC; find the equation of line passing through the centroid of Δ ABC and parallel to the side BC. *Ans: $x + y = 3$*
4. Find the equation of a straight line passing through (3, 2) and perpendicular to the line $4x - 3y - 10 = 0$. *Ans: $3x + 4y = 17$*
5. Find the equation of line passing through the centroid of triangle ABCwith vertices A (0, 3), B (5, 1) and C (1, 2) and perpendicular to the side BC. *Ans: $4x + y = 6$*
6. Find the equation of the perpendicular bisector of line segment joining the points (3, 5) and (9, 3) Ans: $3x - y = 14$
7. A (3, 5) and C (7, 9) are the opposite vertices of a rhombus ABCD, find the equation of the diagonal BD. *Ans: $x + y = 12$*

PAIR OF STRAUGHT LINES

1. Find the separate equations of lines represented by $2x^2 + 7xy + 3y^2 = 0$. Also, find the angle between them. *Ans:$2x + y = 0, x + 3y = 0, 45^0, 135^0$*
2. If α be the acute angle between the pair of lines represented by the equation $x^2 + 2xy\sec\theta + y^2 = 0$, prove that: $\alpha = \theta$
3. If the acute angle between the pair of lines represented by $x^2 - 2xy\operatorname{cosec}\theta + y^2 = 0$ is α, prove that: $\alpha = 90^0 - \theta$.
4. Find the single equation of the pair of straight lines passing through the origin and perpendicular to the lines represented by $2x^2 - 5xy + 2y^2 = 0$. **[SEE MODEL-2076]** *Ans: $2x^2 + 5xy + 2y^2 = 0$*
5. Find the single equation of the pair of straight lines passing through the point (1, 2) and parallel to the lines represented by $x^2 + 3xy + 2y^2 = 0$. *Ans: $x^2 + 3xy + 2y^2 - 8x - 11y + 15 = 0$*
6. If two straight lines represented by an equation $3x^2 + 8xy + my^2 = 0$ are perpendicular to each other, find the separate equation of two lines. *Ans: $x + 3y = 0, 3x - y = 0$*
7. If an angle between the lines represented by $2x^2 + kxy + 3y^2 = 0$ is 45^0, find the positive value of k and then separate equation of lines. *Ans:7, $2x + y = 0, x + 3y = 0$*

CIRCLE

1. Find the centre and the radius of the circle $9x^2 + 9y^2 - 36x + 6y = 107$. *Ans: (2, –1/3), 4units*
2. If (3, 4) is one end of a diameter of a circle $x^2 + y^2 - 4x - 6y + 11 = 0$, find the other end. *Ans: (1, 2)*
3. Find the equation of the circle which passes through the point (1, 4) and equations of two diameters are $2x + y = 5$ and $x - y = 1$. *Ans: $x^2 + y^2 - 4x - 2y = 5$*
4. Find the equation of the circle with centre (3, 2) and passing through the centre of circle $x^2 + y^2 - 2x + 4y + 5 = 0$. *Ans:$x^2 + y^2 - 6x - 4y + 5 = 0$*
5. Find the equation of circle concentric with the circle $x^2 + y^2 - 6x + y = 1$ and passing through the point (4, –2). *Ans:$x^2 + y^2 - 6x + y + 6 = 0$*

6. Find the equation of circle having centre (– 4, 1) and has the same radius as the circle $x^2 + y^2 - 2x + 2y = 7$. *Ans: $x^2 + y2 + 8x - 2y = 8$*
7. Find the equation of the circle which passes through the points (2, 3) and (–1, 2) and its centre lies on the straight line $2x - 3y + 1 = 0$. *Ans: $x^2 + y^2 - 2x - 2y - 3 = 0$*

SEE Q.N. 16

MULTIPLE AND SUBMULTIPLE ANGLES

1. Prove that: (a) $\sqrt{3}\,\text{cosec}20^0 - \sec20^0 = 4$ (b) $\text{cosec}10^0 - \sqrt{3}\,\sec10^0 = 4$
2. Prove that: $\cos^2A + \sin^2A.\cos2B = \cos^2B + \sin^2B.\cos2A$
3. If $2\tan A = 3\tan B$, prove that: $\tan(A + B) = \dfrac{5\sin2B}{5\cos2B - 1}$
4. Prove that: $\cos^6\theta - \sin^6\theta = \cos2\theta\left(1 - \dfrac{1}{4}\sin^2 2\theta\right)$
5. Prove that: (a) $\sin^4x = \dfrac{1}{8}(3 - 4\cos2x + \cos4x)$ (b) $\cos^4\theta = \dfrac{1}{8}(3 + 4\cos2\theta + \cos4\theta)$
6. Prove that: $\text{coec}2A + \cot4A = \cot A - \text{cosec}4A$ (b) $\text{coec}4A + \cot8A = \cot2A - \text{cosec}8A$
7. Prove that: $\dfrac{\sec4A - 1}{\sec2A - 1} = \tan4A.\cot A$
8. Prove that: $\tan\theta + 2\tan2\theta + 4\cot4\theta = \cot\theta$
9. Prove that: $(2\cos A + 1)(2\cos A - 1)(2\cos2A - 1) = 2\cos4A + 1$
10. Prove that: $\sqrt{2 + \sqrt{2 + \sqrt{2 + 2\cos8A}}} = 2\cos A$
11. Prove that: $\left(1 + \sin\dfrac{\pi^c}{8}\right)\left(1 - \sin\dfrac{3\pi^c}{8}\right)\left(1 + \sin\dfrac{5\pi^c}{8}\right)\left(1 - \sin\dfrac{7\pi^c}{8}\right) = \dfrac{1}{8}$
12. Prove that: $4(\cos^320^o + \sin^310^o) = 3(\cos20^o + \sin10^o)$
13. Prove that: (a) $\cos^3A.\cos3A + \sin^3A.\sin3A = \cos^32A$ (b) $\cos^3A.\sin3A + \sin^3A.\cos3A = \dfrac{3}{4}\sin4A$
14. Prove that: (a) $\cos\dfrac{\pi}{7}.\cos\dfrac{2\pi}{7}.\cos\dfrac{3\pi}{7} = \dfrac{1}{8}$ (b) $\cos\dfrac{\pi}{7}.\cos\dfrac{2\pi}{7}.\cos\dfrac{4\pi}{7} = -\dfrac{1}{8}$
15. Prove that: $\dfrac{2\sin x}{\cos3x} + \dfrac{2\sin3x}{\cos9x} + \dfrac{2\sin9x}{\cos27x} = \tan27x - \tan x$

TRNASFORMATION OF TRIGONOMETRIC FORMULAE

1. Prove that: (a) $\dfrac{\sin^2A - \sin^2B}{\sin A.\cos A - \sin B.\cos B} = \tan(A + B)$

   (b) $\dfrac{\cos^2A - \sin^2B}{\sin A.\cos A + \sin B.\cos B} = \cot(A + B)$
2. Prove that: (a) $\sin A.\sin(60^o - A).\sin(60^o + A) = \dfrac{1}{4}\sin3A$

   (b) $\cos A.\cos(60^o - A).\cos(60^o + A) = \dfrac{1}{4}\cos3A$
3. Prove that: $(\cos A + \cos B)^2 + (\sin A + \sin B)^2 = 4\cos^2\left(\dfrac{A - B}{2}\right)$
4. Prove that: (a) $\sin10^0.\sin30^0.\sin50^0.\sin70^0 = \dfrac{1}{16}$ (b) $\sin10^0.\sin50^0.\sin70^0 = \dfrac{1}{8}$
5. Prove that: (a) $\cos10^0.\cos30^0.\cos50^0.\cos70^0 = \dfrac{3}{16}$ (b) $8\cos10^0.\cos50^0.\cos70^0 = \sqrt{3}$
6. Find the value of $\sin20^0.\sin30^0.\sin40^0.\sin80^0$ **[SEE MODEL-2076]** *Ans:* $\dfrac{\sqrt{3}}{16}$
7. Prove that: $\dfrac{\sin2A + \sin5A - \sin A}{\cos2A + \cos5A + \cos A} = \tan2A$
8. Prove that: $\sec\left(\dfrac{\pi}{4} + \dfrac{\theta}{2}\right).\sec\left(\dfrac{\pi}{4} - \dfrac{\theta}{2}\right) = 2\sec\theta$
9. Prove that: $\cos^3A.\sin^2A = \dfrac{1}{16}(2\cos A - \cos3A - \cos5A)$
10. Prove that: $\cos(36^o - A).\cos(36^o + A) + \cos(54^o + A)\cos(54^o - A) = \cos2A$
11. Prove that: $\sin^2A + \sin^2(A - 120^o) + \sin^2(A + 120^o) = \dfrac{3}{2}$

SEE Q.N. 17

CONDITIONAL TRRIGONOMETRIC IDENTITIES

1. If A, B and C are the interior angles of a triangle ABC, prove that:
   a) $\cot\frac{A}{2}.\cot\frac{B}{2}.\cot\frac{C}{2}=\cot\frac{A}{2}+\cot\frac{B}{2}+\cot\frac{C}{2}$
   b) $\tan\frac{A}{2}.\tan\frac{B}{2}+\tan\frac{B}{2}.\tan\frac{C}{2}+\tan\frac{C}{2}.\tan\frac{A}{2}=1$
2. If $A+B+C=\pi^c$, then prove that:
   a) $\sin2A+\sin2B+\sin2C=4\sin A.\sin B.\sin C$
   b) $\sin(B+C-A)+\sin(C+A-B)+\sin(A+B-C)=4\sin A.\sin B.\sin C$
   c) $\frac{\cos A}{\sin B.\sin C}+\frac{\cos B}{\sin C.\sin A}+\frac{\cos C}{\sin A.\sin B}=2$
   d) $\cos2A-\cos2B-\cos2C=4\cos A.\sin B.\sin C-1$
   e) $\cos(B+C-A)+\cos(C+A-B)+\cos(A+B-C)=4\cos A.\cos B.\cos C+1$
3. If $A+B+C=180^o$, prove that:
   a) $\sin A.\cos B.\cos C+\sin B.\cos C.\cos A+\sin C.\cos A.\cos B=\sin A.\sin B.\sin C$
   b) $\cos A.\sin B.\sin C+\cos B.\sin C.\sin A+\cos C.\sin A.\sin B=1+\cos A.\cos B.\cos C$
4. If $A+B+C=\pi^c$, then prove that:
   a) $\sin^2A+\sin^2B+\sin^2C=2+2\cos A.\cos B.\cos C$
   b) $\sin^2A-\sin^2B+\sin^2C=2\sin A.\cos B.\sin C$ **[SEE MODEL-2076]**
   c) $\cos^2A+\cos^2B+\cos^2C=1-2\cos A.\cos B.\cos C$
5. If $A+B+C=180^0$, then prove that:
   a) $\sin A+\sin B+\sin C=4\cos\frac{A}{2}.\cos\frac{B}{2}.\cos\frac{C}{2}$
   b) $\cos A+\cos B+\cos C=1+4\sin\frac{A}{2}.\sin\frac{B}{2}.\sin\frac{C}{2}$
6. If $A+B+C=180^0$, then prove that:
   a) $\sin^2\frac{A}{2}+\sin^2\frac{B}{2}+\sin^2\frac{C}{2}=1-2\sin\frac{A}{2}.\sin\frac{B}{2}.\sin\frac{C}{2}$
   b) $\cos^2\frac{A}{2}+\cos^2\frac{B}{2}+\cos^2\frac{C}{2}=2\left(1+\sin\frac{A}{2}.\sin\frac{B}{2}.\sin\frac{C}{2}\right)$

TRRIGONOMETRIC EQUATIONS

1. $2\cos^2\theta=3\sin\theta$ $(0^o\le\theta\le360^o)$ *Answer: 30^0, 150^0*
2. $3\sin^2\theta+4\cos\theta=4$ $(0^o\le\theta\le360^o)$ *Answer: 0°, 360^0, $\cos^{-1}\left(\frac{1}{3}\right)$*
3. $2\sin^2A+3\cos A=3$ $(0^o\le A\le360^o)$ *Answer: 0^0, 60^0, 300^0, 360^0*
4. $3\tan^2\theta-4\sec\theta-1=0$ $(0^o\le\theta\le360^o)$ *Answer: 60°, 300°*
5. $2\sqrt{3}\sin^2\theta=\cos\theta$ $(0^o\le\theta\le360^o)$ *Answer: 30°, 330°*
6. $\sec\theta.\tan\theta=\sqrt{2}$ $(0^o\le\theta\le360^o)$ *Answer: 45°, 135°*
7. $\cot^2\theta+\left(\sqrt{3}+\frac{1}{\sqrt{3}}\right)\cot\theta+1=0$ $(0^o\le\theta\le360^o)$ *Answer: 120°, 150°, 300°, 330°*
8. $\sqrt{3}\sin A+\cos A=\sqrt{2}$ $(0^o\le A\le360^o)$ *Answer: 15°, 105°*
9. $\sin A=\sqrt{3}(1-\cos A)$ $(0^o\le A\le360^o)$ *Answer: 0^0, 60^0, 360^0*
10. $\cos A+\cos2A+\cos3A=0$ $(0^o\le A\le360^o)$ *Answer: 45^0, 120^0, 135^0*
11. $\sin3\theta+\sin\theta=\sin2\theta$ $(0^o\le\theta\le360^o)$ *Answer: 0°, 60°, 180°, 270°, 300°, 360°*

SEE Q.N. 18

1. The angle of elevation of the top of a tower was observed to be 60^0 from a point. On walking 200m away from the point it was found to be 30^0. Find the height of the tower. *Ans:173.2m*
2. The angle of depression and elevation of the top of a building 40m high from the top and bottom of a tower are found to be 60^0 and 30^0 respectively, find the height of the tower. *Ans:160m*
3. From the top of a cliff 100m high, the angles of depression of the top and bottom of a building are observed to be 30^0 and 45^0 respectively. Find the height of the building. Also, find the distance between the tower and the building. *Ans:42.27m*

4. From a place at the ground level in front of a tower the angle of elevations of the top and bottom of flagstaff 6m high situated at the top of a tower are observed 60° and 45° respectively. Find the height of the tower and the distance between the base of the tower and point of observation. **[SEE MODEL-2076]** *Ans: 8.19 m, 8.19 m*
5. A flagstaff of height 7m stands on the top of a tower. The angles subtended by the tower and the flagstaff at a point on the ground are 45^0 and 15^0 respectively, find the height of the tower. *Ans:9.56m*
6. The angles of elevation of the top of the tower as observed from the distances of 20m and 45m from its foot are found to be complementary. Find the height of the tower. *Ans:30m*
7. Two posts are 180m apart and the height of one is double that of the other. From the mid point of the line joining their feet, an observer finds the angles of the elevation of their tops to be complementary, find the height of the longer post. *Ans: 127.28m*

SEE Q.N. 19

1. A (–1, 1), B (4, 2) and C (5, 6) are the vertices of a ΔABC. Find the coordinates of the vertices of image of ΔABC under the reflection on x–axis followed by the reflection on y–axis and draw the triangles on the same graph paper. *Ans: A' (–2, –3), B' (–4, –5), C' (–1, –4*
2. The vertices of ΔABC are A (2, 0), B (3, 1) and C (1, 1). ΔABC is translated by $\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ the vector. The image so obtained is reflected on the line x + y = 0, find the coordinates of the images under combined transformation and draw all the triangles on the same graph paper.
Ans: A' (4, –3), B' (5, –2), C'(3, –2);A''(3, –4), B''(2, –5), C''(2, –3)
3. A (2, 5), B (–1, 3) and C (4, 1) are the vertices of a ΔABC. Find the coordinates of the vertices of image of ΔABC under the rotation of positive 90^0 about origin followed by enlargement E [(0, 0); 2]. Represent the object and the images on the same graph paper.
Ans: A' (–5, 2), B'(–3, –1), C'(–1, 4);A''(–10, 4), B''(–6, –2), C''(–2, 8)
4. Δ ABC with vertices A (3, 6), B (4, 2) and C (2, 2) is mapped on to aΔA′B′C' by a 2×2 transformation A square WXYZ has the vertices W (0, 3), X (1, 1), Y (3, 2) and Z (2, 4). Transform the given square WXYZ under the matrix $\begin{pmatrix} 0 & -1 \\ 1 & 0 \end{pmatrix}$ and find the coordinates of vertices of its image.
Ans: W' (–3, 0), X' (–1, 1) ,Y' (–2, 3) and Z' (–4, 2)
5. Find the 2×2 matrix which transforms the unit square into the parallelogram $\begin{pmatrix} 0 & 3 & 4 & 1 \\ 0 & 0 & 1 & 1 \end{pmatrix}$. .
[SEE Model–2076] Ans: $\begin{pmatrix} 3 & 1 \\ 0 & 1 \end{pmatrix}$
6. If the matrix $\begin{pmatrix} a & 0 \\ c & -1 \end{pmatrix}$ transforms a rectangle $\begin{pmatrix} 0 & 2 & 2 & 0 \\ 0 & b & 1 & 1 \end{pmatrix}$. into a rectangle $\begin{pmatrix} 0 & 2 & 2 & 0 \\ 0 & 0 & -1 & d \end{pmatrix}$. , find the values of a, b, c and d. *Ans: a = 1, b = 2, c = 1 , d = –1*
7. A square ABCD with vertices A (0, 3), B (1, 1), C (3, 2) and D (2, 4) is mapped on to □A′B′C′D′ by a 2× 2 transformation matrix so that the vertices of □A′B′C′D′ are A′ (6, –6), B′ (3, –1), C′ (7, –1) and D′ (10, –6). Find the 2× 2 matrix. *Ans:* $\begin{pmatrix} 1 & 2 \\ 1 & -2 \end{pmatrix}$

SEE Q.N. 20

1. Calculate e the quartile deviation and its coefficient of the data given below.
OR, find the semi- inter quartile range and its coefficient of the data given below.

Marks obtained	20-30	30-40	40-50	50-60	60-70	70-80
No. of students	3	6	9	5	4	2

Ans: 10.21, 0.215

2. Find the mean deviation from mean and its coefficient of the given data. **[SEE MODEL-2076]**

Marks obtained	0–10	10–20	20–30	30–40	40–50
No. of students	2	3	6	5	4

Ans: 10.3, 0.3678

3. Find the mean deviation and its coefficient from median of the data given alongside.

Marks obtained	0–10	10–20	20–30	30–40	40–50	50–60
No. of students	10	12	25	35	40	50

Ans: 12.45, 0.3036

SEE Q.N. 21

1. Find the standard deviation, coefficient of standard deviation and coefficient of variation of the given data.

Marks obtained	0–10	10–20	20–30	30–40	40–50
No of students	7	10	14	12	6

Ans: 12.33, 0.4932, 49.32%

2. Find the standard deviation, coefficient of standard deviation and coefficient of variation of the given data.

Age in years	0–4	4–8	8–12	12–16	16–20	20–24
No of students	7	7	10	15	7	6

[SEE MODEL-2076] *Ans: 6.05, 0.5042, 50.42%*

Higher Ability (HA) Questions

SEE Q.N. 22

FUNCTION

1. If f (x) = 2x + 5 and fog (x) = 8x + 7 are given functions.
   (i) Find g (x). *Ans:* g (x) = 4x + 1
   (ii) Find the value of x if f (x) = g^{-1} (x) *Ans:* x = -3
   (iii) Find the point of intersection of the functions f and g. *Ans:* (2, 9)
2. The number of food kept in a refregirator is N (T) = $20T^2 - 80T + 500$ ($2 \le T \le 14$), where T denotes the temperature and T (t) = 4t + 2 ($0 \le t \le 3$), where t represents the time in hour.
   (i) Find (NoT)(t) *Ans:* $320T^2 + 420$
   (ii) How many bacteria may be in the food after 2 hours? *Ans: 1700*
   (iii) After how long time, the number of bacteria's may be 3300? *Ans: 3 hrs*

SEQUENCE AND SERIES

1. Three numbers whose sum is 21 are in AP. If 1, 3 and 10 are added to them respectively; then the numbers are in G.P. Find the numbers. *Ans:4, 7, 10 or 19, 7, –5*
2. Three numbers whose sum is 7 are in GP. If 1, 3 and 4 are added to them respectively; then the numbers are in A.P. Fid the numbers. *Ans:1, 2, 4 or 4, 2, 1*
3. A firm produced 2500 pair of shoes in its first year. If it increased its production by a constant number every year and produced 17500 pair of shoes at the end of the fifth yerar, find the increased number of pair of shoes in each year. *Ans: 500*
4. A contrsctor on construction job specifies a penalty for delay of completion beyond a certain date as Rs 200 for the first day, Rs 250 for the second day, Rs 300 for the third day and so on. The penalty for each successing day being Rs 50 more than that of the preceeding day. How much money the contractor has to pay as penalty, if he has delayed the work by 30 days? **[SEE MODEL–2076]** *Ans:Rs 27750*
5. A person pays a loan of Rs 975 in monthly installments, each installment being less than a former by Rs 5. The amount of first installment is Rs 100. In how many installments will the entire amount be paid? Given reason. *Ans:25*
6. A man borrows Rs 3465 without interest and repays the loan in 6 monthly installments, each installment being double the preceding one. Find the first and last installments. *Ans: Rs 55, Rs 1760*

SEE Q.N. 23

1. Find the equation of the line passing through the point of intersection of the lines 3x + 4y = 7 and 5x – 2y = 3 and perpendicular to the line 2x + 3y = 5. *Ans: 3x – 2y = –1*
2. Find the equation the lines passing through the point (2, 3) and making an angle of 45^0 with the line x – 3y = 5. *Ans: 2x – y = 1, x + 2y = 8*
3. Find the equation of line which is parallel to the line 4x + 5y = 6 and makes the intercepts on the axes whose sum is 9. *Ans: 4x+5y = 20*
4. Show that the equation of line passing through the point ($a\cos^3\theta$, $a\sin^3\theta$) and perpendicular to the line $x\sec\theta + y\operatorname{cosec}\theta = a$ is $x\cos\theta - y\sin\theta = a\cos 2\theta$.
5. Find the equation of circle which passes through the points (2, 0), (0, 2) and (–2, 0). *Ans:* $x^2 + y^2 = 4$

6. On a wheel there are three points (5, 7), (–1, 7) and (5, –1) located such that the distance from a fixed point to these points is always equal. Find the coordinates of the fixed point and then derive the equation of representing the locus that contains all three points. **[SEE MODEL-2076]**
   Ans: (2, 3), $x^2 + y^2 - 4x - 6y - 12 = 0$
7. Find the equation of the circle which passes through the origin and making intercepts of lengths 6 and 8 units on the positive x– axis and y– axis. *Ans:$x^2 + y^2 - 6x - 8y = 0$*

SEE Q.N. 24

1. Prove by vector method that the median of an isosceles triangle is perpendicular to the base.
2. Prove by vector method that the mid-point of hypotenuse of a right angled triangle is equidistance from its every vertex.
3. Prove by vector method that the angle in a semi–circle is right angle.
4. Prove by vector method that the diagonals of a rectangle are equal to each other.
5. By using vector method, prove that the quadrilateral formed by joining the midpoints of adjacent sides of a quadrilateral is a parallelogram. **[SEE MODEL–2076]**
6. Prove by vector method that the diagonals of a parallelogram bisect to each other.
7. Prove by vector method that the diagonals of a rhombus bisect to each other perpendicularly.

SEE Q.N. 25

1. The coordinates of vertices of a quadrilateral ABCD are A (1, 1), B (2,3), C (4, 2) and D(3,−2). Rotate this quadrilateral about origin through180°. Reflect this image of quadrilateral about y = −x. Write the name of transformation which denotes the combined transformation of above two transformations. **[SEE Model-2076]** *Ans: y = x, A' (1, 1), B' (3, 2), C' (2, 4) and D' (–2, 3)*
2. State the single transformation equivalent to combination of reflections on the y–axis and y = x respectively. Using this single transformation, find the coordinates of the vertices of the image of ΔABC with vertices A (2, 3), B (3, –4) and C (1, –2). Also draw the object and the image on the same graph paper. *Ans: R [–90^0, (0, 0)]; A' (3, –2), B' (–4, –3), C' (–2,–1)*
3. A triangle with vertices A (1, 2), B (4, –1) and C (2, 5) is reflected successively in the lines x = 5 and y = –2. Find by stating coordinates and graphically represent images under these transformations. State also the single transformation given by the combination of these transformations. *Ans: A' (9, 2), B' (6, –1), C' (8, 5); A'' (9, –6), B'' (6, –3), C'' (8, –9); R [–180^0, (5,–2)]*
4. A triangle with vertices A (1, 2), B (4, –1) and C (2, 5) is reflected successively in the lines x = –1 and y = 2. Find by stating coordinates and graphically represent images under these transformations. State also the single transformation given by the combination of these transformations. *Ans: A' (–3, 2), B' (–6, –1), C' (–4, 5); A'' (–3, 2), B'' (–6, 5), C'' (–4, –1); R [180^0, (–1, 2)]*
5. Find the inverse of the point (6, 7) with respect to the circle $x^2 + y^2 - 4x - 6y = 51$. *Ans: (10, 11)*
6. Find the inverse of the point (4, 5) with respect to the circle $x^2 + y^2 - 4x - 6y = 3$. *Ans: (6, 7)*

HAPPY LEARNING!