Class X | Mathematics

CHAPTER 4 — QUADRATIC EQUATIONS

Objective Type Worksheet

Total Questions: 40 | MCQ: 25 (1 mark each) | Assertion-Reason: 15 (1 mark each)

★ *Competency-Based Questions are marked [CB]. Difficulty: [E] = Easy [M] = Moderate [H] = Hard*

⚠ *No answer key is provided in this sheet. Attempt all questions independently.*

SECTION A — Multiple Choice Questions (MCQ)

Each question carries 1 mark. Choose the most appropriate option.

Easy Level

1. Which of the following is a quadratic equation? *[E]*
(a) $x^3 + 2x + 1 = 0$
(b) $x^2 + (1/x) = 3$
(c) $2x^2 - 5x + 3 = 0$
(d) $x + 5 = 0$

2. The standard form of a quadratic equation is: *[E]*
(a) $ax + b = 0, \quad a \neq 0$
(b) $ax^2 + bx + c = 0, \quad a \neq 0$
(c) $ax^2 + bx = 0, \quad a \neq 0$
(d) $ax^2 + c = 0, \quad a \neq 0$

3. The discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$ is: *[E]*
(a) 8
(b) –8
(c) 4
(d) –4

4. If $x = 3$ is a root of the equation $x^2 - kx + 6 = 0$, then $k =$ *[E]*
(a) 3
(b) 5
(c) 6
(d) –5

5. The roots of the equation $x^2 - 5x + 6 = 0$ are: *[E]*
(a) 2 and 3
(b) –2 and –3
(c) 1 and 6
(d) –1 and –6

6. The sum of roots of $3x^2 - 7x + 2 = 0$ is: *[E]*

(a) 7/3
(b) –7/3
(c) 2/3
(d) –2/3

7. The product of roots of the equation $x^2 + 5x - 14 = 0$ is: *[E]*
(a) 14
(b) –14
(c) 5
(d) –5

8. A rectangular park has length 3 m more than its breadth. If its area is 40 m², which equation models this situation (breadth = x)? *[E · CB]*
(a) $x^2 + 3x - 40 = 0$
(b) $x^2 - 3x - 40 = 0$
(c) $x^2 + 3x + 40 = 0$
(d) $x^2 - 3x + 40 = 0$

Moderate Level

9. For what value of k does $kx^2 + 6x + 1 = 0$ have equal roots? *[M]*
(a) 7
(b) 9
(c) 6
(d) 3

10. The equation $x^2 + 4x + k = 0$ has real and distinct roots when: *[M]*
(a) $k > 4$
(b) $k < 4$
(c) $k = 4$
(d) $k \geq 4$

11. A train travels 360 km at a uniform speed. If it had been 5 km/h faster, it would have taken 1 hour less. Which equation represents the original speed x (in km/h)? *[M · CB]*
(a) $x^2 + 5x - 1800 = 0$
(b) $x^2 + 5x - 360 = 0$
(c) $x^2 - 5x - 1800 = 0$
(d) $x^2 + 5x + 1800 = 0$

12. The roots of $ax^2 + bx + c = 0$ are real and equal when: *[M]*
(a) $b^2 - 4ac > 0$
(b) $b^2 - 4ac < 0$
(c) $b^2 - 4ac = 0$
(d) $b^2 + 4ac = 0$

13. If one root of $2x^2 - 5x + k = 0$ is twice the other, the value of k is: *[M]*
(a) 25/8
(b) 25/4
(c) 50/9
(d) 2

14. The sum of a natural number and its reciprocal is 10/3. The number is: *[M · CB]*

(a) 3
(b) 1/3
(c) Both (a) and (b)
(d) Neither (a) nor (b)

15. Using the quadratic formula, the roots of $x^2 - 3x - 10 = 0$ are: *[M]*

(a) 5 and –2
(b) –5 and 2
(c) 5 and 2
(d) –5 and –2

16. Two consecutive positive integers have a product of 306. Which equation gives the smaller integer x? *[M · CB]*

(a) $x^2 + x - 306 = 0$
(b) $x^2 - x - 306 = 0$
(c) $x^2 + x + 306 = 0$
(d) $x(x - 1) = 306$

17. The value(s) of k for which $x^2 - 2kx + 7k - 12 = 0$ has equal roots is/are: *[M]*

(a) $k = 3$ only
(b) $k = 4$ only
(c) $k = 3$ or $k = 4$
(d) $k = 12$

18. A shopkeeper buys some items for ₹600. If he had bought 5 more items for the same amount, the cost per item would have decreased by ₹10. Which equation gives the original number of items x? *[M · CB]*

(a) $x^2 + 5x - 300 = 0$
(b) $x^2 + 5x + 300 = 0$
(c) $x^2 - 5x - 300 = 0$
(d) $x^2 + 5x - 30 = 0$

Hard Level

19. If α and β are roots of $x^2 - 6x + k = 0$ and $3\alpha + 2\beta = 20$, then k = *[H]*

(a) –16
(b) 8
(c) 16
(d) –8

20. A motorboat, whose speed is 18 km/h in still water, takes 1 hour more to go 24 km upstream than to go 24 km downstream. The speed of the stream (in km/h) is: *[H · CB]*

(a) 3
(b) 6
(c) 9
(d) 2

21. If the equation $(k + 1)x^2 - 2(k - 1)x + 1 = 0$ has equal roots, then k = *[H]*

(a) 0 or 3
(b) 1 or 3

(c) 0 only
(d) 3 only

22. A person on tour has ₹360 for daily expenses. If he extends his tour by 4 days, he must cut his daily expense by ₹3. How many days is the original tour? (Set up and solve the equation for original days x.) *[H · CB]*
(a) 20 days
(b) 24 days
(c) 15 days
(d) 18 days

23. The equation $9x^2 - 6px + (p^2 - q^2) = 0$ has equal roots. In terms of p and q, the roots are: *[H]*
(a) $(p - q)/3$
(b) $(p + q)/3$
(c) $p/3 \pm q$
(d) $p \pm q/3$

24. If the difference of the roots of $x^2 - lx + m = 0$ is 1, then the relation between l and m is: *[H]*
(a) $l^2 = 4m + 1$
(b) $l^2 = 4m - 1$
(c) $l^2 = m + 4$
(d) $l^2 = m - 4$

25. An express train makes a run of 240 km at a certain speed. Another train whose speed is 12 km/h less takes 1 hour more for the same journey. The speed of the express train is: *[H · CB]*
(a) 48 km/h
(b) 60 km/h
(c) 72 km/h
(d) 36 km/h

SECTION B — Assertion-Reason Questions

In each question, a statement of Assertion (A) is followed by a statement of Reason (R). Choose the correct option:
(a) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A).
(b) Both Assertion (A) and Reason (R) are true, but Reason (R) is NOT the correct explanation of Assertion (A).
(c) Assertion (A) is true, but Reason (R) is false.
(d) Assertion (A) is false, but Reason (R) is true.

Easy Level

1. Assertion (A): $x = -2$ is a root of the equation $x^2 + 5x + 6 = 0$. *[E]*
Reason (R): A quadratic equation can have at most two roots.

2. Assertion (A): The equation $x^2 + 1 = 0$ has no real roots. *[E]*
Reason (R): The square of a real number is always non-negative, so $x^2 \geq 0$ for all real x.

3. Assertion (A): The discriminant of $x^2 - 4x + 4 = 0$ is zero. *[E]*
Reason (R): When $D = 0$, the quadratic equation has two equal real roots.

4. Assertion (A): $x^2 - 3x + 2 = 0$ can be solved by the method of factorisation. *[E]*
Reason (R): Every quadratic equation can be solved by the method of completing the square.

Moderate Level

5. Assertion (A): The equation $2x^2 + 5x + 4 = 0$ has no real roots. *[M]*
Reason (R): If $b^2 - 4ac < 0$, the equation $ax^2 + bx + c = 0$ has no real roots.

6. Assertion (A): If the sum of two numbers is 8 and their product is 15, then the numbers satisfy the equation $x^2 - 8x + 15 = 0$. *[M · CB]*
Reason (R): If α and β are roots of $ax^2 + bx + c = 0$, then $\alpha + \beta = -b/a$ and $\alpha\beta = c/a$.

7. Assertion (A): $3x^2 - 4\sqrt{3}\,x + 4 = 0$ has two equal real roots each equal to $2/\sqrt{3}$. *[M]*
Reason (R): Equal roots occur when $b^2 - 4ac = 0$, and each root equals $-b/(2a)$.

8. Assertion (A): A square and a rectangle (length 4 cm more than side of square) together have area 96 cm². This gives the equation $x^2 + 4x - 96 = 0$, where x is the side of the square. *[M · CB]*
Reason (R): Area of a rectangle = length × breadth.

9. Assertion (A): The equation $(x - 2)^2 + 1 = 2x - 3$ reduces to a linear equation after simplification. *[M]*
Reason (R): An equation is quadratic only if the coefficient of x^2 is non-zero after simplification.

10. Assertion (A): For the equation $x^2 + kx + 16 = 0$ to have real roots, the value of k must satisfy $|k| \geq 8$. *[M]*
Reason (R): The equation has real roots if and only if $D = k^2 - 64 \geq 0$.

11. Assertion (A): The roots of the equation $4x^2 + 4bx + (b^2 - a^2) = 0$ are $(-b + a)/2$ and $(-b - a)/2$. *[M]*
Reason (R): The quadratic formula gives $x = [-b \pm \sqrt{(b^2 - 4ac)}] / (2a)$.

Hard Level

12. Assertion (A): If p, q, r are in AP and the equation $px^2 + qx + r = 0$ has real roots, then $|q/p| \geq 2\sqrt{2}$ when $p \neq 0$. *[H]*
Reason (R): For p, q, r in AP: $q = (p + r)/2$. Combined with $D \geq 0$ i.e. $q^2 - 4pr \geq 0$, this gives the stated inequality.

13. Assertion (A): A pipe can fill a tank in 3 hours less than another pipe. Together they fill the tank in 2 hours. If the faster pipe takes x hours alone, then $x^2 - 7x + 6 = 0$. *[H · CB]*
Reason (R): If pipe A fills in x hours and B in (x + 3) hours, together they fill $1/x + 1/(x+3) = 1/2$ of the tank per hour.

14. Assertion (A): The equation $x^2 - (p + 1/p)x + 1 = 0$ always has real roots for any non-zero real value of p. *[H]*
Reason (R): $D = (p + 1/p)^2 - 4 = (p - 1/p)^2 \geq 0$ for all non-zero real p.

15. Assertion (A): A ball is thrown upward. Its height h (in m) at time t (in s) is $h = 20t - 5t^2$. The ball is at height 15 m at t = 1 s and t = 3 s. *[H · CB]*
Reason (R): The values of t for which h = 15 are the roots of $5t^2 - 20t + 15 = 0$, i.e., $t^2 - 4t + 3 = 0$.