

Exercise – 10A

1.

Sol:

(i) $(x^2 - x + 3)$ is a quadratic polynomial

$\therefore x^2 - x + 3 = 0$ is a quadratic equation.

(ii) Clearly, $\left(2x^2 + \frac{5}{2}x - \sqrt{3}\right)$ is a quadratic polynomial.

$\therefore 2x^2 + \frac{5}{2}x - \sqrt{3} = 0$ is a quadratic equation.

(iii) Clearly, $(\sqrt{2}x^2 + 7x + 5\sqrt{2})$ is a quadratic polynomial.

$\therefore \sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$ is a quadratic equation.

(iv) Clearly, $\left(\frac{1}{3}x^2 + \frac{1}{5}x - 2\right)$ is a quadratic polynomial.

$\therefore \frac{1}{3}x^2 + \frac{1}{5}x - 2 = 0$ is a quadratic equation.

(v) $(x^2 - 3x - \sqrt{x} + 4)$ contains a term with $\sqrt{x}$, i.e., $x^{\frac{1}{2}}$, where $\frac{1}{2}$ is not an integer. Therefore, it is not a quadratic polynomial.

$\therefore x^2 - 3x - \sqrt{x} + 4 = 0$ is not a quadratic equation.

(vi) $x - \frac{6}{x} = 3$

$$\Rightarrow x^2 - 6 = 3x$$

$$\Rightarrow x^2 - 3x - 6 = 0$$

$(x^2 - 3x - 6)$ is not a quadratic polynomial; therefore, the given equation is quadratic.

(vii) $x^2 + \frac{2}{x} = x^2$

$$\Rightarrow x^2 + 2 = x^3$$

$$\Rightarrow x^3 - x^2 - 2 = 0$$

$(x^3 - x^2 - 2)$ is not a quadratic polynomial.

$\therefore x^3 - x^2 - 2 = 0$ is not a quadratic equation.

(viii) $x^2 - \frac{1}{x^2} = 5$

$$\Rightarrow x^4 - 1 = 5x^2$$

$$\Rightarrow x^4 - 5x^2 - 1 = 0$$

$(x^4 - 5x^2 - 1)$ is a polynomial with degree 4.

$\therefore x^4 - 5x^2 - 1 = 0$ is not a quadratic equation.

(ix) $(x+2)^3 = x^3 - 8$

$$\Rightarrow x^3 + 6x^2 + 12x + 8 = x^3 - 8$$

$$\Rightarrow 6x^2 + 12x + 16 = 0$$

This is of the form $ax^2 + bx + c = 0$

Hence, the given equation is a quadratic equation.

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

$$\Rightarrow 6x^2 + 4x + 9x + 6 = 6(x^2 - 3x + 2)$$

$$\Rightarrow 6x^2 + 13x + 6 = 6x^2 - 18x + 12$$

$$\Rightarrow 31x - 6 = 0$$

This is of the form $ax^2 + bx + c = 0$

Hence, the given equation is not a quadratic equation.

(xi) $\left(x + \frac{1}{x}\right)^2 = 2\left(x + \frac{1}{x}\right) + 3$

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

$$\Rightarrow (x^2+1)^2 = 2x(x^2+1) + 3x^2$$

$$\Rightarrow x^4 + 2x^2 + 1 = 2x^3 + 2x + 3x^2$$

$$\Rightarrow x^4 - 2x^3 - x^2 - 2x + 1 = 0$$

This is not of the form $ax^2 + bx + c = 0$

Hence, the given equation is not a quadratic equation.

2.

Sol:

The given equation is $(3x^2 + 2x - 1 = 0)$.

(i) $x = (-1)$

$$\begin{aligned}\text{L.H.S.} &= x^2 + 2x - 1 \\ &= 3 \times (-1)^2 + 2 \times (-1) - 1 \\ &= 3 - 2 - 1 \\ &= 0 \\ &= \text{R.H.S.}\end{aligned}$$

Thus, (-1) is a root of $(3x^2 + 2x - 1 = 0)$.

(ii) On subtracting $x = \frac{1}{3}$ in the given equation, we get:

$$\begin{aligned}\text{L.H.S.} &= 3x^2 + 2x - 1 \\ &= 3 \times \left(\frac{1}{3}\right)^2 + 2 \times \frac{1}{3} - 1 \\ &= 3 \times \frac{1}{9} + \frac{2}{3} - 1 \\ &= \frac{1 + 2 - 3}{3} \\ &= \frac{0}{3} \\ &= 0 \\ &= \text{R.H.S.}\end{aligned}$$

Thus, $\left(\frac{1}{3}\right)$ is a root of $(3x^2 + 2x - 1 = 0)$

(iii) On subtracting $x = \left(-\frac{1}{2}\right)$ in the given equation, we get

$$\begin{aligned}\text{L.H.S.} &= 3x^2 + 2x - 1 \\ &= 3 \times \left(-\frac{1}{2}\right)^2 + 2 \times \left(-\frac{1}{2}\right) - 1 \\ &= 3 \times \frac{1}{4} - 1 - 1\end{aligned}$$

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

$$= -\frac{3-8}{4}$$

$$= \frac{-5}{4} \neq 0$$

Thus, $L.H.S = R.H.S.$

Hence, $\left(-\frac{1}{2}\right)$ is a solution of $(3x^2 + 2x - 1 = 0)$.

3.

Sol:

It is given that $(x=1)$ is a root of $(x^2 + kx + 3 = 0)$.

Therefore, $(x=1)$ must satisfy the equation.

$$\Rightarrow (1)^2 + k \times 1 + 3 = 0$$

$$\Rightarrow k + 4 = 0$$

$$\Rightarrow k = -4$$

Hence, the required value of k is -4 .

4.

Sol:

It is given that $\frac{3}{4}$ is a root of $ax^2 + bx - 6 = 0$; therefore, we have:

$$a \times \left(\frac{3}{4}\right)^2 + b \times \frac{3}{4} - 6 = 0$$

$$\Rightarrow \frac{9a}{16} + \frac{3b}{4} = 6$$

$$\Rightarrow \frac{9a + 12b}{16} = 6$$

$$\Rightarrow 9a + 12b - 96 = 0$$

$$\Rightarrow 3a + 4b = 32 \quad \dots\dots\dots(i)$$

Again, (-2) is a root of $ax^2 + bx - 6 = 0$; therefore, we have:

$$a \times (-2)^2 + b \times (-2) - 6 = 0$$

$$\Rightarrow 4a - 2b = 6$$

$$\Rightarrow 2a - b = 3 \quad \text{.....(ii)}$$

On multiplying (ii) by 4 and adding the result with (i), we get:

$$\Rightarrow 3a + 4b + 8a - 4b = 32 + 12$$

$$\Rightarrow 11a = 44$$

$$\Rightarrow a = 4$$

Putting the value of a in (ii), we get:

$$2 \times 4 - b = 3$$

$$\Rightarrow 8 - b = 3$$

$$\Rightarrow b = 5$$

Hence, the required values of a and b are 4 and 5, respectively.

5.

Sol:

$$(2x-3)(3x+1)=0$$

$$\Rightarrow 2x-3=0 \text{ or } 3x+1=0$$

$$\Rightarrow 2x=3 \text{ or } 3x=-1$$

$$\Rightarrow x = \frac{3}{2} \text{ or } x = -\frac{1}{3}$$

Hence the roots of the given equation are $\frac{3}{2}$ and $-\frac{1}{3}$.

6.

Sol:

$$4x^2 + 5x = 0$$

$$\Rightarrow x(4x+5)=0$$

$$\Rightarrow x=0 \text{ or } 4x+5=0$$

$$\Rightarrow x=0 \text{ or } x = -\frac{5}{4}$$

Hence, the roots of the given equation are 0 and $-\frac{5}{4}$.

7.

Sol:

Given:

$$3x^2 - 243 = 0$$

$$\Rightarrow 3(x^2 - 81) = 0$$

$$\Rightarrow (x)^2 - (9)^2 = 0$$

$$\Rightarrow (x+9)(x-9) = 0$$

$$\Rightarrow x+9 = 0 \text{ or } x-9 = 0$$

$$\Rightarrow x = -9 \text{ or } x = 9$$

Hence, -9 and 9 are the roots of the equation

8.

Sol:

We write, $x = 4x - 3x$ as $2x^2 \times (-6) = -12x^2 = 4x \times (-3x)$

$$\therefore 2x^2 + x - 6 = 0$$

$$\Rightarrow 2x^2 + 4x - 3x - 6 = 0$$

$$\Rightarrow 2x(x+2) - 3(x+2) = 0$$

$$\Rightarrow (x+2)(2x-3) = 0$$

$$\Rightarrow x+2 = 0 \text{ or } 2x-3 = 0$$

$$\Rightarrow x = -2 \text{ or } x = \frac{3}{2}$$

Hence, the roots of the given equation are -2 and $\frac{3}{2}$.

9.

Sol:

We write, $6x = x + 5x$ as $x^2 \times 5 = 5x^2 = x \times 5x$

$$\therefore x^2 + 6x + 5 = 0$$

$$\Rightarrow x^2 + x - 5x + 5 = 0$$

$$\Rightarrow x(x+1)+5(x+1)=0$$

$$\Rightarrow (x+1)(x+5)=0$$

$$\Rightarrow x+1=0 \text{ or } x+5=0$$

$$\Rightarrow x=-1 \text{ or } x=-5$$

Hence, the roots of the given equation are -1 and -5 .

10.

Sol:

We write, $-3x = 3x - 6x$ as $9x^2 \times (-2) = -18x^2 = 3x \times (-6x)$

$$\therefore 9x^2 - 3x - 2 = 0$$

$$\Rightarrow 9x^2 + 3x - 6x - 2 = 0$$

$$\Rightarrow 3x(3x+1) - 2(3x+1) = 0$$

$$\Rightarrow (3x+1)(3x-2) = 0$$

$$\Rightarrow 3x+1=0 \text{ or } 3x-2=0$$

$$\Rightarrow x = -\frac{1}{3} \text{ or } x = \frac{2}{3}$$

Hence, the roots of the given equation are $-\frac{1}{3}$ and $\frac{2}{3}$.

11.

Sol:

Given:

$$x^2 + 12x + 35 = 0$$

$$\Rightarrow x^2 + 7x + 5x + 35 = 0$$

$$\Rightarrow x(x+7) + 5(x+7) = 0$$

$$\Rightarrow (x+5)(x+7) = 0$$

$$\Rightarrow x+5=0 \text{ or } x+7=0$$

$$\Rightarrow x=-5 \text{ or } x=-7$$

Hence, -5 and -7 are the roots of the equation $x^2 + 12x + 35 = 0$.

12.

Sol:

Given

$$x^2 = 18x - 77$$

$$\Rightarrow x^2 - 18x + 77 = 0$$

$$\Rightarrow x^2 - (11x + 7x) + 77 = 0$$

$$\Rightarrow x^2 - 11x - 7x + 77 = 0$$

$$\Rightarrow x(x - 11) - 7(x - 11) = 0$$

$$\Rightarrow (x - 7)(x - 11) = 0$$

$$\Rightarrow x - 7 = 0 \text{ or } x - 11 = 0$$

$$\Rightarrow x = 7 \text{ or } x = 11$$

Hence, 7 and 11 are the roots of the equation $x^2 = 18x - 77$.

13.

Sol:

Given:

$$6x^2 + 11x + 3 = 0$$

$$\Rightarrow 6x^2 + 9x + 2x + 3 = 0$$

$$\Rightarrow 3x(2x + 3) + 1(2x + 3) = 0$$

$$\Rightarrow (3x + 1)(2x + 3) = 0$$

$$\Rightarrow 3x + 1 = 0 \text{ or } 2x + 3 = 0$$

$$\Rightarrow x = \frac{-1}{3} \text{ or } x = \frac{-3}{2}$$

Hence, $\frac{-1}{3}$ and $\frac{-3}{2}$ are the roots of the equation

14.

Sol:

Given:

$$6x^2 + x - 12 = 0$$

$$\Rightarrow 6x^2 + 9x - 8x - 12 = 0$$

$$\Rightarrow 3x(2x + 3) - 4(2x + 3) = 0$$

$$\Rightarrow (3x - 4)(2x + 3) = 0$$

$$\Rightarrow 3x - 4 = 0 \text{ or } 2x + 3 = 0$$

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

Hence, $\frac{4}{3}$ and $\frac{-3}{2}$ are the roots of the equation

15.

Sol:

We write, $-2x = -3x + x$ as $3x^2 \times (-1) = -3x^2 = (-3x) \times x$

$$\therefore 3x^2 - 2x - 1 = 0$$

$$\Rightarrow 3x^2 - 3x + x - 1 = 0$$

$$\Rightarrow 3x(x-1) + 1(x-1) = 0$$

$$\Rightarrow (x-1)(3x+1) = 0$$

$$\Rightarrow x-1 = 0 \text{ or } 3x+1 = 0$$

$$\Rightarrow x = 1 \text{ or } x = -\frac{1}{3}$$

Hence, the roots of the given equation are 1 and $-\frac{1}{3}$.

16.

Sol:

Given:

$$4x^2 - 9x = 100$$

$$\Rightarrow 4x^2 - 9x - 100 = 0$$

$$\Rightarrow 4x^2 - (25x - 16x) - 100 = 0$$

$$\Rightarrow 4x^2 - 25x + 16x - 100 = 0$$

$$\Rightarrow x(4x - 25) + 4(4x - 25) = 0$$

$$\Rightarrow (4x - 25)(x + 4) = 0$$

$$\Rightarrow 4x - 25 = 0 \text{ or } x + 4 = 0$$

$$\Rightarrow x = \frac{25}{4} \text{ or } x = -4$$

Hence, the roots of the equation are $\frac{25}{4}$ and -4 .

17.

Sol:

Given:

$$15x^2 - 28 = x$$

$$\Rightarrow 15x^2 - x - 28 = 0$$

$$\Rightarrow 15x^2 - (21x - 20x) - 28 = 0$$

$$\Rightarrow 15x^2 - 21x + 20x - 28 = 0$$

$$\Rightarrow 3x(5x-7)+4(5x-7)=0$$

$$\Rightarrow (3x+4)(5x-7)=0$$

$$\Rightarrow 3x+4=0 \text{ or } 5x-7=0$$

$$\Rightarrow x = \frac{-4}{3} \text{ or } x = \frac{7}{5}$$

Hence, the roots of the equation are $\frac{-4}{3}$ and $\frac{7}{5}$.

18.

Sol:

Given:

$$4-11x=3x^2$$

$$\Rightarrow 3x^2+11x-4=0$$

$$\Rightarrow 3x^2+12x-x-4=0$$

$$\Rightarrow 3x(x+4)-1(x+4)=0$$

$$\Rightarrow (x+4)(3x-1)=0$$

$$\Rightarrow x+4=0 \text{ or } 3x-1=0$$

$$\Rightarrow x = -4 \text{ or } x = \frac{1}{3}$$

Hence, the roots of the equation are -4 and $\frac{1}{3}$.

19.

Sol:

Given:

$$48x^2-13x-1=0$$

$$\Rightarrow 48x^2-(16x-3x)-1=0$$

$$\Rightarrow 48x^2-16x+3x-1=0$$

$$\Rightarrow 16x(3x-1)+1(3x-1)=0$$

$$\Rightarrow (16x+1)(3x-1)=0$$

$$\Rightarrow 16x+1=0 \text{ or } 3x-1=0$$

$$\Rightarrow x = \frac{-1}{16} \text{ or } x = \frac{1}{3}$$

Hence, the roots of the equation are $\frac{-1}{16}$ and $\frac{1}{3}$.

20.

Sol:

We write:

$$2\sqrt{2}x = 3\sqrt{2}x - \sqrt{2}x \text{ as } x^2 \times (-6) = -6x^2 = 3\sqrt{2}x \times (-\sqrt{2}x)$$

$$\therefore x^2 + 2\sqrt{2}x - 6 = 0$$

$$\Rightarrow x^2 + 2\sqrt{2}x - \sqrt{2}x - 6 = 0$$

$$\Rightarrow x(x + 3\sqrt{2}) - \sqrt{2}(x + 3\sqrt{2}) = 0$$

$$\Rightarrow (x + 3\sqrt{2})(x - \sqrt{2}) = 0$$

$$\Rightarrow x + 3\sqrt{2} = 0 \text{ or } x - \sqrt{2} = 0$$

$$\Rightarrow x = -3\sqrt{2} \text{ or } x = \sqrt{2}$$

Hence, the roots of the given equation are $-3\sqrt{2}$ and $\sqrt{2}$

21.

Sol:

We write: $10x = 3x + 7x$ as $\sqrt{3}x^2 \times 7\sqrt{3} = 21x^2 = 3x \times 7x$

$$\therefore \sqrt{3}x^2 + 10x + 7\sqrt{3} = 0$$

$$\Rightarrow \sqrt{3}x^2 + 3x + 7x + 7\sqrt{3} = 0$$

$$\Rightarrow \sqrt{3}x(x + \sqrt{3}) + 7(x + \sqrt{3}) = 0$$

$$\Rightarrow (x + \sqrt{3})(\sqrt{3}x + 7) = 0$$

$$\Rightarrow x + \sqrt{3} = 0 \text{ or } \sqrt{3}x + 7 = 0$$

$$\Rightarrow x = -\sqrt{3} \text{ or } x = -\frac{7}{\sqrt{3}} = -\frac{7\sqrt{3}}{3}$$

Hence, the roots of the given equation are $-\sqrt{3}$ and $-\frac{7\sqrt{3}}{3}$.

22.

Sol:

Given:

$$\sqrt{3}x^2 + 11x + 6\sqrt{3} = 0$$

$$\Rightarrow \sqrt{3}x^2 + 9x + 2x + 6\sqrt{3} = 0$$

$$\Rightarrow \sqrt{3}x(x + 3\sqrt{3}) + 2(x + 3\sqrt{3}) = 0$$

$$\Rightarrow (x + 3\sqrt{3})(\sqrt{3}x + 2) = 0$$

$$\Rightarrow x + 3\sqrt{3} = 0 \text{ or } \sqrt{3}x + 2 = 0$$

$$\Rightarrow x = -3\sqrt{3} \text{ or } x = \frac{-2}{\sqrt{3}} = \frac{-2 \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{-2\sqrt{3}}{3}$$

Hence, the roots of the equation are $-3\sqrt{3}$ and $\frac{-2\sqrt{3}}{3}$.

23.

Sol:

Given:

$$3\sqrt{7}x^2 + 4x - \sqrt{7} = 0$$

$$\Rightarrow 3\sqrt{7}x^2 + 7x - 3x - \sqrt{7} = 0$$

$$\Rightarrow \sqrt{7}x(3x + \sqrt{7}) - 1(3x + \sqrt{7}) = 0$$

$$\Rightarrow (3x + \sqrt{7})(\sqrt{7} - 1) = 0$$

$$\Rightarrow 3x + \sqrt{7} = 0 \text{ or } \sqrt{7}x - 1 = 0$$

$$\Rightarrow x = \frac{-\sqrt{7}}{3} \text{ or } x = \frac{1}{\sqrt{7}} = \frac{1 \times \sqrt{7}}{\sqrt{7} \times \sqrt{7}} = \frac{\sqrt{7}}{7}$$

Hence, the roots of the equation are $\frac{-\sqrt{7}}{3}$ and $\frac{\sqrt{7}}{7}$.

24.

Sol:

We write, $-6x = 7x - 13x$ as $\sqrt{7}x^2 \times (-13\sqrt{7}) = -91x^2 = 7x \times (-13x)$

$$\therefore \sqrt{7}x^2 - 6x - 13\sqrt{7} = 0$$

$$\Rightarrow \sqrt{7}x^2 + 7x - 13x - 13\sqrt{7} = 0$$

$$\Rightarrow \sqrt{7}x(x + \sqrt{7}) - 13(x + \sqrt{7}) = 0$$

$$\Rightarrow (x + \sqrt{7})(\sqrt{7}x - 13) = 0$$

$$\Rightarrow x + \sqrt{7} = 0 \text{ or } \sqrt{7}x - 13 = 0$$

$$\Rightarrow x = -\sqrt{7} \text{ or } x = \frac{13}{\sqrt{7}} = \frac{13\sqrt{7}}{7}$$

Hence, the roots of the given equation are $-\sqrt{7}$ and $\frac{13\sqrt{7}}{7}$.

25.

Sol:

Given:

$$4\sqrt{6}x^2 - 13x - 2\sqrt{6} = 0$$

$$\Rightarrow 4\sqrt{6}x^2 - 16x + 3x - 2\sqrt{6} = 0$$

$$\Rightarrow 4\sqrt{2}x(\sqrt{3}x - 2\sqrt{2}) + \sqrt{3}(\sqrt{3}x - 2\sqrt{2}) = 0$$

$$\Rightarrow (4\sqrt{2}x + \sqrt{3})(\sqrt{3}x - 2\sqrt{2}) = 0$$

$$\Rightarrow 4\sqrt{2}x + \sqrt{3} = 0 \text{ or } \sqrt{3}x - 2\sqrt{2} = 0$$

$$\Rightarrow x = \frac{-\sqrt{3}}{4\sqrt{2}} = \frac{-\sqrt{3} \times \sqrt{2}}{4\sqrt{2} \times \sqrt{2}} = \frac{-\sqrt{6}}{8} \text{ or } x = \frac{2\sqrt{2}}{\sqrt{3}} = \frac{2\sqrt{2} \times \sqrt{3}}{\sqrt{3} \times \sqrt{3}} = \frac{2\sqrt{6}}{3}$$

Hence, the roots of the equation are $\frac{-\sqrt{6}}{8}$ and $\frac{2\sqrt{6}}{3}$.

26.

Sol:

We write, $-2\sqrt{6}x = -\sqrt{6}x$ and $3x^2 \times 2 = 6x^2 = (-\sqrt{6}x) \times (-\sqrt{6}x)$

$$\therefore 3x^2 - 2\sqrt{6}x + 2 = 0$$

$$\Rightarrow 3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$$

$$\Rightarrow \sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$$

$$\Rightarrow (\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$$

$$\Rightarrow (\sqrt{3}x - \sqrt{2})^2 = 0$$

$$\Rightarrow \sqrt{3}x - \sqrt{2} = 0$$

$$\Rightarrow x = \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{6}}{3}$$

Hence, $\frac{\sqrt{6}}{3}$ is the repeated root of the given equation.

27.

Sol:

We write, $-2\sqrt{2}x = -3\sqrt{2}x + \sqrt{2}x$ as $\sqrt{3}x^2 \times (-2\sqrt{3}) = -6x^2 = (-3\sqrt{2}x) \times (\sqrt{2}x)$

$$\therefore \sqrt{3}x^2 - 2\sqrt{2}x - 2\sqrt{3} = 0$$

$$\begin{aligned}
&\Rightarrow \sqrt{3}x^2 - 3\sqrt{2}x + \sqrt{2}x - 2\sqrt{3} = 0 \\
&\Rightarrow \sqrt{3}x(x - \sqrt{6}) + \sqrt{2}(x - \sqrt{6}) = 0 \\
&\Rightarrow (x - \sqrt{6})(\sqrt{3}x + \sqrt{2}) = 0 \\
&\Rightarrow x - \sqrt{6} = 0 \text{ or } \sqrt{3}x + \sqrt{2} = 0 \\
&\Rightarrow x - \sqrt{6} = 0 \text{ or } x = -\frac{\sqrt{2}}{\sqrt{3}} = -\frac{\sqrt{6}}{3}
\end{aligned}$$

Hence, the roots of the given equation are $\sqrt{6}$ and $-\frac{\sqrt{6}}{3}$.

28.

Sol:

We write, $-3\sqrt{5}x = -2\sqrt{5}x - \sqrt{5}x$ as $x^2 \times 10 = 10x^2 = (-2\sqrt{5}x) \times (-\sqrt{5}x)$

$$\begin{aligned}
&\therefore x^2 - 3\sqrt{5}x + 10 = 0 \\
&\Rightarrow x^2 - 2\sqrt{5}x - \sqrt{5}x + 10 = 0 \\
&\Rightarrow x(x - 2\sqrt{5}) - \sqrt{5}(x - 2\sqrt{5}) = 0 \\
&\Rightarrow (x - 2\sqrt{5})(x - \sqrt{5}) = 0 \\
&\Rightarrow x(x - 2\sqrt{5}) - \sqrt{5}(x - 2\sqrt{5}) = 0
\end{aligned}$$

Hence, the roots of the given equation are $\sqrt{5}$ and $2\sqrt{5}$.

29.

Sol:

$$\begin{aligned}
&x^2 - (\sqrt{3} + 1)x + \sqrt{3} = 0 \\
&\Rightarrow x^2 - \sqrt{3}x - x + \sqrt{3} = 0 \\
&\Rightarrow x(x - \sqrt{3}) - 1(x - \sqrt{3}) = 0 \\
&\Rightarrow (x - \sqrt{3})(x - 1) = 0 \\
&\Rightarrow x - \sqrt{3} = 0 \text{ or } x - 1 = 0 \\
&\Rightarrow x = \sqrt{3} \text{ or } x = 1
\end{aligned}$$

Hence, 1 and $\sqrt{3}$ are the roots of the given equation.

30.

Sol:

We write, $3\sqrt{3}x = 5\sqrt{3}x - 2\sqrt{3}x$ as $x^2 \times (-30) = -30x^2 = 5\sqrt{3}x \times (-2\sqrt{3}x)$

$$\therefore x^2 + 3\sqrt{3}x - 30 = 0$$

$$\Rightarrow x^2 + 5\sqrt{3}x - 2\sqrt{3}x - 30 = 0$$

$$\Rightarrow x(x + 5\sqrt{3}) - 2\sqrt{3}(x + 5\sqrt{3}) = 0$$

$$\Rightarrow (x + 5\sqrt{3})(x - 2\sqrt{3}) = 0$$

$$\Rightarrow x + 5\sqrt{3} = 0 \text{ or } x - 2\sqrt{3} = 0$$

$$\Rightarrow x = -5\sqrt{3} \text{ or } x = 2\sqrt{3}$$

Hence, the roots of the given equation are $-5\sqrt{3}$ and $2\sqrt{3}$

31.

Sol:

We write, $7x = 5x + 2x$ as $\sqrt{2}x^2 \times 5\sqrt{2} = 10x^2 = 5x \times 2x$

$$\therefore \sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$$

$$\Rightarrow \sqrt{2}x^2 + 5x + 2x + 5\sqrt{2} = 0$$

$$\Rightarrow x(\sqrt{2}x + 5) + \sqrt{2}(\sqrt{2}x + 5) = 0$$

$$\Rightarrow (\sqrt{2}x + 5)(x + \sqrt{2}) = 0$$

$$\Rightarrow x + \sqrt{2} = 0 \text{ or } \sqrt{2}x + 5 = 0$$

$$\Rightarrow x = -\sqrt{2} \text{ or } x = -\frac{5}{\sqrt{2}} = -\frac{5\sqrt{2}}{2}$$

Hence, the roots of the given equation are $-\sqrt{2}$ and $-\frac{5\sqrt{2}}{2}$.

32.

Sol:

We write, $13x = 5x + 8x$ as $5x^2 \times 8 = 40x^2 = 5x \times 8x$

$$\therefore 5x^2 + 13x + 8 = 0$$

$$\Rightarrow 5x^2 + 5x + 8x + 8 = 0$$

$$\Rightarrow 5x(x + 1) + 8(x + 1) = 0$$

$$\Rightarrow (x + 1)(5x + 8) = 0$$

$$\Rightarrow x + 1 = 0 \text{ or } 5x + 8 = 0$$

$$x = -1 \text{ or } x = -\frac{8}{5}$$

Hence, -1 and $-\frac{8}{5}$ are the roots of the given equation.

33.

Sol:

Given:

$$x^2 - (1 + \sqrt{2})x + \sqrt{2} = 0$$

$$\Rightarrow x^2 - x - \sqrt{2}x + \sqrt{2} = 0$$

$$\Rightarrow x(x-1) - \sqrt{2}(x-1) = 0$$

$$\Rightarrow (x - \sqrt{2})(x-1) = 0$$

$$\Rightarrow x - \sqrt{2} = 0 \text{ or } x - 1 = 0$$

$$\Rightarrow x = \sqrt{2} \text{ or } x = 1$$

Hence, the roots of the equation are $\sqrt{2}$ and 1 .

34.

Sol:

Given:

$$9x^2 + 6x + 1 = 0$$

$$\Rightarrow 9x^2 + 3x + 3x + 1 = 0$$

$$\Rightarrow 3x(3x+1) + 1(3x+1) = 0$$

$$\Rightarrow (3x+1)(3x+1) = 0$$

$$\Rightarrow 3x+1 = 0 \text{ or } 3x+1 = 0$$

$$\Rightarrow x = \frac{-1}{3} \text{ or } x = \frac{-1}{3}$$

Hence, $\frac{-1}{3}$ is the root of the equation $9x^2 + 6x + 1 = 0$.

35.

Sol:

We write, $-20x = -10x - 10x$ as $100x^2 \times 1 = 100x^2 = (-10x) \times (-10x)$

$$\therefore 100x^2 - 20x + 1 = 0$$

$$\Rightarrow 100x^2 - 10x - 10x + 1 = 0$$

$$\Rightarrow 10x(10x-1) - 1(10x-1) = 0$$

$$\Rightarrow (10x-1)(10x-1) = 0$$

$$\Rightarrow (10x-1)^2 = 0$$

$$\Rightarrow 10x-1 = 0$$

$$\Rightarrow x = \frac{1}{10}$$

Hence, $\frac{1}{10}$ is the repeated root of the given equation.

36.

Sol:

We write, $-x = -\frac{x}{2} - \frac{x}{2}$ as $2x^2 \times \frac{1}{8} = \frac{x^2}{4} = \left(-\frac{x}{2}\right) \times \left(-\frac{x}{2}\right)$

$$\therefore 2x^2 - x + \frac{1}{8} = 0$$

$$\Rightarrow 2x^2 - \frac{x}{2} - \frac{x}{2} + \frac{1}{8} = 0$$

$$\Rightarrow 2x\left(x - \frac{1}{4}\right) - \frac{1}{2}\left(x - \frac{1}{4}\right) = 0$$

$$\Rightarrow \left(x - \frac{1}{4}\right)\left(2x - \frac{1}{2}\right) = 0$$

$$\Rightarrow x - \frac{1}{4} = 0 \text{ or } 2x - \frac{1}{2} = 0$$

$$\Rightarrow x = \frac{1}{4} \text{ or } x = \frac{1}{4}$$

Hence, $\frac{1}{4}$ is the repeated root of the given equation.

37.

Sol:

Given:

$$10x - \frac{1}{x} = 3$$

$$\Rightarrow 10x^2 - 1 = 3x$$

[Multiplying both sides by x]

$$\begin{aligned}
&\Rightarrow 10x^2 - 3x - 1 = 0 \\
&\Rightarrow 10x^2 - (5x - 2x) - 1 = 0 \\
&\Rightarrow 10x^2 - 5x + 2x - 1 = 0 \\
&\Rightarrow 5x(2x - 1) + 1(2x - 1) = 0 \\
&\Rightarrow (2x - 1)(5x + 1) = 0 \\
&\Rightarrow 2x - 1 = 0 \text{ or } 5x + 1 = 0 \\
&\Rightarrow x = \frac{1}{2} \text{ or } x = -\frac{1}{5}
\end{aligned}$$

Hence, the roots of the equation are $\frac{1}{2}$ and $-\frac{1}{5}$.

38.

Sol:

Given:

$$\frac{2}{x^2} - \frac{5}{x} + 2 = 0$$

$$\begin{aligned}
&\Rightarrow 2 - 5x + 2x^2 = 0 && [\text{Multiplying both sides by } x^2] \\
&\Rightarrow 2x^2 - 5x + 2 = 0 \\
&\Rightarrow 2x^2 - (4x + x) + 2 = 0 \\
&\Rightarrow 2x^2 - 4x - x + 2 = 0 \\
&\Rightarrow 2x(x - 2) - 1(x - 2) = 0 \\
&\Rightarrow (2x - 1)(x - 2) = 0 \\
&\Rightarrow 2x - 1 = 0 \text{ or } x - 2 = 0 \\
&\Rightarrow x = \frac{1}{2} \text{ or } x = 2
\end{aligned}$$

Hence, the roots of the equation are $\frac{1}{2}$ and 2.

39.

Sol:

We write, $ax = 2ax - ax$ as $2x^2 \times (-a^2) = -2a^2x^2 = 2ax \times (-ax)$

$$\begin{aligned}
&\therefore 2x^2 + ax - a^2 = 0 \\
&\Rightarrow 2x^2 + 2ax - ax - a^2 = 0 \\
&\Rightarrow 2x(x + a) - a(x + a) = 0 \\
&\Rightarrow (x + a)(2x - a) = 0
\end{aligned}$$

$$\Rightarrow x + a = 0 \text{ or } 2x - a = 0$$

$$\Rightarrow x = -a \text{ or } x = \frac{a}{2}$$

Hence, $-a$ and $\frac{a}{2}$ are the roots of the given equation.

40.

Sol:

We write, $4bx = 2(a+b)x - 2(a-b)x$ as

$$4x^2 \times [- (a^2 - b^2)] = -4(a^2 - b^2)x^2 = 2(a+b)x \times [-2(a-b)x]$$

$$\therefore 4x^2 + 4bx - (a^2 - b^2) = 0$$

$$\Rightarrow 4x^2 + 2(a+b)x - 2(a-b)x - (a-b)(a+b) = 0$$

$$\Rightarrow 2x[2x + (a+b)] - (a-b)[2x + (a+b)] = 0$$

$$\Rightarrow [2x + (a+b)][2x - (a-b)] = 0$$

$$\Rightarrow 2x + (a+b) = 0 \text{ or } 2x - (a-b) = 0$$

$$\Rightarrow x = -\frac{a+b}{2} \text{ or } x = \frac{a-b}{2}$$

Hence, $-\frac{a+b}{2}$ and $\frac{a-b}{2}$ are the roots of the given equation.

41.

Sol:

We write, $-4a^2x = -2(a^2 + b^2)x - 2(a^2 - b^2)x$ as

$$4x^2 \times (a^4 - b^4) = 4(a^4 - b^4)x^2 = [-2(a^2 + b^2)]x \times [-2(a^2 - b^2)]x$$

$$\therefore 4x^2 - 4a^2x + (a^4 - b^4) = 0$$

$$\Rightarrow 4x^2 - 2(a^2 + b^2)x - 2(a^2 - b^2)x + (a^2 - b^2)(a^2 + b^2) = 0$$

$$\Rightarrow 2x[2x - (a^2 + b^2)] - (a^2 - b^2)[2x - (a^2 + b^2)] = 0$$

$$\Rightarrow [2x - (a^2 + b^2)][2x - (a^2 - b^2)] = 0$$

$$\Rightarrow 2x - (a^2 + b^2) = 0 \text{ or } 2x - (a^2 - b^2) = 0$$

$$\Rightarrow x = \frac{a^2 + b^2}{2} \text{ or } x = \frac{a^2 - b^2}{2}$$

Hence, $\frac{a^2+b^2}{2}$ and $\frac{a^2-b^2}{2}$ are the roots of the given equation.

42.

Sol:

We write, $5x = (a+3)x - (a-2)x$ as

$$x^2 \times [-(a^2+a-6)] = -(a^2+a-6)x^2 = (a+3)x \times [-(a-2)x]$$

$$\therefore x^2 + 5x - (a^2+a-6) = 0$$

$$\Rightarrow x^2 + (a+3)x - (a-2)x - (a+3)(a-2) = 0$$

$$\Rightarrow x[x + (a+3)] - (a-2)[x + (a+3)] = 0$$

$$\Rightarrow [x + (a+3)][x - (a-2)] = 0$$

$$\Rightarrow x + (a+3) = 0 \text{ or } x - (a-2) = 0$$

$$\Rightarrow x = -(a+3) \text{ or } x = a-2$$

Hence, $-(a+3)$ and $(a-2)$ are the roots of the given equation.

43.

Sol:

We have, $-2ax = (2b-a)x - (2b+a)x$ as

$$x^2 \times [-(4b^2-a^2)] = -(4b^2-a^2)x^2 = (2b-a)x \times [-(2b+a)x]$$

$$\therefore x^2 - 2ax - (4b^2-a^2) = 0$$

$$\Rightarrow x^2 + (2b-a)x - (2b+a)x - (2b-a)(2b+a) = 0$$

$$\Rightarrow x[x + (2b-a)] - (2b+a)[x + (2b-a)] = 0$$

$$\Rightarrow [x + (2b-a)][x - (2b+a)] = 0$$

$$\Rightarrow x + (2b-a) = 0 \text{ or } x - (2b+a) = 0$$

$$x = -(2b-a) \text{ or } x = 2b+a$$

$$\Rightarrow x = a-2b \text{ or } x = a+2b$$

Hence, $a-2b$ and $a+2b$ are the roots of the given equation.

44.

Sol:

We write, $-(2b-1)x = -(b-5)x - (b+4)x$ as

$$x^2 \times (b^2 - b - 20) = (b^2 - b - 20)x^2 = [-(b-5)x] \times [-(b+4)x]$$

$$\therefore x^2 - (2b-1)x + (b^2 - b - 20) = 0$$

$$\Rightarrow x^2 - (b-5)x - (b+4)x + (b-5)(b+4) = 0$$

$$\Rightarrow x[x - (b-5)] - (b+4)[x - (b-5)] = 0$$

$$\Rightarrow [x - b - 5][x - (b+4)] = 0$$

$$\Rightarrow x - (b-5) = 0 \text{ or } x - (b+4) = 0$$

$$\Rightarrow x = b - 5 \text{ or } x = b + 4$$

Hence, $b - 5$ and $b + 4$ are the roots of the given equation.

45.

Sol:

We write, $6x = (a+4)x - (a-2)x$ as

$$x^2 \times [-(a^2 + 2a - 8)] = -(a^2 + 2a - 8)x^2 = (a+4)x \times [-(a-2)x]$$

$$\therefore x^2 + 6x - (a^2 + 2a - 8) = 0$$

$$\Rightarrow x^2 + (a+4)x - (a-2)x - (a+4)(a-2) = 0$$

$$\Rightarrow x[x + (a+4)] - (a-2)[x + (a+4)] = 0$$

$$\Rightarrow [x + (a+4)][x - (a-2)] = 0$$

$$\Rightarrow x + (a+4) = 0 \text{ or } x - (a-2) = 0$$

$$\Rightarrow x = -(a+4) \text{ or } x = a - 2$$

Hence, $-(a+4)$ and $(a-2)$ are the roots of the given equation.

46.

Sol:

$$abx^2 + (b^2 - ac)x - bc = 0$$

$$\Rightarrow abx^2 + b^2x - acx - bc = 0$$

$$\Rightarrow bx(ax + b) - c(ax + b) = 0$$

$$\Rightarrow (bx - c)(ax + b) = 0$$

$$\Rightarrow bx - c = 0 \text{ or } ax + b = 0$$

$$\Rightarrow x = \frac{c}{b} \text{ or } x = \frac{-b}{a}$$

Hence, the roots of the equation are $\frac{c}{b}$ and $\frac{-b}{a}$.

47.

Sol:

We write, $-4ax = -(b+2a)x + (b-2a)x$ as

$$x^2 \times (-b^2 + 4a^2) = (-b^2 + 4a^2)x^2 = -(b+2a)x \times (b-2a)x$$

$$\therefore x^2 - 4ax - b^2 + 4a^2 = 0$$

$$\Rightarrow x^2 - (b+2a)x + (b-2a)x - (b-2a)(b+2a) = 0$$

$$\Rightarrow x[x - (b+2a)] + (b-2a)[x - (b+2a)] = 0$$

$$\Rightarrow [x - (b+2a)][x + (b-2a)] = 0$$

$$\Rightarrow x - (b+2a) = 0 \text{ or } x + (b-2a) = 0$$

$$\Rightarrow x = 2a + b \text{ or } x = -(b-2a)$$

$$\Rightarrow x = 2a + b \text{ or } x = 2a - b$$

Hence, $(2a+b)$ and $(2a-b)$ are the roots of the given equation.

48.

Sol:

Given:

$$4x^2 - 2(a^2 + b^2)x + a^2b^2 = 0$$

$$\Rightarrow 4x^2 - 2a^2x - 2b^2x + a^2b^2 = 0$$

$$\Rightarrow 2x(2x - a^2) - b^2(2x - a^2) = 0$$

$$\Rightarrow (2x - b^2)(2x - a^2) = 0$$

$$\Rightarrow 2x - b^2 = 0 \text{ or } 2x - a^2 = 0$$

$$\Rightarrow x = \frac{b^2}{2} \text{ or } x = \frac{a^2}{2}$$

Hence, the roots of the equation are $\frac{b^2}{2}$ and $\frac{a^2}{2}$.

49.

Sol:

Given:

$$12abx^2 - (9a^2 - 8b^2)x - 6ab = 0$$

$$\Rightarrow 12abx^2 - 9a^2x + 8b^2x - 6ab = 0$$

$$\Rightarrow 3ax(4bx - 3a) + 2b(4bx - 3a) = 0$$

$$\Rightarrow (3ax + 2b)(4bx - 3a) = 0$$

$$\Rightarrow 3ax + 2b = 0 \text{ or } 4bx - 3a = 0$$

$$\Rightarrow x = \frac{-2b}{3a} \text{ or } x = \frac{3a}{4b}$$

Hence, the roots of the equation are $\frac{-2b}{3a}$ and $\frac{3a}{4b}$.

50.

Sol:

Given:

$$a^2b^2x^2 + b^2x - a^2x - 1 = 0$$

$$\Rightarrow b^2x(a^2x + 1) - 1(a^2x + 1) = 0$$

$$\Rightarrow (b^2x - 1)(a^2x + 1) = 0$$

$$\Rightarrow (b^2x - 1) = 0 \text{ or } (a^2x + 1) = 0$$

$$\Rightarrow x = \frac{1}{b^2} \text{ or } x = \frac{-1}{a^2}$$

Hence, $\frac{1}{b^2}$ and $\frac{-1}{a^2}$ are the roots of the given equation.

51.

Sol:

We write, $-9(a+b)x = -3(2a+b)x - 3(a+2b)x$ as

$$9x^2 \times (2a^2 + 5ab + 2b^2) = 9(2a^2 + 5ab + 2b^2)x^2 = [-3(2a+b)x] \times [-3(a+2b)x]$$

$$\therefore 9x^2 - 9(a+b)x + (2a^2 + 5ab + 2b^2) = 0$$

$$\Rightarrow 9x^2 - 3(2a+b)x - 3(a+2b)x + (2a+b)(a+2b) = 0$$

$$\Rightarrow 3x[3x - (2a+b)] - (a+2b)[3x - (2a+b)] = 0$$

$$\Rightarrow [3x - (2a+b)][3x - (a+2b)] = 0$$

$$\Rightarrow 3x - (2a+b) = 0 \text{ or } 3x - (a+2b) = 0$$

$$\Rightarrow x = \frac{2a+b}{3} \text{ or } x = \frac{a+2b}{3}$$

Hence, $\frac{2a+b}{3}$ and $\frac{a+2b}{3}$ are the roots of the given equation.

52.

Sol:

$$\frac{16}{x} - 1 = \frac{15}{x+1}, x \neq 0, -1$$

$$\Rightarrow \frac{16}{x} - \frac{15}{x+1} = 1$$

$$\Rightarrow \frac{16x+16-15x}{x(x+1)} = 1$$

$$\Rightarrow \frac{x+16}{x^2+x} = 1$$

$$\Rightarrow x^2+x = x+16 \quad (\text{Cross multiplication})$$

$$\Rightarrow x^2 - 16 = 0$$

$$\Rightarrow (x+4)(x-4) = 0$$

$$\Rightarrow x+4 = 0 \text{ or } x-4 = 0$$

$$\Rightarrow x = -4 \text{ or } x = 4$$

Hence, -4 and 4 are the roots of the given equation.

53.

Sol:

$$\frac{4}{x} - 3 = \frac{5}{2x+3}, x \neq 0, -\frac{3}{2}$$

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

$$\Rightarrow \frac{8x+12-5x}{x(2x+3)} = 3$$

$$\Rightarrow \frac{3x+12}{2x^2+3x} = 3$$

$$\Rightarrow \frac{x+4}{2x^2+3x} = 1$$

$$\Rightarrow 2x^2 + 3x = x + 4 \quad (\text{Cross multiplication})$$

$$\Rightarrow 2x^2 + 2x - 4 = 0$$

$$\Rightarrow x^2 + x - 2 = 0$$

$$\Rightarrow x^2 + 2x - x - 2 = 0$$

$$\Rightarrow x(x+2) - 1(x+2) = 0$$

$$\Rightarrow (x+2)(x-1) = 0$$

$$\Rightarrow x+2 = 0 \text{ or } x-1 = 0$$

$$\Rightarrow x = -2 \text{ or } x = 1$$

Hence, -2 and 1 are the roots of the given equation.

54.

Sol:

$$\frac{3}{x+1} - \frac{1}{2} = \frac{2}{3x-1}, x \neq -1, \frac{1}{3}$$

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

$$\Rightarrow \frac{9x-3-2x-2}{(x+1)(3x-1)} = \frac{1}{2}$$

$$\Rightarrow \frac{7x-5}{3x^2+2x-1} = \frac{1}{2}$$

$$\Rightarrow 3x^2 + 2x - 1 = 14x - 10 \quad (\text{Cross multiplication})$$

$$\Rightarrow 3x^2 - 12x + 9 = 0$$

$$\Rightarrow x^2 - 4x + 3 = 0$$

$$\Rightarrow x^2 - 3x - x + 3 = 0$$

$$\Rightarrow x(x-3) - 1(x-3) = 0$$

$$\Rightarrow (x-3)(x-1) = 0$$

$$\Rightarrow x-3 = 0 \text{ or } x-1 = 0$$

$$\Rightarrow x = 3 \text{ or } x = 1$$

Hence, 1 and 3 are the roots of the given equation.

55.

Sol:

$$\frac{1}{x-1} - \frac{1}{x+5} = \frac{6}{7}, x \neq 1, -5$$

$$\Rightarrow \frac{x+5-x+1}{(x-1)(x+5)} = \frac{6}{7}$$

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

$$\Rightarrow x^2+4x-5=7$$

$$\Rightarrow x^2+4x-12=0$$

$$\Rightarrow x^2+6x-2x-12=0$$

$$\Rightarrow x(x+6)-2(x+6)=0$$

$$\Rightarrow (x+6)(x-2)=0$$

$$\Rightarrow x+6=0 \text{ or } x-2=0$$

$$\Rightarrow x=-6 \text{ or } x=2$$

Hence, -6 and 2 are the roots of the given equation.

56.

Sol:

$$\frac{1}{2a+b+2x} = \frac{1}{2a} + \frac{1}{b} + \frac{1}{2x}$$

$$\Rightarrow \frac{1}{2a+b+2x} - \frac{1}{2x} = \frac{1}{2a} + \frac{1}{b}$$

$$\Rightarrow \frac{2x-2a-b-2x}{2x(2a+b+2x)} = \frac{2a+b}{2ab}$$

$$\Rightarrow \frac{-(2a+b)}{4x^2+4ax+2bx} = \frac{2a+b}{2ab}$$

$$\Rightarrow 4x^2+4ax+2bx = -2ab$$

$$\Rightarrow 4x^2+4ax+2bx+2ab=0$$

$$\Rightarrow 4x(x+a)+2b(x+a)=0$$

$$\Rightarrow (x+a)(4x+2b)=0$$

$$\Rightarrow x+a=0 \text{ or } 4x+2b=0$$

$$\Rightarrow x=-a \text{ or } x=-\frac{b}{2}$$

Hence, $-a$ and $-\frac{b}{2}$ are the roots of the give equation.

57.

Sol:

Given:

$$\frac{(x+3)}{(x-2)} - \frac{(1-x)}{x} = \frac{17}{4}$$

$$\Rightarrow \frac{x(x+3) - (1-x)(x-2)}{(x-2)x} = \frac{17}{4}$$

$$\Rightarrow \frac{x^2 + 3x - (x - 2 - x^2 + 2x)}{x^2 - 2x} = \frac{17}{4}$$

$$\Rightarrow \frac{x^2 + 3x + x^2 - 3x + 2}{x^2 - 2x} = \frac{17}{4}$$

$$\Rightarrow \frac{2x^2 + 2}{x^2 - 2x} = \frac{17}{4}$$

$$\Rightarrow 8x^2 + 8 = 17x^2 - 34x$$

$$\Rightarrow -9x^2 + 34x + 8 = 0$$

$$\Rightarrow 9x^2 - 34x - 8 = 0$$

$$\Rightarrow 9x^2 - 36x + 2x - 8 = 0$$

$$\Rightarrow 9x(x-4) + 2(x-4) = 0$$

$$\Rightarrow (x-4)(9x+2) = 0$$

$$\Rightarrow x-4 = 0 \text{ or } 9x+2 = 0$$

$$\Rightarrow x = 4 \text{ or } x = \frac{-2}{9}$$

[On cross multiplying]

Hence, the roots of the equation are 4 and $\frac{-2}{9}$.

58.

Sol:

$$\frac{3x-4}{7} + \frac{7}{3x-4} = \frac{5}{2}, x \neq \frac{4}{3}$$

$$\Rightarrow \frac{(3x-4)^2 + 49}{7(3x-4)} = \frac{5}{2}$$

$$\begin{aligned}
&\Rightarrow \frac{9x^2 - 24x + 16 + 49}{21x - 28} = \frac{5}{2} \\
&\Rightarrow \frac{9x^2 - 24x + 65}{21x - 28} = \frac{5}{2} \\
&\Rightarrow 18x^2 - 48x + 130 = 105x - 140 \\
&\Rightarrow 18x^2 - 153x + 270 = 0 \\
&\Rightarrow 2x^2 - 17x + 30 = 0 \\
&\Rightarrow 2x^2 - 12x - 5x + 30 = 0 \\
&\Rightarrow 2x(x - 6) - 5(x - 6) = 0 \\
&\Rightarrow (x - 6)(2x - 5) = 0 \\
&\Rightarrow x - 6 = 0 \text{ or } 2x - 5 = 0 \\
&\Rightarrow x = 6 \text{ or } x = \frac{5}{2}
\end{aligned}$$

Hence, 6 and $\frac{5}{2}$ are the roots of the given equation.

59.

Sol:

$$\begin{aligned}
&\frac{x}{x-1} + \frac{x-1}{x} = 4\frac{1}{4}, x \neq 0, 1 \\
&\Rightarrow \frac{x^2 + (x-1)^2}{x(x-1)} = \frac{17}{4} \\
&\Rightarrow \frac{x^2 + x^2 - 2x + 1}{x^2 - x} = \frac{17}{4} \\
&\Rightarrow \frac{2x^2 - 2x + 1}{x^2 - 1} = \frac{17}{4} \\
&\Rightarrow 8x^2 - 8x + 4 = 17x^2 - 17x \\
&\Rightarrow 9x^2 - 9x - 4 = 0 \\
&\Rightarrow 9x^2 - 12x + 3x - 4 = 0 \\
&\Rightarrow 3x(3x - 4) + 1(3x - 4) = 0 \\
&\Rightarrow (3x - 4)(3x + 1) = 0 \\
&\Rightarrow 3x - 4 = 0 \text{ or } 3x + 1 = 0 \\
&\Rightarrow x = \frac{4}{3} \text{ or } x = -\frac{1}{3}
\end{aligned}$$

Hence, $\frac{4}{3}$ and $-\frac{1}{3}$ are the roots of the given equation.

60.

Sol:

$$\frac{x}{x+1} + \frac{x+1}{x} = 2\frac{4}{15}, x \neq 0, -1$$

$$\Rightarrow \frac{x^2 + (x+1)^2}{x(x+1)} = \frac{34}{15}$$

$$\Rightarrow \frac{x^2 + x^2 + 2x + 1}{x^2 + x} = \frac{34}{15}$$

$$\Rightarrow \frac{2x^2 + 2x + 1}{x^2 + x} = \frac{34}{15}$$

$$\Rightarrow 30x^2 + 30x + 15 = 34x^2 + 34x$$

$$\Rightarrow 4x^2 + 4x - 15 = 0$$

$$\Rightarrow 4x^2 + 10x - 6x - 15x = 0$$

$$\Rightarrow 2x(2x+5) - 3(2x+5) = 0$$

$$\Rightarrow (2x+5)(2x-3) = 0$$

$$\Rightarrow 2x+5=0 \text{ or } 2x-3=0$$

$$\Rightarrow x = -\frac{5}{2} \text{ or } 2x-3=0$$

Hence, $-\frac{5}{2}$ and $\frac{3}{2}$ are the roots of the given equation.

61.

Sol:

$$\frac{x-4}{x-5} + \frac{x-6}{x-7} = 3\frac{1}{3}, x \neq 5, 7$$

$$\Rightarrow \frac{(x-4)(x-7) + (x-5)(x-6)}{(x-5)(x-7)} = \frac{10}{3}$$

$$\Rightarrow \frac{x^2 - 11x + 28 + x^2 - 11x + 30}{x^2 - 12x + 35} = \frac{10}{3}$$

$$\Rightarrow \frac{2x^2 - 22x + 58}{x^2 - 12x + 35} = \frac{10}{3}$$

$$\begin{aligned}
&\Rightarrow \frac{x^2 - 11x + 29}{x^2 - 12x + 35} = \frac{5}{3} \\
&\Rightarrow 3x^2 - 33x + 87 = 5x^2 - 60x + 175 \\
&\Rightarrow 2x^2 - 27x + 88 = 0 \\
&\Rightarrow 2x^2 - 16x - 11x + 88 = 0 \\
&\Rightarrow 2x(x - 8) - 11(x - 8) = 0 \\
&\Rightarrow (x - 8)(2x - 11) = 0 \\
&\Rightarrow x - 8 = 0 \text{ or } 2x - 11 = 0 \\
&\Rightarrow x = 8 \text{ or } x = \frac{11}{2}
\end{aligned}$$

Hence, 8 and $\frac{11}{2}$ are the roots of the given equation.

62.

Sol:

$$\begin{aligned}
&\frac{x-1}{x-2} + \frac{x-3}{x-4} = 3\frac{1}{3}, x \neq 2, 4 \\
&\Rightarrow \frac{(x-1)(x-4) + (x-2)(x-3)}{(x-2)(x-4)} = \frac{10}{3} \\
&\Rightarrow \frac{x^2 - 5x + 4 + x^2 - 5x + 6}{x^2 - 6x + 8} = \frac{10}{3} \\
&\Rightarrow \frac{2x^2 - 10x + 10}{x^2 - 6x + 8} = \frac{10}{3} \\
&\Rightarrow \frac{x^2 - 5x + 5}{x^2 - 6x + 8} = \frac{5}{3} \\
&\Rightarrow 3x^2 - 15x + 15 = 5x^2 - 30x + 40 \\
&\Rightarrow 2x^2 - 15x + 25 = 0 \\
&\Rightarrow 2x^2 - 10x - 5x + 25 = 0 \\
&\Rightarrow 2x(x - 5) - 5(x - 5) = 0 \\
&\Rightarrow (x - 5)(2x - 5) = 0 \\
&\Rightarrow x - 5 = 0 \text{ or } 2x - 5 = 0 \\
&\Rightarrow x = 5 \text{ or } x = \frac{5}{2}
\end{aligned}$$

Hence, 5 and $\frac{5}{2}$ are the roots of the given equation.

63.

Sol:

$$\frac{1}{(x-2)} + \frac{2}{(x-1)} = \frac{6}{x}$$

$$\Rightarrow \frac{(x-1)+2(x-2)}{(x-1)(x-2)} = \frac{6}{x}$$

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

$$\Rightarrow 3x^2 - 5x = 6x^2 - 18x + 12 \quad [\text{On cross multiplying}]$$

$$\Rightarrow 3x^2 - 13x + 12 = 0$$

$$\Rightarrow 3x^2 - (9+4)x + 12 = 0$$

$$\Rightarrow 3x^2 - 9x - 4x + 12 = 0$$

$$\Rightarrow 3x(x-3) - 4(x-3) = 0$$

$$\Rightarrow (3x-4)(x-3) = 0$$

$$\Rightarrow 3x-4=0 \text{ or } x-3=0$$

$$\Rightarrow x = \frac{4}{3} \text{ or } x = 3$$

64.

Sol:

$$\frac{1}{x+1} + \frac{2}{x+2} = \frac{5}{x+4}, x \neq -1, -2, -4$$

$$\Rightarrow \frac{x+2+2x+2}{(x+1)(x+2)} = \frac{5}{x+4}$$

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

$$\Rightarrow (3x+4)(x+4) = 5(x^2+3x+2)$$

$$\Rightarrow 3x^2 + 16x + 16 = 5x^2 + 15x + 10$$

$$\Rightarrow 2x^2 - x - 6 = 0$$

$$\Rightarrow 2x^2 - 4x + 3x - 6 = 0$$

$$\Rightarrow 2x(x-2) + 3(x-2) = 0$$

$$\Rightarrow (x-2)(2x+3) = 0$$

$$\Rightarrow 3x^2 + 16x + 16 = 5x^2 + 15x + 10$$

$$\Rightarrow 2x^2 - x - 6 = 0$$

$$\Rightarrow 2x^2 - 4x + 3x - 6 = 0$$

$$\Rightarrow 2x(x-2) + 3(x-2) = 0$$

$$\Rightarrow (x-2)(2x+3) = 0$$

$$\Rightarrow x-2 = 0 \text{ or } 2x+3 = 0$$

$$\Rightarrow x = 2 \text{ or } x = -\frac{3}{2}$$

Hence, 2 and $-\frac{3}{2}$ are the roots of the given equation.

65.

Sol:

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

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

$$\Rightarrow \frac{3(9x^2 - 6x + 1) - 2(4x^2 + 12x + 9)}{6x^2 + 7x - 3} = 5$$

$$\Rightarrow \frac{27x^2 - 18x + 3 - 8x^2 - 24x - 18}{6x^2 + 7x - 3} = 5$$

$$\Rightarrow \frac{19x^2 - 42x - 15}{6x^2 + 7x - 3} = 5$$

$$\Rightarrow 19x^2 - 42x - 15 = 30x^2 + 35x - 15$$

$$\Rightarrow 11x^2 + 77x = 0$$

$$\Rightarrow 11x(x+7) = 0$$

$$\Rightarrow x = 0 \text{ or } x + 7 = 0$$

$$\Rightarrow x = 0 \text{ or } x = -7$$

Hence, 0 and -7 are the roots of the given equation.

66.

Sol:

$$\begin{aligned}
3\left(\frac{7x+1}{5x-3}\right) - 4\left(\frac{5x-3}{7x+1}\right) &= 11, x \neq \frac{3}{5}, -\frac{1}{7} \\
\Rightarrow \frac{3(7x+1)^2 - 4(5x-3)^2}{(5x-3)(7x+1)} &= 11 \\
\Rightarrow \frac{3(49x^2 + 14x + 1) - 4(25x^2 - 30x + 9)}{35x^2 - 16x - 3} &= 11 \\
\Rightarrow \frac{147x^2 + 42x + 3 - 100x^2 + 120x - 36}{35x^2 - 16x - 3} &= 11 \\
\Rightarrow \frac{47x^2 + 162x - 33}{35x^2 - 16x - 3} &= 11 \\
\Rightarrow 47x^2 + 162x - 33 &= 385x^2 - 176x - 33 \\
\Rightarrow 338x^2 - 338x &= 0 \\
\Rightarrow 338x(x-1) &= 0 \\
\Rightarrow x = 0 \text{ or } x-1 &= 0 \\
\Rightarrow x = 0 \text{ or } x = 1
\end{aligned}$$

Hence, 0 and 1 are the roots of the given equation.

67.

Sol:

Given:

$$\left(\frac{4x-3}{2x+1}\right) - 10\left(\frac{2x+1}{4x-3}\right) = 3$$

Putting $\frac{4x-3}{2x+1} = y$, we get:

$$y - \frac{10}{y} = 3$$

$$\Rightarrow \frac{y^2 - 10}{y} = 3$$

$$\Rightarrow y^2 - 10 = 3y \quad [\text{On cross multiplying}]$$

$$\Rightarrow y^2 - 3y - 10 = 0$$

$$\Rightarrow y^2 - (5-2)y - 10 = 0$$

$$\Rightarrow y^2 - 5y + 2y - 10 = 0$$

$$\Rightarrow y(y-5) + 2(y-5) = 0$$

$$\Rightarrow (y-5)(y+2) = 0$$

$$\Rightarrow y - 5 = 0 \text{ or } y + 2 = 0$$

$$\Rightarrow y = 5 \text{ or } y = -2$$

Case I:

If $y = 5$, we get:

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

$$\Rightarrow 4x - 3 = 5(2x + 1) \quad [\text{On cross multiplying}]$$

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

$$\Rightarrow -6x = 8$$

$$\Rightarrow -6x = 8$$

$$\Rightarrow x = \frac{8}{6}$$

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

Case II:

If $y = -2$, we get:

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

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

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

$$\Rightarrow 8x = 1$$

$$\Rightarrow x = \frac{1}{8}$$

Hence, the roots of the equation are $-\frac{4}{3}$ and $\frac{1}{8}$.

68.

Sol:

$$\left(\frac{x}{x+1}\right)^2 - 5\left(\frac{x}{x+1}\right) + 6 = 0$$

Putting $\frac{x}{x+1} = y$, we get:

$$y^2 - 5y + 6 = 0$$

$$\Rightarrow y^2 - 5y + 6 = 0$$

$$\begin{aligned}
&\Rightarrow y^2 - (3+2)y + 6 = 0 \\
&\Rightarrow y^2 - 3y - 2y + 6 = 0 \\
&\Rightarrow y(y-3) - 2(y-3) = 0 \\
&\Rightarrow (y-3)(y-2) = 0 \\
&\Rightarrow y-3 = 0 \text{ or } y-2 = 0 \\
&\Rightarrow y = 3 \text{ or } y = 2
\end{aligned}$$

Case I:

If $y = 3$, we get

$$\begin{aligned}
&\frac{x}{x+1} = 3 \\
&\Rightarrow x = 3(x+1) \text{ [On cross multiplying]} \\
&\Rightarrow x = 3x + 3 \\
&\Rightarrow x = \frac{-3}{2}
\end{aligned}$$

Case II:

If $y = 2$, we get:

$$\begin{aligned}
&\frac{x}{x+1} = 2 \\
&\Rightarrow x = 2(x+1) \\
&\Rightarrow x = 2x + 2 \\
&\Rightarrow -x = 2 \\
&\Rightarrow x = -2
\end{aligned}$$

Hence, the roots of the equation are $\frac{-3}{2}$ and -2 .

69.

Sol:

$$\begin{aligned}
&\frac{a}{(x-b)} + \frac{b}{(x-a)} = 2 \\
&\Rightarrow \left[\frac{a}{(x-b)} - 1 \right] + \left[\frac{b}{(x-b)} - 1 \right] = 0 \\
&\Rightarrow \frac{a-(x-b)}{x-b} + \frac{b-(x-b)}{x-b} = 0
\end{aligned}$$

$$\Rightarrow (a-x+b) \left[\frac{1}{(x-b)} + \frac{1}{(x-a)} \right] = 0$$

$$\Rightarrow (a-x+b) \left[\frac{(x-a)+(x-b)}{(x-b)(x-a)} \right] = 0$$

$$\Rightarrow (a-x+b) \left[\frac{2x-(a+b)}{(x-b)(x-a)} \right] = 0$$

$$\Rightarrow (a-x+b) [2x-(a+b)] = 0$$

$$\Rightarrow a-x+b=0 \text{ or } 2x-(a+b)=0$$

$$\Rightarrow x=a+b \text{ or } x=\frac{a+b}{2}$$

Hence, the roots of the equation are $(a+b)$ and $\left(\frac{a+b}{2}\right)$.

70.

Sol:

$$\frac{a}{(ax-1)} + \frac{b}{(bx-1)} = (a+b)$$

$$\Rightarrow \left[\frac{a}{(ax-1)} - b \right] + \left[\frac{b}{(bx-1)} - a \right] = 0$$

$$\Rightarrow \frac{a-b(ax-1)}{ax-1} + \frac{b-a(bx-1)}{bx-1} = 0$$

$$\Rightarrow \frac{a-abx+b}{ax-1} + \frac{a-abx+b}{bx-1} = 0$$

$$\Rightarrow (a-abx+b) \left[\frac{1}{ax-1} + \frac{1}{(bx-1)} \right] = 0$$

$$\Rightarrow (a-abx+b) \left[\frac{(bx-1)+(ax-1)}{(ax-1)(bx-1)} \right] = 0$$

$$\Rightarrow (a-abx+b) \left[\frac{(a+b)x-2}{(ax-1)(bx-1)} \right] = 0$$

$$\Rightarrow (a-abx+b) [(a+b)x-2] = 0$$

$$\Rightarrow a-abx+b=0 \text{ or } (a+b)x-2=0$$

$$\Rightarrow x = \frac{(a+b)}{ab} \text{ or } x = \frac{2}{(a+b)}$$

Hence, the roots of the equation are $\frac{(a+b)}{ab}$ and $\frac{2}{(a+b)}$.

71.

Sol:

$$3^{(x+2)} + 3^{-x} = 10$$

$$3^x \cdot 9 + \frac{1}{3^x} = 10$$

Let 3^x be equal to y .

$$\therefore 9y + \frac{1}{y} = 10$$

$$\Rightarrow 9y^2 + 1 = 10y$$

$$\Rightarrow 9y^2 - 10y + 1 = 0$$

$$\Rightarrow (y-1)(9y-1) = 0$$

$$\Rightarrow y-1 = 0 \text{ or } 9y-1 = 0$$

$$\Rightarrow y = 1 \text{ or } y = \frac{1}{9}$$

$$\Rightarrow 3x^x = 1 \text{ or } 3^x = \frac{1}{9}$$

$$\Rightarrow 3^x = 3^0 \text{ or } 3^x = 3^{-2}$$

$$\Rightarrow x = 0 \text{ or } x = -2$$

Hence, 0 and -2 are the roots of the given equation.

72.

Sol:

Given:

$$4^{(x+1)} + 4^{(1-x)} = 10$$

$$\Rightarrow 4^x \cdot 4 + 4^1 \cdot \frac{1}{4^x} = 10$$

Let 4^x be y .

$$\therefore 4y + \frac{4}{y} = 10$$

$$\Rightarrow 4y^2 - 10y + 4 = 0$$

$$\Rightarrow 4y^2 - 8y - 2y + 4 = 0$$

$$\Rightarrow 4y(y-2) - 2(y-2) = 0$$

$$\Rightarrow y = 2 \text{ or } y = \frac{2}{4} = \frac{1}{2}$$

$$\Rightarrow 4^x = 2 \text{ or } \frac{1}{2}$$

$$\Rightarrow 4^x = 2^{2x} = 2^1 \text{ or } 2^{2x} = 2^{-1}$$

$$\Rightarrow x = \frac{1}{2} \text{ or } x = \frac{-1}{2}$$

Hence, $\frac{1}{2}$ and $\frac{-1}{2}$ are roots of the given equation.

73.

Sol:

$$2^{2x} - 3 \cdot 2^{(x+2)} + 32 = 0$$

$$\Rightarrow (2^x)^2 - 3 \cdot 2^x \cdot 2^2 + 32 = 0$$

Let 2^x be y .

$$\therefore y^2 - 12y + 32 = 0$$

$$\Rightarrow y^2 - 8y - 4y + 32 = 0$$

$$\Rightarrow y(y-8) - 4(y-8) = 0$$

$$\Rightarrow (y-8) = 0 \text{ or } (y-4) = 0$$

$$\Rightarrow y = 8 \text{ or } y = 4$$

$$\therefore 2^x = 8 \text{ or } 2^x = 4$$

$$\Rightarrow 2^x = 2^3 \text{ or } 2^x = 2^2$$

$$\Rightarrow x = 3 \text{ or } 2$$

Hence, 2 and 3 are the roots of the given equation.