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LINEAR EQUATIONS

- **Linear polynomial:** A polynomial having degree 1.
- **Equation:** Two expressions separated by sign of equality.
- **Linear Equation:** Equation involving only linear polynomials.
An equation in which the highest power of the variable is 1.
General form of a linear equation in one variable is $ax + b = 0$, $a \neq 0$, and a, b are real numbers.
- **Left Hand Side (LHS) :** Expression to the left of the equality sign.
- **Right Hand side (RHS) :** Expression to the right of the equality sign.
- **Solution of linear equation in one variable:** The value of the variable for which LHS of the given equation becomes equal to RHS.
- **Rules for solving an equation:** Same number can be added to both sides of the equation.
Same number can be subtracted from both sides of the equation.
Both sides of the equation can be multiplied by the same non-zero number.
Both the sides of the equation can be divided by the same non-zero number.
- **Transposition:** Process by which any term of the equation can be taken from one side of the equality to the other side by changing its sign.
- **Formation of a linear equation in one variable:** Represent the unknown by an alphabet say x, y, z, m, n, p etc. and translate the given statement into an equation.
- **Linear equation in two variables :** $ax + by + c = 0$ is a linear equation in two variables x and y . Linear equation in two variables have infinitely many solutions.
In $ax + by + c = 0$ for each value of y , we get a unique value of x .
$$\Rightarrow ax = -by - c \Rightarrow x = \frac{-by}{a} - \frac{c}{a}$$
- A linear equation $ax + c = 0$, $a \neq 0$ can be considered as linear equation in two variables by expressing it as $ax + 0.y + c = 0$.
- **Graph of a linear equation in two variables:** Find at least two points in the plane whose coordinates are solutions of the equation. Plot them on coordinate plane and join them using scale.
Graph of a linear equation in two variables is always a straight line.
- **System of linear equations :** A pair of linear equations in two variables is said to form a system of linear equations written as $a_1x + b_1y + c_1 = 0$ (a_1, b_1 both $\neq 0$)
 $a_2x + b_2y + c_2 = 0$ (a_2, b_2 both $\neq 0$) where $a_1, a_2, b_1, b_2, c_1, c_2$ are real numbers.
System of linear equations can be solved by graphical or any algebraic method.
- **Graphical method for solution of system of linear equations:** Draw the graph of both equations on same graph paper.
If the graph is intersecting lines then the point of intersection gives unique solution of system.
If two lines coincide, system has infinitely many solutions.
If graph is parallel lines, the system has no solution.
- **Algebraic method for Solution of system of linear equations:** Substitution Method: Find the value of one variable in terms of other variable from one equation and substitute it in second equation, second equation will be reduced to linear equation in one variable.
Elimination Method: Multiply both equations by suitable non-zero constants to make the coefficients of one of the variables numerically equal. Now add or subtract one equation from another to eliminate one variable, we get an equation in one variable.
- **Word Problems based on linear equations:** Translate the given information (data) into linear equations(s) and solve them.

CHECK YOUR PROGRESS:

- The degree of a linear equation is:
(A) 1 (B) 2 (C) 3 (D) 0
- Which of the following numbers is the solution of $x + 3 = 9$?
(A) 3 (B) 6 (C) 9 (D) 12
- Which of the following ordered pairs is a point on the straight line represented by $4x - 3y + 1 = 0$?
(A) (2, 1) (B) (5, 3) (C) (3, 2) (D) (5, 7)
- If the point (K, 4) lies on the straight line represented by $3x + y = 10$, then the value of K is :
(A) 1 (B) 2 (C) 3 (D) 4
- A system of linear equations in two variables has unique solution if the graph is :
(A) Intersecting lines (B) Coincident (the same) lines
(C) Parallel lines (D) None of these
- Solve the following system of linear equations graphically:
 $x - 2y = 7$, $3x + y = 35$.
- Solve the following system of linear equations by substitution method:
 $2x + 3y = 13$, $5x - 7y = -11$.
- Solve the following pair of equations by elimination method:
 $3x + 2y = 11$, $2x + 3y = 4$
- If the numerator of a fraction is decreased by one, it becomes $\frac{2}{3}$ but, if the denominator is increased by 5, the fraction becomes $\frac{1}{2}$. Find the fraction.
- The perimeter of a rectangle is 20cm. If length exceeds breadth by 4 cm, Find the area of the rectangle.

STRETCH YOURSELF :

- Draw the graph of $4x + 5y = 20$. Hence show that the point (2, 3) does not lie on the line represented by $4x + 5y = 20$.
- Solve for p and q:
 $4p + \frac{6}{q} = 15$,
 $6p - \frac{8}{q} = 14$.
- Draw the graph of the following pair of equations:
 $2x - y = -8$, $8x + 3y = 24$
Determine the vertices of the triangle formed by the lines represented by these equations

and x -axis. Shade the triangular region so formed.

ANSWERS**CHECK YOUR PROGRESS:**

- A
- B
- D
- B
- A
- $x = 11$, $y = 2$
- $x = 2$, $y = 3$
- $x = 5$, $y = -2$
- $\frac{7}{9}$
- 21cm²

STRETCH YOURSELF :

- $p = 3$, $q = 2$.
- (0, 8) (-4, 0) and (3, 0)