1. Define Quadratic equation .Prove that the quadratic equation cannot have more than two roots. Discuss the nature of the roots of a quadratic equation.
2. Show that the roots of the equation $x^2 - 4lmx + (l^2 + 2m^2)^2 = 0$ are imaginary.
3. For what values of m will the equation $x^2 - 2(5 + 2m)x + 3(7 + 10m) = 0$ have equal roots?
4. Prove that the roots of the equation $x^2 + (2k - 1)x + k^2 = 0$ *are real if* $k \leq \frac{1}{4}$.
5. Discuss the relation between roots and coefficients. Find a quadratic equation whose roots are the square squares of the roots $3x^2 - 5x + 4 = 0$
6. For what value of k will the equation $(3k + 1)x^2 - 5x + 4 = 0$ may have
   a) Roots equal in magnitude and opposite in sign
   b) One root zero.
   c) Reciprocal roots.
   d) Sum is equal to 4.
7. Find the value of m for which one root of the equation $x^2 + mx + 1 = 0$ is the square of other.
8. Find the value of P in $2x^2 - (p + 1)x + (p - 1) = 0$ *if* $\alpha - \beta = \alpha\beta$.
9. If the roots of the equation $rx^2 + sx + t = 0$ be in the ratio of $m:n$, prove that

$$\sqrt{\frac{m}{n}} + \sqrt{\frac{n}{m}} + \sqrt{\frac{t}{r}} = 0$$

10. If the roots of the equation $12x^2 - mx + 5 = 0$ are in the ratio of 2: 3 .find the value of$m$.
11. Determine the condition for a quadratic equation may have i) one root common ii) both root common Also, prove that $a^3 + b^3 + c^3 = 3abc$ if the equations $ax^2 + bx + c = 0$ *and* $bx^2 + cx + a = 0$ have a common root.
12. If P be the length of the perpendicular dropped from the origin on the line $\frac{x}{a} + \frac{y}{b} = 1$,prove that

$$\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2}$$

13. The length of the perpendicular drawn from the point $(a, 3)$ on the line $3x + 4y + 5 = 0$ is 4.Find the value of a.
14. Find the equation of the two straight lines each of which is parallel to and at a distance of $\sqrt{5}$ from the line $x + 2y - 7 = 0$
15. Find the equation of the line which is at right angles to $3x + 4y = 12$,such that its perpendicular distance from the origin is equal to the length of the perpendicular from (3,2) On the given line.
16. If p and p' be the length of the perpendiculars from the origin upon the straight line whose equations are $xsec\theta + ycosec\theta = a$ and $xcos\theta - ysin\theta = acos2\theta$,prove that $4p^2 + p'^2 = a^2$

17. The origin is a corner of a square and two of its sides are $y + 2x = 0$ and $y + 2x = 3$. Find the equation of the other two sides.

18. Find the equation of the two lines represented by $x^2 + 6xy + 9y^2 + 4x + 12y - 5 = 0$. Prove that the two lines are parallel. Also, find the distance between them.

19. If the line pairs $ax^2 + 2hxy + by^2 = 0$ *and* $a'x^2 + 2h'xy + b'y^2 = 0$ have the same bisectors, prove that $h(a' - b') = h'(a - b)$

20. Find the value of k so that the lines which join the origin to the point of intersection of the lines $y - x = k$ and the curve $x^2 + y^2 + 4x - 6y - 36 = 0$ may be at right angles.

21. Define Conjunction and Disjunction.

22. Define Conditional and Bi-conditional with example.

23. Let p, q, r and s be four simple statements. If p is true , q is false , r is true and s is false , find the truth values of the following compound statements.

a) $p \wedge q$ b) $(p \vee q) \wedge (r \vee s)$ c)$[(p \wedge q) \Rightarrow p] \Rightarrow (q \wedge \sim q)$ is a contradiction

24. Let A, B and C be the subsets of a universal set U. Then prove that

i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$

ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$

25. State and prove De-Morgan's Law.

26. For any two real numbers x *and* y. Prove that

a) $|x + y| \leq |x| + |y|$

b) $|x - y| \geq |x| - |y|$

27. Prove that if $x \in R$ and a be any positive real number then $|x| < a \Rightarrow -a < x < a$ and conversely.

28. Solve the following inequalities

a) $6 + 5x - x^2 \geq 0$

b) $\frac{x(x+2)}{x-1} \leq 0$

29. Solve the inequalities of $|2x + 1| \geq 3$

30. Compute the following limit

a) $\lim_{x \to 0} \frac{4x^3 - x^2 + 2x}{3x^2 + 4x}$ b) $\lim_{x \to 2} \frac{x^2 - 4x + 4}{x^2 - 7x + 10}$ c) $\lim_{x \to a} \frac{\sqrt{3a - x} - \sqrt{x + a}}{4(x - a)}$

31. Calculate the following limits

a) $\lim_{x \to \infty} (\sqrt{x} - \sqrt{x - 3})$ b) $\lim_{x \to \infty} \sqrt{x}(\sqrt{x} - \sqrt{x - a})$

32. Evaluate the following

a) $\lim_{x \to a} \frac{\sin(x-a)}{x^2 - a^2}$ b) $\lim_{x \to 0} \frac{1 - \cos 6x}{x^2}$ c) $\lim_{x \to \theta} \frac{x\cot\theta - \theta\cot x}{x - \theta}$