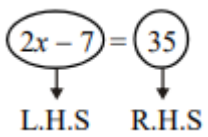


- Expression:** An expression is a constant or a variable or combination of these two, using the mathematical operations (+, -, ×, ÷) i.e., terms are added to form expressions
- Algebraic expression:** If an expression has at least one algebraic term, then that expression is Algebraic expression.
Ex: d , $a + 3$, $5c - 4$, $2x^2 + 3x - 6$, $\frac{x}{y}$ are Algebraic expressions.
- Coefficient:** A coefficient may be either a numerical or an algebraic factor or a product of both in a term.
- The terms having the same algebraic factors are like terms and the terms having different algebraic factors are unlike terms.
Examples:
(i). The terms $2x$, $-3x$ and $4x$ are like terms, as they have same algebraic factor 'x'
(ii). The terms $5t$ and $8s$ are unlike terms, as they have different algebraic factors t and s
- Monomial:** An expression with only one term is called Monomial.
- Binomial:** An expression which contains two unlike terms is called a Binomial.
- Trinomial:** An expression which contains three unlike terms is called a Trinomial.
- Polynomial :** An algebraic expression in which the exponent of variable is a non-negative integer is called a Polynomial
- In an expression, if the terms are arranged in such a way that the exponents of the terms are in descending order then the expression is said to be in standard form.
- Linear equations in one variable:** An equation of the form $ax + b = 0$ or $ax = b$ where a, b are constants and $a \neq 0$ is called linear equation in one variable or simple equation.
- If the degree of an equation is one then it is called a linear equation.
- The expression on the left of the equality sign is called the **L.H.S** (Left Hand Side) of the equation and right of the equality sign is called **R.H.S** (Right Hand Side) of the equation.


- The value which when substituted for the variable in the given equation makes L.H.S. = R.H.S. is called a solution or root of the given equation.
- When we transpose terms

'+ quantity becomes '- quantity	'×' quantity becomes '÷' quantity
'- quantity becomes '+ quantity	'÷' quantity becomes '×' quantity

Example 1: Find the solution of $2x - 3 = 7$

Sol: Given equation: $2x - 3 = 7$

(Transposing -3 to R.H.S it become $+3$)

$$2x = 7 + 3.$$

$$2x = 10$$

Divide both sides by 2

$$\frac{2x}{2} = \frac{10}{2}$$

$$x = 5$$

Example 2: Solve $5x + \frac{7}{2} = \frac{3}{2}x - 14$

Sol: Given equation: $5x + \frac{7}{2} = \frac{3}{2}x - 14$

Multiply both sides by 2

$$2 \times \left(5x + \frac{7}{2}\right) = 2 \times \left(\frac{3}{2}x - 14\right)$$

$$(2 \times 5x) + \left(2 \times \frac{7}{2}\right) = \left(2 \times \frac{3}{2}x\right) - (2 \times 14)$$

$$10x + 7 = 3x - 28$$

$$10x - 3x = -28 - 7 \text{ (transposing } 3x \text{ to LHS and } +7 \text{ to RHS)}$$

$$7x = -35$$

Divide both sides by 7

$$\frac{7x}{7} = \frac{-35}{7}$$

$$x = -5$$

\therefore Solution $x = -5$

EXERCISE 2.3

Solve the following equations and check your results.

1. $3x = 2x + 18$

Sol: $3x = 2x + 18$

$$3x - 2x = 18$$

$$x = 18$$

Check:

Putting $x=18$

$$\text{LHS} = 3 \times 18 = 54$$

$$\text{RHS} = 2 \times 18 + 18 = 36 + 18 = 54$$

$$\text{LHS} = \text{RHS}$$

Hence verified

$$2. 5t - 3 = 3t - 5$$

$$\text{Sol: } 5t - 3 = 3t - 5$$

$$5t - 3t = -5 + 3$$

$$2t = -2$$

$$t = \frac{-2}{2} = -1$$

$$3. 5x + 9 = 5 + 3x$$

$$\text{Sol: } 5x + 9 = 5 + 3x$$

$$5x - 3x = 5 - 9$$

$$2x = -4$$

$$x = \frac{-4}{2} = -2$$

$$4. 4z + 3 = 6 + 2z$$

$$\text{Sol: } 4z + 3 = 6 + 2z$$

$$4z - 2z = 6 - 3$$

$$2z = 3$$

$$z = \frac{3}{2}$$

$$5. 2x - 1 = 14 - x$$

$$\text{Sol: } 2x - 1 = 14 - x$$

$$2x + x = 14 + 1$$

$$3x = 15$$

$$x = \frac{15}{3} = 5$$

$$6. 8x + 4 = 3(x - 1) + 7$$

$$\text{Sol: } 8x + 4 = 3(x - 1) + 7$$

$$8x + 4 = 3x - 3 + 7$$

$$8x + 4 = 3x + 4$$

$$8x - 3x = 4 - 4$$

$$5x = 0$$

$$x = 0$$

$$7. x = \frac{4}{5}(x + 10)$$

Check: Putting $t = -1$

$$\text{LHS} = 5(-1) - 3 = -5 - 3 = -8$$

$$\text{RHS} = 3(-1) - 5 = -3 - 5 = -8$$

LHS = RHS \therefore Hence verified

Check: Putting $x = -2$

$$\text{LHS} = 5(-2) + 9 = -10 + 9 = -1$$

$$\text{RHS} = 5 + 3(-2) = 5 - 6 = -1$$

LHS = RHS, Hence verified

Check: Putting $z = \frac{3}{2}$

$$\text{LHS} = 4\left(\frac{3}{2}\right) + 3 = 6 + 3 = 9$$

$$\text{RHS} = 6 + 2\left(\frac{3}{2}\right) = 6 + 3 = 9$$

LHS = RHS, Hence verified.

Check: Putting $x = 5$

$$\text{LHS} = 2(5) - 1 = 10 - 1 = 9$$

$$\text{RHS} = 14 - 5 = 9$$

LHS = RHS . Hence verified

Check: Putting $x = 0$

$$\text{LHS} = 8(0) + 4 = 0 + 4 = 4$$

$$\text{RHS} = 3(0 - 1) + 7 = -3 + 7 = 4$$

LHS = RHS

Hence verified.

$$\text{Sol: } x = \frac{4}{5}(x + 10)$$

$$5x = 4(x + 10)$$

$$5x = 4x + 40$$

$$5x - 4x = 40$$

$$x = 40$$

$$8. \frac{2x}{3} + 1 = \frac{7x}{15} + 3$$

$$\text{Sol: } \frac{2x}{3} + 1 = \frac{7x}{15} + 3$$

Multiply with '15'

$$15 \times \left(\frac{2x}{3} + 1\right) = 15 \times \left(\frac{7x}{15} + 3\right)$$

$$15 \times \frac{2x}{3} + 15 \times$$

$$= 15 \times \frac{7x}{15} + 15 \times 3$$

$$10x + 15 = 7x + 45$$

$$10x - 7x = 45 - 15$$

$$9. 2y + \frac{5}{3} = \frac{26}{3} - y$$

$$\text{Sol: } 2y + \frac{5}{3} = \frac{26}{3} - y$$

Multiply with '3'

$$3 \times \left(2y + \frac{5}{3}\right) = 3 \times \left(\frac{26}{3} - y\right)$$

$$3 \times 2y + 3 \times \frac{5}{3} = 3 \times \frac{26}{3} - 3 \times y$$

$$6y + 5 = 26 - 3y$$

$$6y + 3y = 26 - 5$$

$$9y = 21$$

$$y = \frac{21}{9} = \frac{7}{3}$$

$$10. 3m = 5m - \frac{8}{5}$$

$$\text{Sol: } 5m - \frac{8}{5} = 3m$$

$$5m - 3m = \frac{8}{5}$$

$$2m = \frac{8}{5}$$

Check: Putting $x = 40$

$$\text{LHS} = 40$$

$$\text{RHS} = \frac{4}{5}(40 + 10) = \frac{4}{5} \times 50 = 4 \times 10 = 40$$

LHS = RHS, Hence verified.

$$3x = 30$$

$$x = \frac{30}{3} = 10$$

Check: Putting $x = 10$

$$\text{LHS} = \frac{2 \times 10}{3} + 1 = \frac{20}{3} + 1 = \frac{23}{3}$$

$$\text{RHS} = \frac{7 \times 10}{15} + 3 = \frac{14}{3} + 3 = \frac{23}{3}$$

$$\text{LHS} = \text{RHS}$$

Hence verified

Check: Putting $y = 7$

$$\text{LHS} = 2 \left(\frac{7}{3}\right) + \frac{5}{3} = \frac{14}{3} + \frac{5}{3} = \frac{19}{3}$$

$$\text{RHS} = \frac{26}{3} - \frac{7}{3} = \frac{26 - 7}{3} = \frac{19}{3}$$

$$\text{LHS} = \text{RHS}$$

Hence verified.

$$m = \frac{8}{5 \times 2} = \frac{4}{5}$$

Check:

$$\text{Putting } m = \frac{4}{5}$$

$$\text{LHS} = 3 \times \frac{4}{5} = \frac{12}{5}$$

$$\text{RHS} = 5 \times \frac{4}{5} - \frac{8}{5} = \frac{20}{5} - \frac{8}{5} = \frac{12}{5}$$

$$\text{LHS} = \text{RHS}$$

Reducing Equations to Simpler Form

Ex 16: Solve $\frac{6x+1}{3} + 1 = \frac{x-3}{6}$

Sol: LCM of 3,6=6

Multiplying both sides of the equation by 6

$$6 \times \left(\frac{6x+1}{3}\right) + 6 \times 1 = 6 \times \left(\frac{x-3}{6}\right)$$

$$2(6x+1) + 6 = x-3$$

$$12x + 2 + 6 = x - 3$$

$$12x + 8 = x - 3$$

$$12x - x = -3 - 8$$

$$11x = -11$$

$$x = -1$$

Ex 17: Solve $5x - 2(2x - 7) = 2(3x - 1) + \frac{7}{2}$

Sol: $5x - 2(2x - 7) = 2(3x - 1) + \frac{7}{2}$

$$5x - 4x + 14 = 6x - 2 + \frac{7}{2}$$

$$x + 14 = 6x - 2 + \frac{7}{2}$$

$$14 + 2 - \frac{7}{2} = 6x - x$$

$$16 - \frac{7}{2} = 5x$$

$$5x = \frac{32 - 7}{2} = \frac{25}{2}$$

$$x = \frac{25}{2 \times 5} = \frac{5}{2}$$

EXERCISE 2.5

Solve the following linear equations.

1. $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

Sol: $\frac{x}{2} - \frac{1}{5} = \frac{x}{3} + \frac{1}{4}$

Hence verified.

Check: put $x = -1$

$$\text{LHS} = \frac{6(-1) + 1}{3} + 1$$

$$= \frac{-6 + 1}{3} + 1 = \frac{-5}{3} + \frac{3}{3} = \frac{-2}{3}$$

$$\text{RHS} = \frac{-1 - 3}{6} = \frac{-4}{6} = \frac{-2}{3}$$

$$\text{LHS} = \text{RHS}$$

$$\frac{5x - 2}{10} = \frac{4x + 3}{12}$$

$$12(5x - 2) = 10(4x + 3)$$

$$12 \times 5x - 12 \times 2 = 10 \times 4x + 10 \times 3$$

$$60x - 24 = 40x + 30$$

$$60x - 40x = 30 + 24$$

$$20x = 54$$

$$x = \frac{54}{20} = \frac{27}{10}$$

$$2. \frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} = 21$$

$$\text{sol: } \frac{n}{2} - \frac{3n}{4} + \frac{5n}{6} = 21$$

$$\frac{6n - 9n + 10n}{12} = 21$$

$$\frac{7n}{12} = 21$$

$$7n = 21 \times 12$$

$$n = \frac{21 \times 12}{7} = 36$$

$$3. x + 7 - \frac{8x}{3} = \frac{17}{6} - \frac{5x}{2}$$

$$\text{Sol: } x + 7 - \frac{8x}{3} = \frac{17}{6} - \frac{5x}{2}$$

LCM of 3,6,2 = 6

Multiply with '6'

$$6 \times x + 6 \times 7 - 6 \times \frac{8x}{3} = 6 \times \frac{17}{6} - 6 \times \frac{5x}{2}$$

$$6x + 42 - 16x = 17 - 15x$$

$$42 - 10x = 17 - 15x$$

$$15x - 10x = 17 - 42$$

$$5x = -25$$

$$x = \frac{-25}{5} = -5$$

$$4. \frac{x - 5}{3} = \frac{x - 3}{5}$$

$$\text{Sol: } \frac{x - 5}{3} = \frac{x - 3}{5}$$

$$5(x - 5) = 3(x - 3)$$

$$5x - 25 = 3x - 9$$

$$5x - 3x = -9 + 25$$

$$2x = 16$$

$$x = \frac{16}{2} = 8$$

$$5. \frac{3t - 2}{4} - \frac{2t + 3}{3} = \frac{2}{3} - t$$

$$\text{Sol: } \frac{3t - 2}{4} - \frac{2t + 3}{3} = \frac{2}{3} - t$$

LCM of 4,3=12

Multiply with '12'

$$12 \times \frac{3t - 2}{4} - 12 \times \frac{2t + 3}{3} = 12 \times \frac{2}{3} - 12 \times t$$

$$3(3t - 2) - 4(2t + 3) = 4 \times 2 - 12t$$

$$9t - 6 - 8t - 12 = 8 - 12t$$

$$t - 18 = 8 - 12t$$

$$t + 12t = 8 + 18$$

$$13t = 26$$

$$t = \frac{26}{13} = 2$$

$$6. m - \frac{m - 1}{2} = 1 - \frac{m - 2}{3}$$

$$\text{Sol: } m - \frac{m - 1}{2} = 1 - \frac{m - 2}{3}$$

LCM of 2,3=6

Multiply with '6'

$$6 \times m - 6 \times \left(\frac{m - 1}{2}\right) = 6 \times 1 - 6 \times \left(\frac{m - 2}{3}\right)$$

$$6m - 3(m - 1) = 6 - 2(m - 2)$$

$$6m - 3m + 3 = 6 - 2m + 4$$

$$3m + 3 = 10 - 2m$$

$$3m + 2m = 10 - 3$$

$$5m = 7$$

$$m = \frac{7}{5}$$

Simplify and solve the following linear equations.

$$7. \quad 3(t - 3) = 5(2t + 1)$$

$$\text{Sol: } 3(t - 3) = 5(2t + 1)$$

$$3t - 9 = 10t + 5$$

$$3t - 10t = 5 + 9$$

$$-7t = 14$$

$$t = \frac{14}{-7} = -2$$

$$\mathbf{8. 15(y - 4) - 2(y - 9) + 5(y + 6) = 0}$$

$$\text{Sol: } 15(y - 4) - 2(y - 9) + 5(y + 6) = 0$$

$$15y - 60 - 2y + 18 + 5y + 30 = 0$$

$$18y - 12 = 0$$

$$18y = 12$$

$$y = \frac{12}{18} = \frac{2}{3}$$

$$\mathbf{9. 3(5z - 7) - 2(9z - 11) = 4(8z - 13) - 17}$$

$$\text{Sol: } 3(5z - 7) - 2(9z - 11) = 4(8z - 13) - 17$$

$$15z - 21 - 18z + 22 = 32z - 52 - 17$$

$$-3z + 1 = 32z - 69$$

$$32z + 3z = 1 + 69$$

$$35z = 70$$

$$z = \frac{70}{35} = 2$$

$$\mathbf{10. 0.25(4f - 3) = 0.05(10f - 9)}$$

$$\text{Sol: } 0.25(4f - 3) = 0.05(10f - 9)$$

$$\frac{25}{100}(4f - 3) = \frac{5}{100}(10f - 9)$$

$$25(4f - 3) = 100 \times \frac{5}{100}(10f - 9)$$

$$100f - 75 = 50f - 45$$

$$100f - 50f = -45 + 75$$

$$50f = 30$$

$$f = \frac{30}{50} = 0.6$$