LINEAR EQUATION IN ONE VARIABLE

SOLUTION OF LINEAR EQUATION

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Solution : A value of the variable which when substituted for the variable in an equation, makes L.H.S. = R.H.S. is said to satisfy the equation and is called a solution or a root of the equation.

Rules for Solving Linear Equations in One Variable :

Rule-1 Same quantity (number) can be added to both sides of an equation without changing the equality.

Rule-2 Same quantity can be subtracted from both sides of an equation without changing the equality.

Rule-3 Both sides of an equation may be multiplied by the same non-zero number without changing the equality.

Rule-4 Both sides of an equation may be divided by the same non-zero number without changing the equality.

Solving Equations having Variable Terms on One Side and Number(s) on the Other Side :

Ex.1 Solve the equation : $\frac{x}{5} + 11 = \frac{1}{15}$ and check the result.

Sol. We have,

$$\frac{x}{5} + 11 = \frac{1}{15} \qquad \Rightarrow \frac{x}{5} + 11 - 11 = \frac{1}{15} - 11$$

[Subtracting 11 from both sides]

$\Rightarrow \frac{x}{5} = \frac{1}{15} - 11$ $\Rightarrow \frac{x}{5} = \frac{1-165}{15}$

$\Rightarrow \frac{x}{5} = -\frac{164}{15}$ $\Rightarrow 5 \times \frac{x}{5} = 5 \times -\frac{164}{15}$

$\Rightarrow x = -\frac{164}{3}$

Thus, $x = -\frac{164}{3}$ is the solution of the given equation.

Check Substituting $x = \frac{-164}{3}$ in the given equation,

we get

L.H.S. $= \frac{x}{5} + 11$

$= \frac{-164}{3} \times \frac{1}{5} + 11 = \frac{-164}{15} + 11$

$= \frac{164+165}{15} = \frac{1}{15}$ and,

R.H.S. $= \frac{1}{15}$

$\therefore$ L.H.S. = R.H.S. for $x = \frac{-164}{3}$

Hence, $x = \frac{-164}{3}$ is the solution of the given equation.

Ex.2 Solve : $\frac{1}{3} x - \frac{5}{2} = 6$

Sol. We have,

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

[Adding $\frac{5}{2}$ on both sides]

$\Rightarrow \frac{1}{3}x = 6 + \frac{5}{2}$ $\Rightarrow \frac{1}{3}x = \frac{12+5}{2}$

$\Rightarrow \frac{1}{3}x = \frac{17}{2}$ $\Rightarrow 3 \times \frac{1}{3}x = 3 \times \frac{17}{2}$

[Multiplying both sides by 3]

$\Rightarrow x = \frac{51}{2}$

Thus, $x = \frac{51}{2}$ is the solution of the given equation.

Check Substituting $x = \frac{51}{2}$ in the given equation, we get

L.H.S.$= \frac{1}{3}x - \frac{5}{2} = \frac{1}{3} \times \frac{51}{2} - \frac{5}{2}$

$= \frac{17}{2} - \frac{5}{2} = \frac{17-5}{2} = \frac{12}{2} = 6$

and, R.H.S. $= 6$

$\therefore$ L.H.S. $=$ R.H.S. for $x = \frac{51}{2}$

Hence, $x = \frac{51}{2}$ is the solution of the given equation.

Ex.3 Solve : $\frac{x}{2} - \frac{x}{3} = 8$

Sol. We have, $\frac{x}{2} - \frac{x}{3} = 8$

LCM of denominators 2 and 3 on L.H.S. is 6. Multiplying both sides by 6, we get

$\Rightarrow 3x - 2x = 6 \times 8$ $\Rightarrow x = 48$

Check Substituting $x = 48$ in the given equation, we get

L.H.S. $= \frac{x}{2} - \frac{x}{3} = \frac{48}{2} - \frac{48}{3} = 24 - 16 = 8$ and,

R.H.S. $= 8$

$\therefore$ L.H.S. $=$ R.H.S. for $x = 48$

Hence, $x = 48$ is the solution of the given equation.

Ex.4 Solve : $\frac{x}{2} + \frac{x}{3} - \frac{x}{4} = 7$

Sol. We have, $\frac{x}{2} + \frac{x}{3} - \frac{x}{4} = 7$

LCM of denominators 2, 3, 4 on L.H.S. is 12. Multiplying both sides by 12, we get

$6x + 4x - 3x = 7 \times 12$

$\Rightarrow 7x = 7 \times 12 \Rightarrow 7x = 84$

$\Rightarrow \frac{7x}{7} = \frac{84}{7}$ [Dividing both sides by 7]

$\Rightarrow x = 12$

Check Substituting $x = 12$ in the given equation, we get

L.H.S. $= \frac{12}{2} + \frac{12}{3} - \frac{12}{4} = 6 + 4 - 3 = 7$

and, R.H.S.$= 7$

$\therefore$ L.H.S. $=$ R.H.S. for $x = 12$.

Hence, $x = 12$ is the solution of the given equation.

Ex.5 Solve : $\frac{y-1}{3} - \frac{y-2}{4} = 1$

Sol. We have, $\frac{y-1}{3} - \frac{y-2}{4} = 1$

LCM of denominators 3 and 4 on L.H.S. is 12.

Multiplying both sides by 12, we get

$12 \times \left(\frac{y-1}{3}\right) - 12 \times \left(\frac{y-2}{4}\right) = 12 \times 1$

$\Rightarrow$ 4 (y – 1) – 3(y – 2) = 12

$\Rightarrow$ 4y – 4 – 3y + 6 = 12

$\Rightarrow$ 4y – 3y – 4 + 6 =12

$\Rightarrow$ y + 2 = 12

$\Rightarrow$ y + 2 – 2 = 12 – 2 [Subtracting 2 from both sides]

$\Rightarrow$ y = 10

Thus, y = 10 is the solution of the given equation.

Check Substituting y = 10 in the given equation, we get

L.H.S. = $\frac{10-1}{3} - \frac{10-2}{3} = \frac{9}{3} - \frac{8}{4} = 3 - 2 = 1$

and, R.H.S. = 1

$\therefore$ L.H.S. = R.H.S. for y = 10.

Hence, y = 10 is the solution of the given equation.