

Chapter 7
Quadratic Equations
Exercise 7.1

Solve the following (1 to 12) equations:

Question 1.

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

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

Solution:

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

Let us simplify the given equation,

By factorizing, we get

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

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

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

So,

$$(x - 5) = 0 \text{ or } (x - 6) = 0$$

$$x = 5 \text{ or } x = 6$$

Value of $x = 5, 6$

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

Let us simplify the given equation,

$$4x^2 = 25$$

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

$$X = \pm \sqrt{\frac{25}{4}}$$

$$= \pm \frac{5}{2}$$

$$\text{Value of } x = +\frac{5}{2} - \frac{5}{2}$$

Question 2.

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

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

Solution:

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

Let us simplify the given equation,

$$X(2x - 5) = 0$$

So,

$$X = 0 \text{ or } 2x - 5 = 0$$

$$X = 0 \text{ or } 2x = 5$$

$$X = 0 \text{ or } x = \frac{5}{2}$$

$$\text{Value of } x = 0, \frac{5}{2}$$

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

Let us simplify the given equation,

By factorizing , we get

$$X^2 - 2x - 48 = 0$$

$$X^2 - 8x + 6x - 48 = 0$$

$$X(x - 8) + 6(x - 8) = 0$$

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

So,

$$(x - 8) = 0 \text{ or } (x + 6) = 0$$

$$X = 8 \text{ or } x = -6$$

Value of $x = 8$ or $x = -6$

Question 3.

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

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

Solution:

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

Let us simplify the given equation,

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

$$X^2 - x - 6 = 0$$

By factorizing, we get

$$X^2 - 3x + 2x - 6 = 0$$

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

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

So ,

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

$$X = 3 \text{ or } x = -2$$

Value of $x = 3, -2$

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

Let us simplify the given equation,

By factorizing, we get

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

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

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

So,

$$(x - 1) = 0 \text{ or } (2x - 1) = 0$$

$$X = 1 \text{ or } 2x = 1$$

$$X = 1 \text{ or } x = \frac{1}{2}$$

Value of $x = 1, \frac{1}{2}$

Question 4.

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

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

Solution;

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

Let us simplify the given equation,

$$3x^2 = 2x + 8 = 0$$

By factorizing , we get

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

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

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

So,

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

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

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

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

Let us simplify the given equation,

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

By factorizing , we get

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

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

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

So,

$$(2x - 3) = 0 \text{ or } (2x - 5) = 0$$

$$2x = 3 \text{ or } 2x = 5$$

$$X = \frac{3}{2} \text{ or } x = \frac{5}{2}$$

Question 5 .

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

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

Solution:

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

Let us simplify the given equation,

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

By factorizing, we get

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

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

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

So,

$$(x + 5) = 0 \text{ or } (2x - 5) = 0$$

$$X = -5 \text{ or } 2x = 5$$

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

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

Let us simplify the given equation,

$$X^2 - 3x + 3x - 9 = 40$$

$$X^2 - 9 - 40 = 0$$

$$X^2 - 49 = 0$$

$$X^2 = 49$$

$$X = \sqrt{49}$$

$$= \pm 7$$

Value of $x = 7, -7$

Question 6.

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

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

Solution:

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

Let us simplify the given equation,

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

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

By factorizing, we get

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

$$X(2x - 9) + 2(2x - 9) = 0$$

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

So,

$$(2x - 9) = 0 \text{ or } (x + 2) = 0$$

$$2x = 9 \text{ or } x = -2$$

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

Value of $x = \frac{9}{2}, -2$

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

Let us simplify the given equation,

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

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

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

So,

$$x = 0 \text{ or } 6x + 11 = 0$$

$$x = 0 \text{ or } 6x = -11$$

$$x = 0 \text{ or } x = -\frac{11}{6}$$

$$\text{Value of } x = 0, -\frac{11}{6}$$

Question 7.

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

$$(ii) (x - 4)^2 + 5^2 = 13^2$$

Solution:

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

Let us simplify the given equation,

By factorizing, we get

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

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

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

So,

$$(2x + 1) = 0 \text{ or } (2x + 1) = 0$$

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

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

$$\text{Value of } X = -\frac{1}{2}, -\frac{1}{2}$$

$$(ii) (x - 4)^2 + 5^2 = 13^2$$

Let us simplify the given equation,

$$X^2 + 16 - 2(x)(4) + 25 - 169 = 0$$

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

By factorizing, we get

$$X^2 - 16x + 8x - 128 = 0$$

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

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

So,

$$(x - 16) = 0 \text{ or } (x + 8) = 0$$

$$X = 16 \text{ or } x = -8$$

$$\text{Value of } x = 16, -8$$

Question 8.

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

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

Solution:

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

Let us simplify the given equation,

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

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

By factorizing, we get

$$21x^2 - 14x + 6x - 4 = 0$$

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

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

So,

$$(3x - 2) = 0 \text{ or } (7x + 2) = 0$$

$$3x = 2 \text{ or } 7x = -2$$

$$\text{Value of } x = \frac{2}{3} \text{ or } -\frac{2}{7}$$

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

Let us simplify the given equation,

By taking 3 as LCM and cross multiplying

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

By factorizing , we get

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

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

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

So,

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

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

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

$$\text{Value of } x = \frac{3}{2}, -1$$

Question 9.

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

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

Solution:

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

Let us simplify the given equation,

By cross multiplying , we get

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

By factorizing , we get

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

$$6x (x + 5) - 1 (x + 5) = 0$$

$$(x + 5)(6x - 1) = 0$$

So,

$$(x + 5) = 0 \text{ or } (6x - 1) = 0$$

$$X = -5 \text{ or } 6x = 1$$

$$X = -5 \text{ or } x = \frac{1}{6}$$

$$\text{Value of } x = -5, \frac{1}{6}$$

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

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

Let us simplify the given equation,

By taking LCM

$$X^2 + 1 = \frac{5x}{2}$$

By cross multiplying,

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

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

By factorizing, we get

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

$$X(2x - 1) - 2(2x - 1) = 0$$

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

So,

$$(2x - 1) = 0 \text{ or } (x - 2) = 0$$

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

$$X = \frac{1}{2} \text{ or } x = 2$$

$$\text{Value of } x = \frac{1}{2}, 2$$

Question 10.

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

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

Solution:

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

Let us simplify the given equation,

By taking LCM and cross multiplying

$$3x^2 - 8 = 2x$$

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

By factorizing, we get

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

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

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

So,

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

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

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

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

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

Let us simplify the given equation,

By taking $3x$ as LCM and cross multiplying

$$X^2 + 27 = 12x$$

$$X^2 - 12x + 27 = 0$$

By factorizing, we get

$$X^2 - 3x - 9x + 27 = 0$$

$$X(x - 3) - 9(x - 3) = 0$$

$$(x - 3)(x - 9) = 0$$

$$\text{So, } (x - 3) = 0 \text{ or } (x - 9) = 0$$

$$X = 3 \text{ or } x = 9$$

$$\text{Value or } x = 3, 9$$

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:

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

Let us simplify the given equation,

By cross multiplying,

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

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

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

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

By factorizing, we get

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

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

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

So,

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

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

Value of $x = 4, 3$

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

Let us simplify the given equation,

By taking $x(x+2)$ as LCM

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

By cross multiplying,

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

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

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

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

By factorizing, we get

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

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

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

So,

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

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

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

$$\text{Value of } x = 2, -\frac{4}{3}$$

Question 12.

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

$$(ii) \frac{x}{x+1} + \frac{x+1}{x} = \frac{21}{6}$$

Solution:

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

Let us simplify the given equation,

By taking $(x + 3)(2 - x)$ as LCM

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

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

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

$$2x^2 + 2x - 11x - 12 + 7$$

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

By factorizing, we get

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

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

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

So,

$$(x - 5) = 0 \text{ or } (2x + 1) = 0$$

$$X = 5 \text{ or } 2x = -1$$

$$X = 5 \text{ or } x = -\frac{1}{2}$$

$$(ii) \frac{x}{x+1} + \frac{x+1}{x} = \frac{21}{6}$$

Let us simplify the given equation,

By taking $x(x + 1)$ as LCM

$$\frac{[x(x) + (x+1)(x+1)]}{x(x+1)} = \frac{13}{6}$$

$$6[x^2 + x^2 + x + x + 1] = 13x(x + 1)$$

$$6[2x^2 + 2x + 1] = 13x^2 + 13x$$

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

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

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

By factorizing, we get

$$X^2 + 3x - 2x - 6 = 0$$

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

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

So,

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

$$X = -3 \text{ or } x = 2$$

Value of $x = -3, 2$

Chapter Test

Question 1.

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

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

Solution:

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

We can write it as

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

By further calculation

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

By taking out the common terms

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

So we get

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

Here

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

$$2x - 1 = 0 \text{ then } 2x = 1 \text{ where } x = \frac{1}{2}$$

Therefore ,

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

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

We can write it as

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

By taking out the common terms

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

So we get

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

Here

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

$$3x + 2 = 0 \text{ then } 3x = -2 \text{ where } x = -\frac{2}{3}$$

$$\text{Therefore, } x = 2 - \frac{2}{3}$$

Question 2.

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

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

Solution:

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

Multiply the equation by 4

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

We can write it as

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

Taking out the common terms

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

So we get

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

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

Here

$$4x - 1 = 0$$

$$4x = 1$$

By division

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

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

We can write it as

$$2x^2 + 4x + 3x + 6 = 0$$

By further calculation

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

So we get

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

Here

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

$$2x + 3 = 0 \text{ then } 2x = -3 \text{ where } x = -\frac{3}{2}$$

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

Question 3.

$$(i) \frac{x-1}{x-2} + \frac{x-3}{x-4} = \frac{31}{3}$$

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

Solution:

$$(i) \frac{x-1}{x-2} + \frac{x-3}{x-4} = \frac{31}{3}$$

By taking LCM

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

By further calculation

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

By cross multiplication

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

By further simplification

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

So we get

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

Dividing by 2

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

It can be written as

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

Taking out the common terms

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

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

Here

$$x - 5 = 0 \text{ then } x = 5$$

$$2x - 5 = 0 \text{ then } 2x = 5 \text{ where } x = \frac{5}{2}$$

$$\text{Therefore, } x = 5, \frac{5}{2}$$

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

Taking LCM

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

By cross multiplication

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

So we get

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

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

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

Taking out the common terms

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

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

Here

$$3x - 4 = 0 \text{ then } 3x = 4 \text{ where } x = \frac{4}{3}$$

$$x - 3 = 0 \text{ then } x = 3$$

$$\text{Therefore, } x = 3, \frac{4}{3}$$