

Grade 10 Mathematics

Chapter 15: Quadratic Equations and Inequalities

SLO-Wise Solved Questions

Step-by-step solutions

Essential facts used throughout

- **Standard form of a quadratic equation:** $ax^2 + bx + c = 0$, where $a \neq 0$.
- **Zero-product rule:** if $AB = 0$, then $A = 0$ or $B = 0$.
- **Completing the square:** $x^2 + 2px = (x + p)^2 - p^2$.
- **Quadratic formula:** $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$.
- **Discriminant:** $D = b^2 - 4ac$.
 - If $D > 0$, the equation has two distinct real roots.
 - If $D = 0$, the equation has two equal real roots.
 - If $D < 0$, the equation has no real roots.
- **Vertex of $y = ax^2 + bx + c$:** $x = -\frac{b}{2a}$. If $a < 0$, the vertex gives a maximum value; if $a > 0$, it gives a minimum value.
- In rational equations, values that make a denominator zero must be excluded.

SLO 15.1.2 — Write quadratic equations in standard form

The standard form is

$$ax^2 + bx + c = 0, \quad a \neq 0.$$

Question 1

(i) $3x - 1 = 2x^2$

Bring all terms to one side:

$$\begin{aligned} 3x - 1 &= 2x^2 \\ 2x^2 - 3x + 1 &= 0. \end{aligned}$$

Answer: $2x^2 - 3x + 1 = 0$

(ii) $2x(x + 1) = 4(2x + 3)$

Expand both sides:

$$2x^2 + 2x = 8x + 12.$$

Bring all terms to one side:

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

Divide by 2:

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

Answer: $x^2 - 3x - 6 = 0$

(iii) $2x^2 - 4x = 4x + 7$

$$2x^2 - 4x - 4x - 7 = 0$$

$$2x^2 - 8x - 7 = 0.$$

Answer: $2x^2 - 8x - 7 = 0$

(iv) $4(3x - 2) = 9x^2$

Expand the left-hand side:

$$12x - 8 = 9x^2.$$

Bring all terms to one side:

$$9x^2 - 12x + 8 = 0.$$

Answer: $9x^2 - 12x + 8 = 0$

(v) $2x + \frac{1}{x} = 5 - \frac{1}{x}, x \neq 0$

Multiply every term by x :

$$2x^2 + 1 = 5x - 1.$$

Bring all terms to one side:

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

Answer: $2x^2 - 5x + 2 = 0$, with $x \neq 0$.

(vi) $\frac{6x+6}{20-x} = \frac{1}{x}, x \neq 0, 20$

Cross-multiply:

$$x(6x + 6) = 20 - x.$$

Expand and rearrange:

$$6x^2 + 6x = 20 - x$$

$$6x^2 + 7x - 20 = 0.$$

Answer: $6x^2 + 7x - 20 = 0$, with $x \neq 0, 20$.

SLO 15.2.1 — Solve quadratic equations by prescribed methods

A. Factorization method

Question 1

(i) $x^2 - x - 6 = 0$

Find two numbers whose product is -6 and sum is -1 :

$$x^2 - x - 6 = (x - 3)(x + 2).$$

Therefore,

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

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

Answer: $x = 3$ or $x = -2$

(ii) $x^2 + 3x - 28 = 0$

$$x^2 + 3x - 28 = (x + 7)(x - 4).$$

$$(x + 7)(x - 4) = 0.$$

$$x + 7 = 0 \quad \text{or} \quad x - 4 = 0.$$

Answer: $x = -7$ or $x = 4$

(iii) $6x^2 + 13x - 5 = 0$

Split the middle term:

$$6x^2 + 15x - 2x - 5 = 0.$$

Factor by grouping:

$$3x(2x + 5) - 1(2x + 5) = 0$$

$$(3x - 1)(2x + 5) = 0.$$

Hence,

$$3x - 1 = 0 \quad \text{or} \quad 2x + 5 = 0.$$

Answer: $x = \frac{1}{3}$ or $x = -\frac{5}{2}$

(iv) $x^2 - \frac{3}{2}x = \frac{9}{2}$

Bring all terms to one side and multiply by 2:

$$x^2 - \frac{3}{2}x - \frac{9}{2} = 0$$

$$2x^2 - 3x - 9 = 0.$$

Factorize:

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

Therefore,

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

Answer: $x = -\frac{3}{2}$ or $x = 3$

(v) $\frac{3x-8}{x-2} = \frac{5x-2}{x+5}, x \neq 2, -5$

Cross-multiply:

$$(3x - 8)(x + 5) = (5x - 2)(x - 2).$$

Expand:

$$3x^2 + 7x - 40 = 5x^2 - 12x + 4.$$

Rearrange:

$$2x^2 - 19x + 44 = 0.$$

Factorize:

$$(2x - 11)(x - 4) = 0.$$

Thus,

$$x = \frac{11}{2} \quad \text{or} \quad x = 4.$$

Neither value is excluded.

Answer: $x = \frac{11}{2}$ or $x = 4$

(vi) $\frac{1}{x-1} - \frac{1}{x+3} = \frac{1}{35}, x \neq 1, -3$

Combine the fractions on the left: