

Mathematics XI

SET - I

Group A

[5×3×2=30]

1. a. Construct the truth table for $\sim(p \vee q) \wedge q$ and hence draw a conclusion from the truth table.
b. If $A = \{1, 2, 3\}$, find a relation on A determined by the condition $x + y > 4$.
c. Test periodicity and symmetricity of the function $y = \tan 2x$.
2. a. Solve: $\sqrt{3} \sin x - \cos x = 1$ for $0 \leq x \leq 2\pi$
b. Using principle of mathematical induction, prove that : $1 + 3 + 5 + \dots + (2n-1) = n^2$.
c. If $\begin{pmatrix} -3 & -2 \\ 5 & 3 \end{pmatrix}$ and $\begin{pmatrix} x & y \\ -5 & -3 \end{pmatrix}$ are inverse matrices of each other, find x and y.
3. a. Using Cramer's rule, solve
 $2x + y = 8, \quad x - 2y = -1$
b. If $\alpha = \frac{-1 + \sqrt{-3}}{2}$ and $\beta = \frac{-1 - \sqrt{-3}}{2}$, prove that $\alpha^4 + \alpha^2\beta^2 + \beta^4 = 0$.
c. For what value of a will the equation $x^2 + (3a - 1)x - 2(a^2 - 1) = 0$ has equal roots.
4. a. Find the distance between two parallel lines $3x + 4y = 17$ and $6x + 8y + 1 = 0$
b. Find the equation of a circle concentric with $x^2 + y^2 - 4x + 6y + 7 = 0$ and passing through a point $(-2, 0)$.
c. Evaluate: $\lim_{\theta \rightarrow \pi/4} \frac{\cos \theta - \sin \theta}{\theta - \pi/4}$
5. a. Find $\frac{dy}{dx}$ if $x = t + \frac{1}{t}$ and $y = t - \frac{1}{t}$
b. Evaluate: $\int \ln x^2 dx$
c. The side of a square is increasing at the rate of 2 cm/min. At what rate is the area increasing when the side is 5 cm long?

Group B

[5×2×4 = 40]

6. a. Define the complement of a set. State and prove De-Morgan's Laws.

OR

Define absolute value of a real number. For any two real numbers x and y prove that:

$$|x + y| \leq |x| + |y|$$

- b. Draw the graph of the function $y = x^2 - 4x + 3$ giving its different characteristics.
7. a. In any triangle ABC
 If $\frac{1}{a+c} + \frac{1}{b+c} = \frac{3}{(a+b+c)}$ show that $\angle C = 60^\circ$.
- OR**
- If $\cos^{-1}x + \cos^{-1}y + \cos^{-1}z = \pi$, show that $xy + yz + zx = 1$
- b. If a, b, c are non-zero and $\begin{vmatrix} a & a^2 & a^3-1 \\ b & b^2 & b^3-1 \\ c & c^2 & c^3-1 \end{vmatrix} = 0$
 then show that, $abc = 1$.
8. a. Using row equivalent method **or** inverse matrix method, solve the system of linear equations:

$$\begin{aligned} x + 2y - z &= 8 \\ 2x + 3y + z &= 5 \\ 3x + y + 2z &= -1 \end{aligned}$$
- b. Under what condition will quadratic equation $ax^2 + bx + c = 0$ has,
 i. reciprocal roots
 ii. roots equal in magnitude but opposite in sign
9. a. Obtain the condition that $lx + my + n = 0$ may be a tangent to the circle $x^2 + y^2 + 2gx + 2fy + c = 0$.
- b. Evaluate: $\lim_{x \rightarrow \theta} \frac{x \sin \theta - \theta \sin x}{x - \theta}$

OR

- Show that the function $f(x) = \begin{cases} x & 0 \leq x < 1/2 \\ 1 & x = 1/2 \\ 1-x & 1/2 < x < 1 \end{cases}$
 is discontinuous at $x = \frac{1}{2}$. Also, write how it could be made continuous?
10. a. Find from the definition, the derivative of $\sin^2 3x$.
 b. Using the method of integration, find the area bounded by the curve $\frac{x^2}{16} + \frac{y^2}{25} = 1$

Group C

[5×6 = 30]

11. Define one to one function and onto function with suitable example. Determine whether the function $f: \mathbb{R} \rightarrow \mathbb{R}$ given by $f(x) = x^2 - 1$ is one to one or onto or both or neither.
12. If G_1 and G_2 are two geometric means between b and c and a is their arithmetic mean, then show that $G_1^3 + G_2^3 = 2abc$. Also prove that A.M., G.M. and H.M. between two unequal positive quantities satisfy A.M. > G.M. > H.M.

13. The origin is a corner of the square and two of its sides are $y + 2x = 0$ and $y + 2x = 3$. Find the equations of other two sides. Also prove that the distance between two parallel lines $y = mx + c_1$ and $y = mx + c_2$ is $\frac{|c_2 - c_1|}{\sqrt{1 + m^2}}$.

OR

Prove that the product of the perpendicular from (α, β) to the lines given by $ax^2 + 2hxy + by^2 = 0$ is $\frac{a\alpha^2 + 2h\alpha\beta + b\beta^2}{\sqrt{(a-b)^2 + 4h^2}}$. Also find the acute angle of bisector between the lines $4x + 3y - 7 = 0$ and $24x + 7y - 31 = 0$.

14. Define absolute value of complex number and solve by using De-Moivre's theorem : $Z^6 = 1$.
15. For a function, write the conditions so that its graph has concave upward and concave downward. Find the interval where given function $f(x) = x^4 - 8x^3 + 18x - 24$ is concave upward and concave downward. Also find the point of inflection.

OR

Two concentric circles are expanding in such a way that the radius of the inner circle is increasing at the rate 8 cm/sec. and that of the outer circle at the rate of 5 cm/sec. At a certain instant the radii of the inner and outer circles are respectively 24 cm and 30 cm. At what rate does the area between the two circles changes.

SET - II

Group A

[5×3×2=30]

- Write inverse and converse of the statement "If two triangles are similar then their corresponding sides are proportional."
 - If $A = \{1, 2\}$ and $B = \{2, 3, 4\}$, find a relation from A on B defined by the condition $y = 2x$.
 - Examine whether the function $f(x) = 3x^2 + \cos x$ is even or odd. Also test for symmetry.
- Solve: $\tan\theta + \cot\theta = 2$ ($0 \leq \theta \leq \pi$)
 - Using principle of mathematical induction, prove that " $x^n - y^n$ is divisible by $x - y$."
 - If $A = \begin{pmatrix} 2 & -3 \\ 4 & 0 \end{pmatrix}$ and $B = \begin{pmatrix} 3 & 1 \\ 0 & -1 \end{pmatrix}$, find $(AB)^T$.
- Using inverse matrix method, solve
 $x + 2y = 5$; $3x - y = 1$
 - If w is complex cube root of unity, find the value of $(1 - w + w^2)^4 (1 + w - w^2)^4$.
 - Find the value of k so that the equation $(3k + 1)x^2 + 2(k + 1)x + k = 0$ has reciprocal roots.
- Find the equation of a straight line passing through origin and perpendicular to the line $3x - 5y = 7$.

- b. Find equation of a circle whose two of the diameters are $2x + y = 10$ and $x - y + 1 = 0$ and passing through origin.
- c. Evaluate: $\lim_{x \rightarrow \infty} \sqrt{x} (\sqrt{x} - \sqrt{x-a})$
5. a. Find $\frac{dy}{dx}$ if $x^3 + y^3 - 3xy = 0$
- b. Evaluate: $\int \cot x (\ln \sin x)^3 dx$
- c. Find the intervals in which $f(x) = x^2 - 2x + 10$ is increasing or decreasing

Group B

[5×2×4 = 40]

6. a. If A, B and C be three non-empty sets, prove that,
 $A - (B \cup C) = (A - B) \cap (A - C).$

OR

Define absolute value of real number. Rewrite the given relation without using absolute value sign $|2x - 1| \leq 5$. Also, draw the graph of the inequality.

- b. Sketch the graph of $f(x) = (x - 4)^2 - 8$ indicating its characteristics.
7. a. If $\tan^{-1}x + \tan^{-1}y + \tan^{-1}z = \pi$, show that $x + y + z = xyz$.

OR

Solve the triangle if $a = \sqrt{6}$, $b = 2$ and $c = \sqrt{3} - 1$.

- b. Prove that:

$$\begin{vmatrix} a & b & ax+by \\ b & c & bx+cy \\ ax+by & bx+cy & 0 \end{vmatrix} = (b^2 - ac) (ax^2 + 2bxy + cy^2)$$

8. a. Applying row equivalent matrix method **or** inverse matrix method, solve the following system of linear equations:

$$\begin{aligned} x + y + z &= 1 \\ x + 2y + 3z &= 4 \\ x + 3y + 7z &= 13 \end{aligned}$$

- b. Find the condition for two given quadratic equations $p_1x^2 + q_1x + r_1 = 0$ and $p_2x^2 + q_2x + r_2 = 0$ may have one root common.
9. a. Find the equation of the line through $(1, -1)$ which cuts off a chord of length $4\sqrt{3}$ from the circle $x^2 + y^2 - 6x + 4y - 3 = 0$.
- b. Evaluate: $\lim_{x \rightarrow 0} \frac{(a+x) \sec(a+x) - a \sec a}{x}$

OR

A function $f(x)$ is defined as follows:

$$f(x) = \begin{cases} 2x + 3 & \text{for } x < 1 \\ 3 & \text{for } x = 1 \\ 6x - 1 & \text{for } x > 1 \end{cases}$$

Is the function continuous at $x = 1$? If not how can you make it continuous?

10. a. Find the derivative of $\sqrt{\sin 2x}$ by the definition.
 b. Using method of integration, find the area of the circle $x^2 + y^2 = r^2$

Group C

[5×6 = 30]

11. Let a function $f: A \rightarrow B$ be defined by $f(x) = \frac{x+1}{2x-1}$ with $A = \{-1, 0, 1, 2, 3, 4\}$ and $B = \{-1, 0, \frac{4}{5}, \frac{5}{7}, 1, 2, 3\}$. Find the range of f . Is the function f one-one and onto both? If not, how can the function be made one-one and onto both?
12. Define sequence and series. Find the n^{th} term and then sum of first n term of the given series
 $6 + 13 + 24 + 29 + \dots$
13. Derive the formula for the length of the perpendicular from a point (x_1, y_1) to the line $x \cos \alpha + y \sin \alpha = p$. Also find, the distance between the parallel lines $3x + 5y = 11$ and $3x + 5y = -23$

OR

Find the condition that the general equation of second degree may represent a pair of lines. For what value of k will the given equation represent a pair of straight lines.

$$x^2 - kxy + 4y^2 + x + 2y - 2 = 0$$

14. State De-Moivre's theorem for any complex number solve by using De-Moivre's theorem : $z^6 = -1$.
15. Write the conditions for a function to have local maximum and local minimum value of a function. Find the maxima or minima for the given function $4x^3 - 15x^2 + 12x + 7$. Also, find the point of inflection.

OR

Water is running into a conical reservoir, 10 cm deep and 5 cm in radius at the rate of $1.5 \text{ cm}^3/\text{min}$.

- i. At what rate is the water level rising when the water is 4 cm deep.
 ii. At what rate is the area of water surface of the reservoir increasing when the water is 6 cm deep.

SET - III

Group A

[5×3×2=30]

1. a. Write inverse and converse of the statement “if 3 is an odd number then 6 is not an odd number”
 b. Check whether the function $f: [-2, 3] \rightarrow \mathbb{R}$ given by $f(x) = x^2$ is one to one, onto or both.
 c. What are the odd and even functions? Determine whether the function $f(x) = 2^x + 2^{-x}$ is even, odd or neither.

2. a. Solve: $\tan x + \tan 2x = \tan 3x$.
 b. If H is the harmonic mean between a and b, prove that $(H-2a)(H-2b)=H^2$
 c. For the given, matrices $A = \begin{bmatrix} -1 & 2 \\ 3 & 1 \end{bmatrix}$ and $B = \begin{bmatrix} 2 & 3 \\ 0 & -1 \end{bmatrix}$. Show that $(A+B)^T = A^T + B^T$.
3. a. Can you solve the system $3x+4y=10$, $6x+8y=24$ by the inverse matrix method, if not why?
 b. Prove that $\frac{a+bw+cw^2}{b+cw+aw^2} = w$ where w, w^2 are complex cube roots of unity.
 c. If one root of the equation $ax^2+bx+c=0$ be twice the other show that $2b^2 = 9ac$.
4. a. Find the angle between the pairs of line represented by $7x^2 + 8xy + y^2 = 0$
 b. Find the equation of the circle which has the points (0,-1) and (2,3) as ends of a diameter.
 c. Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos qx}{1 - \cos px}$
5. a. Find the derivative of $\frac{1}{\sqrt[3]{3x^2 + x - 5}}$
 b. Show that the function $y = x^3 - 3x^2 + 6x + 3$ has neither maximum nor minimum value.
 c. Evaluate $\int \sec x \, dx$

Group B

[5×2×4 = 40]

6. a. What is contradiction? Prepare the truth table for the compound statement $(p \wedge \sim q) \wedge (\sim p \vee q)$.

Or

Write the axiom of addition which are satisfied by the field of real number. Also solve the inequality; $x(x-2)(x+3) \leq 0$.

- b. Sketch the graph of the function $y = -x^2 - 2x + 5$ indicating its different characteristics.

7. a. In any $\triangle ABC$ if $\frac{\sin A + \cos A}{\cos B} = \sqrt{2}$ prove that $\angle C = 135^\circ$.
Or

If $\tan^{-1} x + \tan^{-1} y + \tan^{-1} z = \frac{\pi}{2}$, prove that $xy + yz + zx = 1$

- b. Write the any two properties of determinant? Hence prove that
- $$\begin{vmatrix} a & b & c \\ a^2 & b^2 & c^2 \\ b+c & c+a & a+b \end{vmatrix} = (b-c)(c-a)(a-b)(a+b+c)$$
8. a. Solve; $3x + 4y + 5z = 18$; $2x - y + 8z = 13$; $5x - 2y + 7z = 20$ by using Row – equivalent matrix method or inverse matrix method.
- b. Prove that the quadratic equation $ax^2 + bx + c = 0$ ($a \neq 0$) cannot have more than two roots.
9. a. Find the equations of tangents drawn from the point $(4, -2)$ to the circle $x^2 + y^2 = 10$. Also show that they are at right angle.
- b. Evaluate: $\lim_{y \rightarrow x} \frac{y \sec y - x \sec x}{y - x}$.

10. a. Find from the first principle the derivative of $\frac{1}{\sqrt{4-3x}}$

b. Evaluate: $\int e^x \cos x \, dx$ or

Find the area of ellipse $\frac{x^2}{16} + \frac{y^2}{9} = 1$ by using integration.

Group C

[5×6 = 30]

11. Define domain and range of a function. Find the domain and range of the function $y = \sqrt{6 - x - x^2}$
12. Using the principle of mathematical induction prove that $1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$.
13. State De Moivre's theorem. Use it to find the fourth roots of 'i'.
14. Derive the formula for the length of the perpendicular from a point (x_1, y_1) to a line $ax + by + c = 0$. Also find the distance between the parallel lines $5x + 12y + 8 = 0$ and $10x + 24y - 3 = 0$

Or

Prove that the bisectors of the angle between the pair of straight lines $ax^2 +$

$2hxy + by^2 = 0$ is given by $\frac{x^2 - y^2}{xy} = \frac{a - b}{h}$.

15. A gardener having 120 meter of fencing wishes to enclose a rectangular plot of land and also erect a fence across a land parallel to two sides. Find the maximum area he can enclose.

Or

The volume of a spherical balloon is increasing at the rate of 25 cubic cm/sec. Find the rate of change of its surface at the instant when its radius is 5 cm.

SET - IV

Group A

[5×3×2=30]

1. a. Write the truth table of the statement $p \wedge (p \Rightarrow q) \Rightarrow q$. Draw a conclusion from a table.
 b. Examine the function $y = \cos x$ for symmetry and even or odd in nature.
 c. Prove by the principle of mathematical induction: $2+4+6+\dots +2n = n(n+1)$
2. a. If $x = \sqrt{3}$, and $y = \sqrt{3}$, test the validity of $\tan^{-1}x + \tan^{-1}y = \tan^{-1} \frac{x+y}{1-xy}$
 b. If $A = \begin{bmatrix} 3 & -1 \\ 5 & -2 \end{bmatrix}$ and $B = \begin{bmatrix} 1 & 2 \\ 3 & -2 \end{bmatrix}$ find $(AB)^T$.
 c. Using Cramer's rule, solve: $x-2y = 0$; $3x + 7y = 5$.
3. a. For what value of p will the equation $5x^2 - px + 45 = 0$ has equal roots.
 b. If w be a complex cube root of unity, find the value of $:(1-w+w^2)^4(1+w-w^2)^4$.
 c. Define one to one and onto functions with an example.
4. a. What are the points on x -axis whose perpendicular distance from the straight line $\frac{x}{a} + \frac{y}{b} = 1$ is 'a'?
 b. Find the equation of the circle concentric with the circle $x^2+y^2 - 8x + 12y + 15 = 0$ and passing through at the point (5, 4).
 c. Prove that $\lim_{x \rightarrow 0} \frac{\ln(1+x)}{x} = 1$
5. a. Find $\frac{dy}{dx}$ if $x^3+y^3 - 3axy = 0$.
 b. The side of a square sheet is increasing at the rate of 5 cm/min. At what rate is the area increasing when the side is 12 cm. long?
 c. Evaluate: $\int \cot x (\log \sin x)^3 dx$

Group B**[5×2×4 = 40]**

6. a. Define symmetric difference of two sets. Prove that $A - (B \cup C) = (A - B) \cap (A - C)$

Or

Define the absolute value of real number. For any positive real number a , prove that $|x| \leq a \Rightarrow -a \leq x \leq a$

- b. Sketch the graph of the function $y = \sin x$ indicating its different characteristics.
7. a. Solve : $2 \sin^2 x - 3 \sin x \cos x + 3 \cos^2 x = 1$

Or

State and prove that sine law of trigonometry.

- b. Prove that
$$\begin{vmatrix} a+b+2c & a & b \\ c & b+c+2a & b \\ c & a & c+a+2b \end{vmatrix} = 2(a+b+c)^3$$
8. a. What is elementary row operation? Use it, solve; $3y+2z = 1$; $x+2y = -5$; $2x-z = -3$

Or

When is matrix has its inverse? Use inverse matrix method solves:
 $x+y+z=6$; $x-y+z=2$; $x+y-z=0$.

- b. Find the conditions that the two quadratic equations $a_1x^2 + b_1x + c_1 = 0$ and $a_2x^2 + b_2x + c_2 = 0$ have one root common and both roots common.
9. a. Find the equation of the line through the point $(1, -1)$ which cuts off a chord of length $4\sqrt{3}$ from the circle $x^2 + y^2 - 6x + 4y - 3 = 0$.
- b. Discuss the limit of the function $f(x) = \frac{|x-2|}{2-x}$ at $x=2$. Is f continuous at $x=2$?
10. a. Find from the first principle the derivative of $\sqrt{\sec x}$
- b. Evaluate; $\int_0^{\frac{\pi}{4}} \tan^3 x \, dx$.

Or

Find the area of the region between the curves $y^2 = 16x$ and the line $y = 2x$.

Group C**[5×6 = 30]**

11. What is function? Find the domain and range of the function $y = \sqrt{36 - x^2}$.
12. Find the n^{th} term and the sum of the n -term of the series:
 $1^2.2 + 2^2.3 + 3^2.4 + \dots$

13. Define the conjugate of a complex number. Write its geometrical meaning.
Also find the square roots of $\frac{(8,-6)}{(1,1)}$.

14. Find the equation of the bisectors of the angle between the straight lines $3x+4y+2=0$ and $5x-12y-6=0$. Verify that bisectors are perpendicular to each other. Also identify the acute angle bisector.

Or

What is the homogenous equation of degree two? Prove that the two lines represented by $(x^2 + y^2)\sin^2 \alpha = (x\cos\theta - y\sin\theta)^2$ include an angle 2α

15. A door is in the form of a rectangle surmounted by a semi-circle. If total perimeter is 9m, find the radius of semi-circle for the greatest door area.

Or

Water is running into a conical reservoir, 10cm deep and 5cm in radius at the rate of $1.5 \text{ cm}^3/\text{min}$. At what rate is the level rising when the water is 4 cm deep?

SET - V

Group A

(5×3×2=30)

1. a. If $M=\{1,3,5,7\}$, $N=\{2,4,6,8\}$, and $U=\{1,2,3,4,5,6,7,8,9\}$, find $\overline{M \cap N}$ and $\overline{M - N}$
 b. If $A=\{1,2,3\}$, find the relation A satisfy the condition $x+y<4$. Is this relation a function? Give on reason.
 c. Evaluate $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$
2. a. Rewrite $-1 \leq x \leq 5$ using absolute value sign.
 b. Does the limit of the function $f(x) = \begin{cases} x & \text{when } x > 0 \\ -x & \text{when } x < 0 \end{cases}$ exist at $x=0$? Justify your answer.
 c. Find $\frac{dy}{dx}$ if $x = e^{\cos 2t}$ and $y = e^{\sin 2t}$
3. a. Show that the function $f(x) = 2 - 3x + 3x^2 - x^3$ is increasing on R.
 b. If $A = \begin{pmatrix} -1 & -1 \\ 1 & 0 \end{pmatrix}$, find the value of A^3 .

4. a. Using Cramer's rule, solve the system of equations.
 $3x + 4y = -2$
 $5x - 7y - 24 = 0$
- b. Without expanding the determinant prove that
- $$\begin{vmatrix} 1 & a(b+c) & bc \\ 1 & b(c+a) & ca \\ 1 & c(a+b) & ab \end{vmatrix} = 0$$
- c. If the equation $2x^2 + 7xy + 3y^2 - 4x - 7y + K = 0$ represent a pair of line, find the value of K.
5. a. If $1, w, w^2$ are the cube roots of unity, prove that
 $(1+w^2)^3 - (1+w)^3 = 0$
- b. Find $\frac{dy}{dx}$ if $y = \tan^{-1}(1+x+x^2)$
- c. Express $-1 - \sqrt{3}i$ into polar form.

Group B

(5×4×2=40)

6. a. If A, B and C be any three non-empty sets, prove that
 $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
- b. Evaluate $\lim_{x \rightarrow \frac{\pi}{4}} \frac{\sec^2 x - 2}{\tan x - 1}$
7. a. Define bi-conditional of two statements . Prepare the truth table of
 $(p \rightarrow q) \leftrightarrow (\sim p \vee q)$.
- b. A function f(x) is defined as follows.
- $$f(x) = \begin{cases} 2x - 3 & \text{for } x < 2 \\ 2 & \text{for } x = 2 \\ 2x - 5 & \text{for } x > 2 \end{cases}$$
- Is f(x) continuous at x=2. If not, how can f(x) be made continuous at x=2?
8. a. If $x = \log_{2a} a$, $y = \log_{3a} 2a$ and $z = \log_{4a} 3a$. Prove that
 $xyz + 1 = 2yz$.
- b. Find from the definition, the derivative of $\sqrt{\tan x}$

9. a. Prove that $\begin{vmatrix} x & y & z \\ x^2 & y^2 & z^2 \\ yz & xz & xy \end{vmatrix} = (y-z)(z-x)(x-y)(yz + zx + xy)$
- b. Solve the following system of linear equations by row equivalent matrix method or inverse matrix method.
- $$\begin{array}{rcl} 2x+6y=2 & 3x-z=-8 & 2x-y+z=-3 \end{array}$$
10. a. If $x+y=2$ is the equation of the chord of the circle $x^2 + y^2 - 2y = 0$, find the equation of the circle so that this chord is a diameter.
- b. Find $\frac{dy}{dx}$ when $x^2y + xy^2 = a^3$

Group C

(5×6=30)

11. Define bijective function with an example. Let R be the set of real numbers. Show that the function $f : R \rightarrow R$ define by $f(x) = 4x - 7$ is bijective and find the formula for f^{-1} .
12. The AM, GM and HM between two unequal positive numbers satisfy the relations
- i. $AM \times HM = (GM)^2$ ii. $AM > GM > HM$
13. Prove that the straight lines joining the origin to the point of intersection of the line $\frac{x}{a} + \frac{y}{b} = 1$ and the curve $x^2 + y^2 = c^2$ are right angle if
- $$\frac{1}{a^2} + \frac{1}{b^2} = \frac{2}{c^2}.$$

OR

What are the three standard equations of straight lines? The origin is a corner of a square and two of its sides are $y + 2x = 0$ and $y + 2x = 3$, find the equations of the other two sides.

14. State De-Moivre's theorem. Using De-Moivre's theorem, find the square roots of $4 + 4\sqrt{3}i$.
15. List the criteria for the function $y=f(x)$ to have local maxima and local minima at a point. Find the local maxima and minima of $f(x) = 4x^3 - 6x^2 - 9x + 1$ on the interval $(-1, 2)$, also find the point of inflection.

OR

A ladder 5 meters long rests against a vertical wall. If its top slides downwards at the rate of 10 cm/s, find the rate at which the foot of the ladder is sliding when the foot of the ladder is 4 meters away from the wall.