Question 1.

State which of the following are equations with a variable. In case of an equation with a variable, identify the variable.

(i) 17 + x = 5

(ii) 2b − 3 = 7

(iii) (y − 7) > 5

(iv) $\frac{9}{3} = 3$

(v) 7 × 3 − 19 = 2

(vi) 5 × 4 − 8 = 31

(vii) 2p < 15

(viii) 7 = 11 × 5 − 12 × 4

(ix) $\frac{3}{2}q = 5$

Solution:

(i) 17 + x= 5 Is an equation → L.H.S. = R.H.S. → Related variable x.

(ii) 2b − 3 = 7 Is an equation → L.H.S. = R.H.S. → Related variable b.

(iii) (y− 7) >5

Is not an equation → L.H.S. ≠ R.H.S.

It has no sign of equality (=).

(iv) $\frac{9}{3} = 3$

Is an equation = L.H.S. = R.H.S.

It has no variable.

(v) 7 × 3 − 19 = 2

Is an numerical equation = L.H.S. = R.H.S. It has no variable.

(vi) 5 × 4 − 8 = 31

Is an equation = L.H.S. = R.H.S. → Related variable t.

(vii) 2p < 15

Is not an equation = L.H.S. ≠ R.H.S.

It has no sign of equality.

(viii) 7 = 11 × 5 – 12 × 4

Is an numerical equation = L.H.S. = R.H.S. It has no variable.

(ix) $\frac{3}{2}q = 5$

Is an equation → L.H.S. = R.H.S. → Related variable q.

Question 2.

Solve each of the following equations :

(i) x + 6 = 8

(ii) 2 – x = 5

(iii) 4x = –6

(iv) $\frac{x}{2} = 5$

(v) 2y – 3 = 2

(vi) 4 – 5y = 2

Solution:

(i) x + 6 = 8

= x = 8 – 6 ⇒ x = 2

(ii) 2 – x = 5

= –x = 5 – 2 ⇒ –x = 3 ⇒ x = – 3

(iii) 4x = –6

$= x = \frac{-6}{4} = \frac{-3}{2}$

(iv) $\frac{x}{2} = 5$

= x = 5 × 2 ⇒ x = 10

(v) 2y – 3 = 2

= 2y = 2 + 3 ⇒ 2y = 5 ⇒ y = $\frac{5}{2}$

(vi) 4 – 5y = 2

= 4 – 2 = 5y ⇒ 5y = 2

⇒ y = $\frac{2}{5}$

Question 3.

Solve the following linear equations:

(i) 5(x + 1) = 25

(ii)2(3x − 1) = 10

(iii) $\frac{3x-1}{4} = 11$

Solution:

(i) Givrn 5(x + 1) = 25

$\Rightarrow \frac{5(x+1)}{5} = \frac{25}{5}$ (dividing both sides by 5)

⇒ x + 1 = 5

⇒ x + 1 − 1 = 5 − 1 (Subtracting 1 from both sides)

⇒ x = 4

(ii) 2(3x − 1) = 10

$\Rightarrow \left(\frac{2(3x-1)}{2}\right) = \frac{10}{2}$ (dividing both sides by 2)

⇒ 3x − 1 = 5

⇒ 3x − 1 + 1 = 5 + 1 (adding 1 to both sides)

⇒ 3x = 6

$\Rightarrow \frac{3x}{3} = \frac{6}{3}$ (dividing both sides by 3)

⇒ x = 2

(iii) Given $\frac{3x-1}{4} = 11$

$\Rightarrow 4 \times \frac{3x-1}{4} = 4 \times 11$ (multiplying both sides by 4)

⇒ 3x − 1 = 44

⇒ 3x − 1 + 1 = 44 + 1 (adding 1 to both sides)

⇒ 3x = 45

$\Rightarrow \frac{3x}{3} = \frac{45}{3}$ (dividing both sides by 3)

⇒ x = 15

Question 4.

Solve the following linear equations:

(i) $5x - 6 = 12 - x$ (ii) $\frac{n}{3} + 1 = 4 - n$

(iii) $5p + 7 = 19 - 2p$ (iv) $2x + \frac{5}{2} = \frac{2}{3} - x$

(v) $\frac{x}{2} - 5 = \frac{x}{3} - 4$ (vi) $18 - \frac{3y}{4} = 11 + y$

Solution:

(i) 5x − 6 = 12 − x

⇒ 5x + x = 12 + 6

$6x = 18 \Rightarrow x = \frac{18}{6} = 3$

Verification

5x − 6 = 12 − x ⇒ 5(3) − 6 = 12 − 3

⇒ 15 − 6 = 9 ⇒ 9 = 9

(ii) $\frac{n}{3} + 1 = 4 - n$

$$\frac{n+3}{3} = \frac{4-n}{1}$$

⇒ 3(4 − n) = 1 (n + 3)

⇒ 12 − 3n = n + 3

⇒ −3 n − n = 3 − 12 ⇒ −4n = − 9

$\Rightarrow n = \frac{-9}{-4} = \frac{9}{4}$

Verification

$$\Rightarrow \frac{n}{3} + 1 = 4 - n \Rightarrow \frac{\frac{9}{4}}{3} + 1 = 4 - \frac{9}{4}$$

$$\Rightarrow \frac{9}{4} \times \frac{1}{3} + 1 = \frac{16-9}{4} \Rightarrow \frac{3}{4} + 1 \Rightarrow \frac{7}{4} = \frac{7}{4}$$

(iii) 5p + 7 = 19 − 2p

⇒ 5p + 2p = 19 − 7 ⇒ 7p = 12

$\Rightarrow p = \frac{12}{7}$

Verification

$$5p + 7 = 19 - 2p \Rightarrow 5\left(\frac{12}{7}\right) + 7 = 19 - 2\left(\frac{12}{7}\right)$$

$$\Rightarrow \frac{60}{7} + 7 = 19 - \frac{24}{7} \Rightarrow \frac{60+49}{7} = \frac{133-24}{7}$$

$$\Rightarrow \frac{109}{7} = \frac{109}{7}$$

(iv) $2x + \frac{5}{2} = \frac{2}{3} - x$

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

⇒ 3(4x + 5) = 2(2 − 3x)

⇒ 12x + 15 = 4 − 6x

⇒ 12x + 6x = 4 − 15

⇒ 18x = −11 ⇒ x = $\frac{-11}{18}$

Verification

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

$$\Rightarrow 2\left(\frac{-11}{18}\right) + \frac{5}{2} = \frac{2}{3} - \frac{-11}{18}$$

$$\Rightarrow \frac{-22}{18} + \frac{5}{2} = \frac{2}{3} + \frac{11}{18}$$

$$\Rightarrow \frac{-22+45}{18} = \frac{12+11}{18}$$

$$\Rightarrow \frac{23}{18} = \frac{23}{18}$$

(v) $\frac{x}{2} - 5 = \frac{x}{3} - 4$

$\Rightarrow \frac{x-10}{2} = \frac{x-12}{3}$

$\Rightarrow 3(x - 10) = 2(x - 12)$

$\Rightarrow 3x - 30 = 2x - 24$

$\Rightarrow 3x - 2x = -24 + 30 \Rightarrow x = 6$

Verification

$$\Rightarrow \frac{x}{2} - 5 = \frac{x}{3} - 4$$

$$\Rightarrow \frac{6}{2} - 5 = \frac{6}{3} - 4$$

$$\Rightarrow 3 - 5 = 2 - 4 \Rightarrow -2 = -2$$

$$(vi)\ 18 - \frac{3y}{4} = 11 + y$$

$$\Rightarrow \frac{72 - 3y}{4} = 11 + y$$

$\Rightarrow 72 - 3y = 44 + 4y$ (cross multiplication)

$\Rightarrow -3y - 4y = 44 - 72 \Rightarrow -7y = -28$

$$\Rightarrow y = \frac{-28}{-7} = 4$$

Verification

$$18 - \frac{3y}{4} = 11 + y$$

$$\Rightarrow 18 - \frac{3 \times 4}{4} = 11 + 4$$

$\Rightarrow 18 - 3 = 15$

$\Rightarrow 15 = 15$

Question 5.

Solve the following equations and verify your answers:

(i) 3(x + 7) = 18

(ii) 2(x– 1) = x + 2

(iii) $3x - \frac{1}{3} = 2\left(x - \frac{1}{2}\right) + 5$

(iv) 4(2x – 1) –2(x – 5) = 5(x + 1) + 3

Solution:

(i) 3(x + 7) = 18

⇒ 3x + 21 = 18

⇒ 3x = 18 – 21 ⇒ 3x = –3 ⇒ x = $\frac{-3}{3}$

⇒ x = –1

Verification

⇒ 3(x + 7) = 18 ⇒ 3(–1 + 7) = 18 ⇒ 3(6)= 18

⇒ 18 = 18

(ii) 2(x – 1) = x + 2

⇒ 2x – 2 = x + 2

⇒ 2x – x = 2 + 2

⇒ x = 4

Verification

⇒ 2(x – 1) = x + 2

⇒ 2(4– 1) = 4 + 2

⇒ 2(3) = 6 ⇒ 6 = 6

(iii) $3x-\frac{1}{3}=2\left(x-\frac{1}{2}\right)+5$

$\frac{9x-1}{3}=2\left(\frac{2x-1}{2}\right)+5$

$$\Rightarrow \frac{9x-1}{3}=\frac{4x-2}{2}+5 \Rightarrow \frac{9x-1}{3}=\frac{4x-2+10}{2}$$

$\Rightarrow 2(9x - 1) = 3(4x - 2 + 10)$

$\Rightarrow 18x - 2 = 3(4x + 8)$

$\Rightarrow 18x - 2 = 12x + 24$

$\Rightarrow 18x - 12x = 24 + 2$

$\Rightarrow 6x = 26 \Rightarrow x = \frac{26}{6} = \frac{13}{3} = 4\frac{1}{3}$

Verification

$$\Rightarrow 3x-\frac{1}{3}=2\left(x-\frac{1}{2}\right)+5$$

$$\Rightarrow 3\left(\frac{13}{3}\right)-\frac{1}{3}=2\left(\frac{13}{3}-\frac{1}{2}\right)+5$$

$$\Rightarrow 13-\frac{1}{3}=2\left(\frac{26-3}{6}\right)+5$$

$$\Rightarrow \frac{39-1}{3}=2\left(\frac{23}{6}\right)+5$$

$$\Rightarrow \frac{38}{3}=\frac{23}{3}+5$$

$$\Rightarrow \frac{38}{3}=\frac{23+15}{3} \Rightarrow \frac{38}{3}=\frac{38}{3}$$

(iv) $4(2x - 1) - 2(x - 5) = 5(x + 1) + 3$

$8x - 4 - 2x + 10 = 5x + 5 + 3$

$\Rightarrow 8x - 2x - 4 + 10 = 5x + 5 + 3$

$\Rightarrow 6x - 5x = 8 - 6 \Rightarrow x = 2 \Rightarrow x = 2$

Verification

$4(2x - 1) - 2(x - 5) = 5(x + 1) + 3$

$\Rightarrow 4(2 \times 2 - 1) - 2(2 - 5) = 5(2 + 1) + 3$

$\Rightarrow 4(4 - 1) - 2(-3) = 5(3) + 3$

$\Rightarrow 4 \times 3 + 6 = 15 + 3$

$\Rightarrow 12 + 6 = 18$

$\Rightarrow 18 = 18$