

## Quadratic Equations

### Question 1.

Solve the following (1 to 12) equations:

(i)  $x^2 - 11x + 30 = 0$

(ii)  $4x^2 - 25 = 0$

**Solution:**

(i)  $x^2 - 11x + 30 = 0$

$$x^2 - 5x - 6x + 30 = 0 \quad \left\{ \begin{array}{l} \because 30 = -5 \times (-6) \\ -11 = -5 - 6 \end{array} \right\}$$

$$\Rightarrow x(x - 5) - 6(x - 5) = 0$$

$$\Rightarrow (x - 5)(x - 6) = 0$$

Either,  $x - 5 = 0$ , then  $x = 5$

or  $x - 6 = 0$ , then  $x = 6$

$$\therefore x = 5, 6$$

(ii)  $4x^2 - 25 = 0 \Rightarrow 4x^2 = 0 + 25$

$$\Rightarrow x^2 = \frac{25}{4}$$

$$\therefore x = \pm \sqrt{\frac{25}{4}} = \pm \frac{5}{2}$$

$$\therefore x = \frac{5}{2}, \frac{-5}{2}$$

**Question 2.**

(i)  $2x^2 - 5x = 0$

(ii)  $x^2 - 2x = 48$

**Solution:**

(i)  $2x^2 - 5x = 0$

$x(2x - 5) = 0$

Either,  $x = 0$

or  $2x - 5 = 0$ , then  $2x = 5$

$\Rightarrow x = \frac{5}{2}$

$\therefore x = 0, \frac{5}{2}$

(ii)  $x^2 - 2x = 48$

$\Rightarrow x^2 - 2x - 48 = 0$

$\Rightarrow x^2 - 8x + 6x - 48 = 0 \quad \left\{ \begin{array}{l} \because -48 = -8 \times 6 \\ -2 = -8 + 6 \end{array} \right\}$

$\Rightarrow x(x - 8) + 6(x - 8) = 0$

$\Rightarrow (x - 8)(x + 6) = 0$

Either,  $x - 8 = 0$ , then  $x = 8$

or  $x + 6 = 0$ , then  $x = -6$

$\therefore x = 8, -6$

**Question 3.**

(i)  $6 + x = x^2$

(ii)  $2x^2 + 3x + 1 = 0$

**Solution:**

(i)  $6 + x = x^2$

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

$\Rightarrow x^2 - 3x + 2x - 6 = 0$   $\left\{ \begin{array}{l} \because -6 = -3 \times 2 \\ -1 = -3 + 2 \end{array} \right\}$

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

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

Either,  $x - 3 = 0$ , then  $x = 3$

or  $x + 2 = 0$ , then  $x = -2$

$\therefore x = 3, -2$

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

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

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

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

Either,  $x - 1 = 0$ , then  $x = 1$

or  $2x - 1 = 0$ , then  $2x = 1$

$\Rightarrow x = \frac{1}{2}$

$\therefore x = 1, \frac{1}{2}$

**Question 4.**

(i)  $3x^2 = 2x + 8$

(ii)  $4x^2 + 15 = 16x$

**Solution:**

(i)  $3x^2 = 2x + 8$

$$\Rightarrow 3x^2 - 2x - 8 = 0$$

$$\Rightarrow 3x^2 - 6x + 4x - 8 = 0 \quad \left\{ \begin{array}{l} \because -8 \times 3 = -24 \\ -24 = -6 \times 4 \\ -2 = -6 + 4 \end{array} \right.$$

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

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

Either,  $x - 2 = 0$ , then  $x = 2$ or  $3x + 4 = 0$ , then  $3x = -4$ 

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

$$\therefore x = 2, \frac{-4}{3}$$

(ii)  $4x^2 + 15 = 16x$

$$\Rightarrow 4x^2 - 16x + 15 = 0$$

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

$$\left\{ \begin{array}{l} \because 4 \times 15 = 60 \\ -16 = -6 + (-10) \\ -16 = -6 - 10 \end{array} \right.$$

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

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

Either,  $2x - 3 = 0$ , then  $2x = 3 \Rightarrow x = \frac{3}{2}$

or  $2x - 5 = 0$ , then  $2x = 5 \Rightarrow x = \frac{5}{2}$

$$\therefore x = \frac{3}{2}, \frac{5}{2}$$

**Question 5.**

(i)  $x(2x + 5) = 25$

(ii)  $(x + 3)(x - 3) = 40$

**Solution:**

(i)  $x(2x + 5) = 25$

$$\Rightarrow 2x^2 + 5x - 25 = 0$$

$$\Rightarrow 2x^2 + 10x - 5x - 25 = 0$$

$$\left\{ \begin{array}{l} \because -25 \times 2 = -50 \\ -50 = 10 \times (-5) \\ 5 = 10 - 5 \end{array} \right\}$$

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

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

Either,  $x + 5 = 0$ , then  $x = -5$

or  $2x - 5 = 0$ , then  $2x = 5 \Rightarrow x = \frac{5}{2}$

$$\therefore x = -5, \frac{5}{2}$$

(ii)  $(x + 3)(x - 3) = 40$

$$\Rightarrow x^2 - 9 = 40 \Rightarrow x^2 - 9 - 40 = 0$$

$$\Rightarrow x^2 - 49 = 0 \Rightarrow (x)^2 - (7)^2 = 0$$

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

Either,  $x + 7 = 0$ , then  $x = -7$

or  $x - 7 = 0$ , then  $x = 7$

$$\therefore x = 7, -7$$

**Question 6.**

(i)  $(2x + 3)(x - 4) = 6$

(ii)  $(3x + 1)(2x + 3) = 3$

**Solution:**

(i)  $(2x + 3)(x - 4) = 6$

$$\Rightarrow 2x^2 - 8x + 3x - 12 - 6 = 0$$

$$\Rightarrow 2x^2 - 5x - 18 = 0$$

$$\Rightarrow 2x^2 - 9x + 4x - 18 = 0$$

$$\left\{ \begin{array}{l} \because -18 \times 2 = -36 \\ \because -36 = -9 \times 4 \\ -5 = -9 + 4 \end{array} \right.$$

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

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

$$\text{Either, } 2x - 9 = 0, \text{ then } 2x = 9 \Rightarrow x = \frac{9}{2}$$

$$\text{or } x + 2 = 0, \text{ then } x = -2$$

$$\therefore x = \frac{9}{2}, -2$$

(ii)  $(3x + 1)(2x + 3) = 3$

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

$$\Rightarrow 6x^2 + 11x = 0$$

$$\Rightarrow x(6x + 11) = 0$$

$$\text{Either, } x = 0,$$

$$\text{or } 6x + 11 = 0, \text{ then } 6x = -11 \Rightarrow x = \frac{-11}{6}$$

$$\therefore x = 0, \frac{-11}{6}$$

**Question 7.**

(i)  $4x^2 + 4x + 1 = 0$

(ii)  $(x - 4)^2 + 5^2 = 132$

**Solution:**

(i)  $4x^2 + 4x + 1 = 0$

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

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

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

Either,  $2x + 1 = 0$ , then  $x = \frac{-1}{2}$

$\therefore x = \frac{-1}{2}, \frac{-1}{2}$

(ii)  $(x - 4)^2 + 5^2 = 132$

$\Rightarrow x^2 - 8x + 16 + 25 = 169$

$x^2 - 8x + 16 + 25 - 169 = 0$

$x^2 - 8x - 128 = 0$

$x^2 - 16x + 8x - 128 = 0 \left\{ \begin{array}{l} \because -128 = -16 \times 8 \\ -8 = -16 + 8 \end{array} \right\}$

$x(x - 16) + 8(x - 16) = 0$

$(x - 16)(x + 8) = 0$

Either,  $x - 16 = 0$ , then  $x = 16$

or  $x + 8 = 0$ , then  $x = -8$

$\therefore x = 16, -8$

**Question 8.**

(i)  $21x^2 = 4(2x + 1)$

(ii)  $\frac{2}{3}x^2 - \frac{1}{3}x - 1 = 0$

**Solution:**

(i)  $21x^2 = 4(2x + 1)$

$$\Rightarrow 21x^2 = 8x + 4$$

$$\Rightarrow 21x^2 - 8x - 4 = 0$$

$$\Rightarrow 21x^2 - 14x + 6x - 4 = 0 \left\{ \begin{array}{l} \because 21 \times (-4) = -84 \\ \therefore -84 = -14 \times 6 \\ -8 = -14 + 6 \end{array} \right.$$

$$\Rightarrow 7x(3x - 2) + 2(3x - 2) = 0$$

$$\Rightarrow (3x - 2)(7x + 2) = 0$$

Either,  $3x - 2 = 0$ , then  $3x = 2 \Rightarrow x = \frac{2}{3}$

or  $7x + 2 = 0$ , then  $7x = -2 \Rightarrow x = \frac{-2}{7}$

$$\therefore x = \frac{2}{3}, \frac{-2}{7}$$

(ii)  $\frac{2}{3}x^2 - \frac{1}{3}x - 1 = 0$

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

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

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

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

Either,  $2x - 3 = 0$ , then  $2x = 3 \Rightarrow x = \frac{3}{2}$

or  $x + 1 = 0$ , then  $x = -1$

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



**Question 9.**

(i)  $6x + 29 = \frac{5}{x}$

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

**Solution:**

$$6x + 29 = \frac{5}{x}$$

$$\Rightarrow 6x^2 + 29x - 5 = 0$$

$$\Rightarrow 6x^2 + 30x - x - 5 = 0$$

$$\Rightarrow 3x(2x + 10) - 1(2x + 10) = 0$$

$$\Rightarrow (3x - 1)(2x + 10) = 0$$

$$\Rightarrow 3x - 1 = 0 \quad \text{or} \quad 2x + 10 = 0$$

$$\Rightarrow 3x = 1 \quad \text{or} \quad 2x = -10$$

$$\Rightarrow x = \frac{1}{3} \quad \text{or} \quad x = -5$$

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

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

$$\Rightarrow 2x + \frac{2}{x} = 5$$

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

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

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

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

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

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

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

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

**Question 10.**

(i)  $3x - \frac{8}{x} = 2$

(ii)  $\frac{x}{3} + \frac{9}{x} = 4$

**Solution:**

*(Note: The following text is a mirrored image of the solution steps, appearing upside down in the original document.)*

(i)  $3x - \frac{8}{x} = 2$   
 $3x^2 - 8 = 2x$   
 $3x^2 - 2x - 8 = 0$   
 $(3x + 4)(x - 2) = 0$   
 $3x + 4 = 0$  or  $x - 2 = 0$   
 $x = -\frac{4}{3}$  or  $x = 2$   
 $\therefore x = -\frac{4}{3}$  or  $x = 2$

(ii)  $\frac{x}{3} + \frac{9}{x} = 4$   
 $x^2 + 27 = 12x$   
 $x^2 - 12x + 27 = 0$   
 $(x - 3)(x - 9) = 0$   
 $x - 3 = 0$  or  $x - 9 = 0$   
 $x = 3$  or  $x = 9$   
 $\therefore x = 3$  or  $x = 9$

**Question 11.**

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

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

**Solution:**

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

By cross multiplication,

$$(x-1)(3x-7) = (x+1)(2x-5)$$

$$\Rightarrow 3x^2 - 7x - 3x + 7 = 2x^2 - 5x + 2x - 5$$

$$3x^2 - 10x + 7 = 2x^2 - 3x - 5 = 0$$

$$3x^2 - 10x + 7 - 2x^2 + 3x + 5 = 0$$

$$\Rightarrow x^2 - 7x + 12 = 0$$

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

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

$$\left\{ \begin{array}{l} \because 12 = -4 \times (-3) \\ -7 = -4 - 3 \end{array} \right\}$$

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

Either,  $x - 4 = 0$ , then  $x = 4$

or  $x - 3 = 0$ , then  $x = 3$

$$\therefore x = 3, 4$$

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

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

By cross multiplication,

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

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

$$\Rightarrow 3x^2 + 6x - 8x - 8 = 0$$

$$\Rightarrow 3x^2 - 2x - 8 = 0$$

$$\Rightarrow 3x^2 - 6x + 4x - 8 = 0$$

$$\left\{ \begin{array}{l} \because 3 \times (-8) = -24 \\ \therefore -24 = -6 \times 4 \\ -2 = -6 + 4 \end{array} \right\}$$

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

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

Either,  $x - 2 = 0$ , then  $x = 2$

or  $3x + 4 = 0$ , then  $3x = -4 \Rightarrow x = \frac{-4}{3}$

Hence,  $x = 2, \frac{-4}{3}$

**Question 12.**

$$(i) \frac{8}{x+3} - \frac{3}{2-x} = 2$$

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

**Solution:**

$$(i) \frac{8}{x+3} - \frac{3}{2-x} = 2$$

$$\Rightarrow \frac{8(2-x) - 3(x+3)}{(x+3)(2-x)} = \frac{2}{1}$$

$$\Rightarrow \frac{16 - 8x - 3x - 9}{2x - x^2 + 6 - 3x} = \frac{2}{1}$$

$$\Rightarrow \frac{7 - 11x}{-x^2 - x + 6} = \frac{2}{1}$$

$$\Rightarrow 7 - 11x = -2x^2 - 2x + 12$$

(By cross multiplication)

$$\Rightarrow 2x^2 + 2x - 12 + 7 - 11x = 0$$

$$\Rightarrow 2x^2 - 9x - 5 = 0$$

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

$$\left\{ \begin{array}{l} \because 2 \times (-5) = -10 \\ \therefore -10 = -10 \times 1 \\ -9 = -10 + 1 \end{array} \right\}$$

$$\Rightarrow 2x(x - 5) + 1(x - 5) = 0$$

$$\Rightarrow (x - 5)(2x + 1) = 0$$

Either,  $x - 5 = 0$ , then  $x = 5$

or  $2x + 1 = 0$ , then  $2x = -1 \Rightarrow x = \frac{-1}{2}$

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

$$\therefore x = 5, \frac{-1}{2}$$

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

$$\frac{x^2 + (x+1)^2}{x(x+1)} = \frac{13}{6}$$

$$\Rightarrow \frac{x^2 + x^2 + 2x + 1}{x^2 + x} = \frac{13}{6}$$

$$\Rightarrow \frac{2x^2 + 2x + 1}{x^2 + x} = \frac{13}{6}$$

$$13x^2 + 13x = 12x^2 + 12x + 6$$

$$\Rightarrow 13x^2 + 13x - 12x^2 - 12x - 6 = 0$$

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

$$\Rightarrow x^2 + 3x - 2x - 6 = 0 \quad \left\{ \begin{array}{l} \because -6 = 3 \times (-2) \\ 1 = 3 - 2 \end{array} \right\}$$

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

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

$$\text{Either, } x + 3 = 0, \text{ then } x = -3$$

$$\text{or } x - 2 = 0, \text{ then } x = 2$$

$$\therefore x = 2, -3$$

## Multiple Choice Questions

Choose the correct Solution from the given four options (1 to 5):

### Question 1.

Which of the following is not a quadratic equation :

- (a)  $2x^2 = 3x - 5$
- (b)  $(2x - 1)(x - 1) = 2x^2 - 7x + 2$
- (c)  $(2x - 1)(x + 2) = (x - 1)(x + 1)$
- (d)  $(x + 1), = x, + 2x + 2$

**Solution:**

$(2x - 1)(x - 1) = 2x^2 - 7x + 2$  is not a quadratic equation. (b)

### Question 2.

If 2 is a root of the quadratic equation  $2x^2 - kx + 1 = 0$ , then the value of k is

- (a) 9
- (b) -9
- (c)  $\frac{9}{2}$
- (d)  $-\frac{9}{2}$

**Solution:**

$$\because 2 \text{ is root of } 2x^2 - kx + 1 = 0$$

$$\therefore 2(2)^2 - k(2) + 1 = 0$$

$$8 - 2k + 1 = 0 = 9 = 2k$$

$$\Rightarrow k = \frac{9}{2} \quad (\text{c})$$

### Question 3.

If -3 is a root of the quadratic equation  $kx^2 + 2x - 3 = 0$ , then the value of k is

- (a) 1
- (b) -1
- (c)  $\frac{1}{9}$
- (d)  $\frac{1}{-9}$

**Solution:**

-3 is a root of quadratic equation.

$$kx^2 + 2x - 3 = 0$$

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

$$\Rightarrow 9k - 6 - 3 = 0 \Rightarrow 9k = 9$$

$$\Rightarrow k = \frac{9}{9} = 1 \quad (\text{a})$$

**Question 4.**

Which of the following quadratic equations has -1 as a root?

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

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

(c)  $2x^2 + x - 3 = 0$

(d)  $2x^2 - x - 3 = 0$

**Solution:**

$\therefore -1$  is a root of the quadratic equation.

$\therefore$  It will satisfy it

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

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

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

$$\Rightarrow 3 - 3 = 0$$

(d)

**Question 5.**

The root of the quadratic equation  $x^2 - 3x - 4 = 0$  are

(a) -4, 1

(b) 4, -1

(c) 4, 1

(d) -4, -1

**Solution:**

$$x^2 - 3x - 4 = 0$$

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

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

$$\text{If } x - 4 = 0, \text{ then } x = 4$$

$$x + 1 = 0, \text{ then } x = -1$$

$$\therefore x = 4, -1$$

(b)



## Chapter Test

Solve the following (1 to 3) equations:

**Question 1.**

(i)  $x(2x + 5) = 3$

(ii)  $3x^2 - 4x - 4 = 0$

**Solution:**

(i)  $x(2x + 5) = 3$

$$\Rightarrow 2x^2 + 5x - 3 = 0 \quad \left\{ \begin{array}{l} \because 2 \times (-3) = -6 \\ \because -6 = 6 \times (-1) \\ 5 = 6 - 1 \end{array} \right.$$

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

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

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

Either,  $x + 3 = 0$ , then  $x = -3$

or  $2x - 1 = 0$ , then  $2x = 1 \Rightarrow x = \frac{1}{2}$

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

(ii)  $3x^2 - 4x - 4 = 0$

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

$$\left\{ \begin{array}{l} \because 3 \times (-4) = -12 \\ \because -12 = -6 \times 2 \\ -4 = -6 + 2 \end{array} \right.$$

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

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

Either,  $x - 2 = 0$ , then  $x = 2$

or  $3x + 2 = 0$ , then  $3x = -2 \Rightarrow x = \frac{-2}{3}$

$$\therefore x = 2, \frac{-2}{3}$$

**Question 2.**

(i)  $4x^2 - 2x + \frac{1}{4} = 0$

(ii)  $2x^2 + 7x + 6 = 0$

**Solution:**

$$(i) 4x^2 - 2x + \frac{1}{4} = 0$$

$$\Rightarrow 16x^2 - 8x + 1 = 0$$

$$\Rightarrow 16x^2 - 8x + 1 = 0$$

$$\Rightarrow 16x^2 - 4x - 4x + 1 = 0$$

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

$$\Rightarrow (4x - 1)(4x - 1) = 0 \Rightarrow (4x - 1)^2 = 0$$

$$\Rightarrow 4x - 1 = 0 \Rightarrow 4x = 1$$

$$\therefore x = \frac{1}{4}, \frac{1}{4}$$

(ii)  $2x^2 + 7x + 6 = 0$

$$\Rightarrow 2x^2 + 4x + 3x + 6 = 0 \quad \left\{ \begin{array}{l} \because 2 \times 6 = 12 \\ \because 12 = 3 \times 4 \\ 7 = 3 + 4 \end{array} \right.$$

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

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

Either,  $x + 2 = 0$ , then  $x = -2$

or  $2x + 3 = 0$ , then  $2x = -3 \Rightarrow x = \frac{-3}{2}$

$$\therefore x = -2, \frac{-3}{2}$$

**Question 3.**

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

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

**Solution:**

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

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

$$\Rightarrow \frac{x^2 - 5x + 4 + x^2 - 5x + 6}{x^2 - 6x + 8} = \frac{10}{3}$$

$$\Rightarrow \frac{2x^2 - 10x + 10}{x^2 - 6x + 8} = \frac{10}{3}$$

$$\Rightarrow 10x^2 - 60x + 80 = 6x^2 - 30x + 30$$

$$\Rightarrow 10x^2 - 60x + 80 - 6x^2 + 30x - 30 = 0$$

$$\Rightarrow 4x^2 - 30x + 50 = 0$$

$$\Rightarrow 2x^2 - 15x + 25 = 0$$

$$\Rightarrow 2x^2 - 10x - 5x + 25 = 0$$

$$\left. \begin{array}{l} \because 2 \times 25 = 50 \\ \therefore 50 = -10 \times (-5) \\ -15 = -10 - 5 \end{array} \right\}$$

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

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

Either,  $x - 5 = 0$ , then  $x = 5$

or  $2x - 5 = 0$ , then  $2x = 5 \Rightarrow x = \frac{5}{2}$

$$\therefore x = 5, \frac{5}{2}$$

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

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

$$\Rightarrow \frac{4x-6}{x^2-x} = \frac{1}{x-2}$$

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

(By cross multiplication)

$$\Rightarrow 4x^2 - 8x - 6x + 12 = x^2 - x$$

$$\Rightarrow 4x^2 - 14x + 12 - x^2 + x = 0$$

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

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

$$\left. \begin{array}{l} \because 3 \times 12 = 36 \\ \therefore 36 = (-4) \times (-9) \\ -13 = -4 - 9 \end{array} \right\}$$

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

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

Either,  $3x - 4 = 0$ , then  $3x = 4 \Rightarrow x = \frac{4}{3}$

or  $x - 3 = 0$ , then  $x = 3$

$$\therefore x = 3, \frac{4}{3}$$