Class 10 Mathematics · Chapter 4: Quadratic Equations

Answer key and marking scheme · 20 marks · about 40 minutes · based on NCERT

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1. Which of the following is NOT a quadratic equation? [1]

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

(c) $x(2x + 3) = x^2 + 1$ (d) $(x + 1)^3 = 2x(x^2 + 1)$

Answer: (d) In (d) the left side has x^3 and the right side $2x^3$; they do not cancel, and the equation becomes $-x^3 + 3x^2 + x + 1 = 0$, a cubic. The others reduce to $3x^2 + 3x - 1 = 0$, $x^2 - 6x + 8 = 0$ and $x^2 + 3x - 1 = 0$.

2. The solution of $\frac{x^2}{x-3} = \frac{9}{x-3}$ is [1]

(a) $x = 3$ only (b) $x = -3$ only

(c) $x = 3$ and $x = -3$ (d) no value of x

Answer: (b) Multiplying by $(x - 3)$ gives $x^2 = 9$, so $x = 3$ or $x = -3$. But $x = 3$ makes the denominator zero in the given equation, so it is rejected; the solution is $x = -3$.

3. The roots of $(3x - 2)(x + 4) = 0$ are [1]

(a) 2 and −4 (b) $-\frac{2}{3}$ and 4

(c) $\frac{3}{2}$ and −4 (d) $\frac{2}{3}$ and −4

Answer: (d) Set each factor to zero: $3x - 2 = 0$ gives $x = 2/3$; $x + 4 = 0$ gives $x = -4$.

4. When $(x - 1)^3 = x^3 + 2$ is simplified, it becomes [1]

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

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

Answer: (b) $x^3 - 3x^2 + 3x - 1 = x^3 + 2$ gives $-3x^2 + 3x - 3 = 0$; dividing by -3, $x^2 - x + 1 = 0$. The x^3 terms cancel, so it is quadratic.

5. If $x = 2$ is a root of $x^2 + kx - 10 = 0$, then k is [1]

(a) 3 (b) −3

(c) 7 (d) 2

Answer: (a) Substitute $x = 2$: $4 + 2k - 10 = 0$, so $2k = 6$ and $k = 3$.

6. Check whether $(2x + 1)(x - 3) = (x + 4)(x - 2)$ is a quadratic equation. [2]

LHS $= 2x^2 - 5x - 3$; RHS $= x^2 + 2x - 8$. Bringing all terms to one side: $x^2 - 7x + 5 = 0$. This is of the form $ax^2 + bx + c = 0$ with $a = 1 \neq 0$, so it is a quadratic equation.

- expands both sides correctly (1)
- reduces to $x^2 - 7x + 5 = 0$ and concludes it is quadratic since $a \neq 0$ (1)

7. Find the roots of $2x^2 - 2\sqrt{2}x + 1 = 0$ by factorisation. [2]

Split $-2\sqrt{2}x$ as $-\sqrt{2}x - \sqrt{2}x$ (product 2 = ac, sum $-2\sqrt{2}$ = b). $2x^2 - \sqrt{2}x - \sqrt{2}x + 1 = \sqrt{2}x(\sqrt{2}x - 1) - 1(\sqrt{2}x - 1) = (\sqrt{2}x - 1)(\sqrt{2}x - 1) = 0$. So $x = 1/\sqrt{2}$, $1/\sqrt{2}$ (a repeated root).

- splits the middle term and factorises to $(\sqrt{2}x - 1)(\sqrt{2}x - 1)$ (1)
- roots $1/\sqrt{2}$ and $1/\sqrt{2}$, i.e. $\sqrt{2}/2$ repeated (1)

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8. Find the discriminant of $2x^2 - 4x + 3 = 0$ and hence state the nature of its roots. [2]

$a = 2, b = -4, c = 3$. $D = b^2 - 4ac = 16 - 24 = -8$. Since $D < 0$, the equation has no real roots.

- $D = -8$ (1)
- no real roots, because $D < 0$ (1)

9. Solve $\frac{1}{x-1} + \frac{1}{x+3} = \frac{2}{3}$, $x \neq 1, -3$. [3]

Combine: $(x + 3 + x - 1)/((x - 1)(x + 3)) = 2/3$, so $3(2x + 2) = 2(x^2 + 2x - 3)$. $6x + 6 = 2x^2 + 4x - 6$ gives $2x^2 - 2x - 12 = 0$, i.e. $x^2 - x - 6 = 0$, $(x - 3)(x + 2) = 0$. $x = 3$ or $x = -2$; neither makes a denominator zero. Check $x = 3$: $1/2 + 1/6 = 2/3$.

- clears the denominators correctly (1)
- reduces to $x^2 - x - 6 = 0$ (1)
- $x = 3, -2$, both admissible (1)

10. Find two numbers whose sum is 15 and whose product is 56. [3]

The numbers are the roots of $x^2 - 15x + 56 = 0$. Split $-15x$ as $-7x - 8x$: $x(x - 7) - 8(x - 7) = (x - 7)(x - 8) = 0$. The numbers are 7 and 8. Check: $7 + 8 = 15$, $7 \times 8 = 56$.

- forms $x^2 - 15x + 56 = 0$ (1)
- factorises to $(x - 7)(x - 8)$ (1)
- numbers 7 and 8 (1)

11. If α and β are the roots of $2x^2 - 6x + 3 = 0$, find $\alpha^2 + \beta^2$. [3]

The roots of the equation are the zeroes of $2x^2 - 6x + 3$, so $\alpha + \beta = -b/a = 3$ and $\alpha\beta = c/a = 3/2$. $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta = 9 - 3 = 6$.

- $\alpha + \beta = 3$ (1)
- $\alpha\beta = 3/2$ (1)
- $\alpha^2 + \beta^2 = 6$ (1)

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