1. If A, B and C are any three non-empty sets, prove that $A - (B \cup C) = (A - B) \cap (A - C)$.
2. Define disjunction of two statements. Prepare a truth table for the compound statement $\sim (p \vee q)$.
3. Write the truth table for $p \wedge q \Rightarrow p \vee q$ hence draw a conclusion from the truth table.
4. Find the distance between the lines $3x - 4y + 9 = 0$ and $6x - 8y - 17 = 0$.
5. Evaluate: $\lim_{x \to y} \frac{\tan x - \tan y}{x-y}$.
6. Find the limit of $f(x) = \frac{x^2-4}{x-2}$ as $x \to 2$. Is f(x) continuous? If not, find the point of discontinuity.
7. If the equation $x^2 + px + q = 0$ and $x^2 + qx + p = 0$ have a common root prove that either $p = q$ or $p + q + 1 = 0$.
8. Let p and q be any two statements, prove that $\sim(p \vee q) \equiv (\sim p \wedge \sim q)$.
9. Find the angle between two straight lines whose equations are $y = m_1x + c_1$ and $y = m_2x + c_2$. Also find the conditions under which the two straight lines will be (i) perpendicular (ii) parallel.
10. Find $A \cup B$, if $A = \{x: x = 2n + 1, n \leq 5, n \in N\}$ and $B = \{x : x = 3n - 2, n \leq 4, n \in N\}$
11. If one root of the equation $x^2 - px + q = 0$ be twice the other, show that $2p^2 = 9q$.
12. If one root of the equation $ax^2 + bx + c = 0$ be the square of the other, prove that $b^3 + a^2c + ac^2 = 3abc$.
13. Evaluate $\lim_{x \to \theta} \frac{x\sin\theta - \theta\sin x}{x-\theta}$.
14. Evaluate $\lim_{x \to \theta} \frac{x\tan\theta - \theta\tan x}{x-\theta}$
15. Find the condition that one of the lines given by $ax^2 + 2hxy + by^2 = 0$ may be perpendicular to one of the lines given by $a'x^2 + 2h'xy + b'y^2 = 0$.
16. Find the equation of the sides of the right angled isosceles triangle vertex is (-2, -3) and whose base is $x = 0$.
17. Evaluate: $\lim_{x \to a} \frac{\sin(x-a)}{x^2-a^2}$.
18. State and prove the De-Morgan's law.
19. Evaluate $\lim_{x \to y} \frac{\sin x - \sin y}{x-y}$.
20. If the equation $ax^2 + 2hxy + by^2 + 2gx + 2fy + c = 0$ represent a pair of parallel lines, prove that
    i) $\frac{a}{h} = \frac{h}{b} = \frac{g}{f}$ and ii) the distance between them is $2\sqrt{\frac{g^2-ac}{a^2+ab}}$
21. Given $A = \{1, 2, 3\}$ and $B = \{3, 4, 5, 6\}$, show that $A - (A - B) = A \cap B$.
22. If the equation $(1+m^2)x^2 + 2mcx + c^2 - a^2 = 0$ has equal roots, show that $c^2 = a^2(1+m^2)$.
23. Prove geometrically $\lim_{\theta \to 0} \frac{\sin\theta}{\theta} = 1$.
24. If p and p′ be the length of the perpendicular from the origin upon the straight line whose equation are $x \sec\theta + y \operatorname{cosec}\theta = a$ and $x \cos\theta - y \sin\theta = a \cos 2\theta$. Prove that $4p^2 + p'^2 = a^2$.
25. For any two real numbers x and y show that $|x + y| \leq |x| + |y|$.
26. Solve the inequality $|2x-1| \geq 3$ and draw its graph.
27. Prove that the equation of the straight line passing through the point $(a \cos^3\theta, a \sin^3\theta)$ and is parallel to the straight line $x \operatorname{cosec}\theta - y \sec\theta = a$ is $x \cos\theta - y \sin\theta = a \cos 2\theta$.
28. Evaluate $\lim_{x \to \infty} \sqrt{x}\,(\sqrt{x} - \sqrt{x-a})$.
29. If the ratio of the roots of $ax^2 + bx + c = 0$ be equal to that of the roots of $a'x^2 + b'x + c' = 0$ prove that $\frac{b^2}{b'^2} = \frac{ac}{a'c'}$.
30. Find the equation to the pair of straight lines joining the origin to the intersection of the straight line $y = mx + c$ and the curve $x^2+y^2 = a^2$ prove that they are at right angles if $2c^2 = a^2(1+m^2)$.
31. If A,B and C and the subjects of a universal set U. Then prove that
    i) $A \cup (B \cap C) = (A \cup B) \cap (A \cup C)$
    ii) $A \cap (B \cup C) = (A \cap B) \cup (A \cap C)$
32. Prove that $\sim(p \leftrightarrow q) \equiv (p \wedge \sim q) \vee (q \wedge \sim p)$.
33. Show that the roots of the equation $(a^2-bc)x^2 + 2(b^2-ca)x + (c^2-ab) = 0$ will be equal, if either $b = 0$, or $a^3 + {}^3 + c^3 - 3abc = 0$.
34. If α and $\beta$and the roots of $px^2 + qx + q = 0$, prove that $\sqrt{\frac{\alpha}{\beta}} + \sqrt{\frac{\beta}{\alpha}} + \sqrt{\frac{q}{p}} = 0$.
35. The opposite corner A and C of a square have the coordinates (-2, 7) and(4-3) find the equation of the diagonal BD.
36. The origin is a corner of square and two of its sides are $y+2x=0$ and $y+2x=3$ find the equation of the other two sides.
37. Solve the inequality $x-1 < \frac{1}{3}(5-x) - 1$
38. If $x \in R$ and a be any positive real number then prove that $|x| < a \Rightarrow -a < x < a$ and conversely.
39. Prove that the quadratic equation $ax^2 + bx + c = 0$ can not have more than

41. If the equation $x^2 + 2(k+2)x + 9k = 0$ has equal roots find k.

42. The sum of the roots of the equation
$\frac{1}{x+a} + \frac{1}{x+b} = \frac{1}{c}$ is zero prove that the product of the roots is $-\frac{1}{2}(a^2 + b^2)$

43. If the roots of the equation $x^2 + ax + c = 0$ differ by 1. Prove that $a^2 = 4c + 1$.

44. Find the angle between the line pair $2x^2 + 7xy + 3y^2 = 0$.

45. For what value of m, the equation $x^2 - mx + m + 1 = 0$ may have it's roots in the ratio 2:3?

46. If the roots of the equation $lx^2 + nx + n = 0$ be in the ratio p:q prove that

$$\sqrt{\frac{p}{q}} + \sqrt{\frac{q}{p}} + \sqrt{\frac{n}{l}} = 0$$

47. Find the angle between the lines $y - \sqrt{3}x - 5 = 0$ and $\sqrt{3}y - x + 6 = 0$.

48. Find the equation of the lines through the point (1, -1) and making an angle 60^0 with the line $\sqrt{3}x - y + 7 = 0$.

49. P and Q are two points on the line $x - y + 1 = 0$ and are at distance 5 units from the origin find the area of the triangle OPQ.

50. Find the limiting values of $\lim_{y \to 0} \frac{(x+y)\sec(x+y) - x\sec x}{y}$

51. Show that the homogeneous equation of second degree always represents a pair of straight line passing through the origin. Also find the angle between them.

52. If the quadratic equation $x^2 + px + q = 0$ and $x^2 + p'x + q' = 0$ have a common root show that it must be either $\frac{pq' - p'q}{q - q'}$ or $\frac{q - q'}{p' - p}$.

53. Find the condition that one of the lines given by $ax^2 + 2hxy + by^2 = 0$ may be perpendicular to one of the lines given line $a'x^2 + 2h'xy + b'y^2 = 0$.

54. If p is the length of the perpendicular dropped from the point (a, b) on the line $\frac{x}{a} + \frac{y}{b} = 1$ prove that $\frac{1}{a^2} + \frac{1}{b^2} = \frac{1}{p^2}$

55. A function f(x) is defined by $f(x) = \begin{cases} x^2 - 1 & for \quad x < 2 \\ 2x & for \quad x = 2 \\ x + 1 & for \quad x > 2 \end{cases}$

Is the function continuous at x = 2? If not how can you make it continuous at x=?

56. Write the condition of perpendicularity of the line pair represented by $ax^2 + 2hxy + by^2 = 0$. Prove that the line pair joining origin to points of intersection of the curve $7x^2 - 4xy + 8y^2 + 2x - 4y - 8 = 0$ and the line $3x - y = 2$ are at right angles.

57. A function f(x) is defined below

58. $f(x) = \begin{cases} kx + 3 & for \quad x \geq 2 \\ 3x - 1 & for \quad x < 2 \end{cases}$, Find the value of k so that f(x) is continuous at x = 2.