

QUADRATIC EQUATIONS

Most Important Previous Years Questions (2020 - 2025) / CBSE Class 10 Mathematics

Section A: Standard Mathematics (10 Questions & Solutions)

[Q1. CBSE 2023] Find the value of k for which the quadratic equation $(k+4)x^2 + (k+1)x + 1 = 0$ has equal roots.

Solution:

For an equation $ax^2 + bx + c = 0$ to have equal roots, its discriminant $D = b^2 - 4ac = 0$.

Here, $a = (k+4)$, $b = (k+1)$, and $c = 1$.

Substituting these into the formula:

$$(k+1)^2 - 4(k+4)(1) = 0$$

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

$$k^2 - 2k - 15 = 0$$

Splitting the middle term:

$$k^2 - 5k + 3k - 15 = 0$$

$$k(k - 5) + 3(k - 5) = 0 \Rightarrow (k - 5)(k + 3) = 0$$

Therefore, $k = 5$ or $k = -3$.

[Q2. CBSE 2020] Solve for x : $\frac{1}{x+4} - \frac{1}{x-7} = \frac{11}{30}$, where $x = -4, 7$.

Solution:

Taking LCM on the Left-Hand Side:

$$\frac{(x-7)-(x+4)}{(x+4)(x-7)} = \frac{11}{30}$$

$$\frac{x-7-x-4}{x^2-7x+4x-28} = \frac{11}{30}$$

$$\frac{-11}{x^2-3x-28} = \frac{11}{30}$$

Dividing both sides by 11:

$$\frac{-1}{x^2-3x-28} = \frac{1}{30}$$

$$x^2 - 3x - 28 = -30 \text{ ----- (Cross-multiplying)}$$

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

Factorizing the equation:

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

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

Thus, $x = 1$ or $x = 2$.

[Q3. CBSE 2024] If one root of the quadratic equation $2x^2 + kx - 6 = 0$ is 2, find the value of k. Also, find the other root.

Solution:

Since $x = 2$ is a root, it must satisfy the equation:

$$2(2)^2 + k(2) - 6 = 0$$

$$2(4) + 2k - 6 = 0 \Rightarrow 8 + 2k - 6 = 0$$

$$2k + 2 = 0$$

$$2k = -2 \Rightarrow k = -1$$

Substitute $k = -1$ back into the equation:

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

To find the other root, split the middle term:

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

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

Thus, the roots are $x = 2$ and $x = -\frac{3}{2}$.

[Q4. CBSE 2022] Solve the quadratic equation $9x^2 - 6b^2x - (a^4 - b^4) = 0$ for x.

Solution:

We use the quadratic formula:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Here, $A = 9$, $B = -6b^2$, $C = -(a^4 - b^4)$

First find Discriminant $D = B^2 - 4AC$:

$$D = (-6b^2)^2 - 4(9)[-(a^4 - b^4)]$$

$$D = 36b^4 + 36(a^4 - b^4) = 36b^4 + 36a^4 - 36b^4 = 36a^4$$

Now, calculating x:

$$x = \frac{6b^2 \pm \sqrt{36a^4}}{2 \times 9}$$

$$x = \frac{6b^2 \pm 6a^2}{18}$$

Taking 6 common from numerator and simplifying:

$$x = \frac{b^2 + a^2}{3} \quad \text{or} \quad x = \frac{b^2 - a^2}{3}$$

[Q5. CBSE 2023] A motor boat whose speed is 18 km/h in still water takes 1 hour more to go 24 km upstream than to return downstream to the same spot. Find the speed of the stream.

Solution:

Let the speed of the stream be y km/h.

Speed upstream = $(18 - y)$ km/h, Speed downstream = $(18 + y)$ km/h.

$$\text{Time taken upstream} = \frac{24}{(18-y)}$$

$$\text{Time taken downstream} = \frac{24}{(18+y)}$$

According to the problem statement:

$$\frac{24}{(18-y)} - \frac{24}{(18+y)} = 1$$

$$\frac{24(18+y) - 24(18-y)}{(18+y)(18-y)} = 1$$

$$\frac{24[(18+y) - (18-y)]}{(18+y)(18-y)} = 1 \text{ ----- (taking 24 is common)}$$

$$\frac{24[18+y-18+y]}{(18+y)(18-y)} = 1$$

$$\frac{24[2y]}{324 - y^2} = 1$$

$$48y = 324 - y^2$$

$$\Rightarrow y^2 + 48y - 324 = 0$$

Factoring the quadratic equation:

$$y^2 + 54y - 6y - 324 = 0$$

$$y(y + 54) - 6(y + 54) = 0$$

$$\Rightarrow (y - 6)(y + 54) = 0$$

Since speed cannot be negative, $y = 6$ km/h.

The speed of the stream is 6 km/h.

[Q6. CBSE 2020] Two water taps together can fill a tank in $9\frac{3}{8}$ hours. The tap of larger diameter takes 10 hours less than the smaller one to fill the tank separately. Find the time in which each tap can separately fill the tank.

Solution:

Total time together = $9\frac{3}{8} = \frac{75}{8}$ hours.

Let the smaller tap take t hours to fill the tank.

Then the larger tap takes $(t - 10)$ hours.

Part filled by smaller tap in 1 hour = $\frac{1}{t}$; Part filled by larger tap in 1 hour = $\frac{1}{t-10}$.

Combined 1-hour rate:

$$\frac{1}{t} + \frac{1}{t-10} = \frac{8}{75}$$

$$\frac{(t-10)+t}{t(t-10)} = \frac{8}{75}$$

$$\frac{2t-10}{t(t-10)} = \frac{8}{75}$$

Cross-multiplying:

$$75(2t - 10) = 8(t^2 - 10t)$$

$$\Rightarrow 150t - 750 = 8t^2 - 80t$$

$$8t^2 - 230t + 750 = 0$$

$$\Rightarrow 4t^2 - 115t + 375 = 0$$

Factoring via splitting middle term:

$$4t^2 - 100t - 15t + 375 = 0$$

$$4t(t - 25) - 15(t - 25) = 0$$

$$\Rightarrow (4t - 15)(t - 25) = 0$$

If $t = \frac{15}{4} = 3.75$ hours, then larger tap time becomes negative, which is invalid.

Therefore, $t = 25$ hours.

Smaller tap takes 25 hours and larger tap takes 15 hours.

[Q7. CBSE 2024] Find the nature of the roots of the quadratic equation $3x^2 - 4\sqrt{3}x + 4 = 0$. If real roots exist, find them.

Solution:

Identify coefficients: $a = 3$, $b = -4\sqrt{3}$, $c = 4$.

Discriminant $D = b^2 - 4ac$

$$D = (-4\sqrt{3})^2 - 4(3)(4)$$

$$= 48 - 48 = 0$$

Since $D = 0$, the roots are real and equal.

The roots are given by $x = \frac{-b}{2a}$

$$x = \frac{-(-4\sqrt{3})}{(2 \times 3)} = \frac{4\sqrt{3}}{6} = \frac{2\sqrt{3}}{3} = 2\sqrt{3}$$

Thus, both roots are equal to $2\sqrt{3}$.

[Q8. CBSE 2021] If the total cost of a certain number of books is Rs 960 and if 4 more books are bought for the same amount, each book would cost Rs 20 less. Find the original number of books.

Solution:

Let the original number of books be n .

$$\text{Original cost per book} = \frac{960}{n}$$

New number of books = $n + 4$. New cost per book = $\frac{960}{n+4}$

According to the given condition:

$$\frac{960}{n} - \frac{960}{n+4} = 20$$

Divide the entire equation by 20:

$$\frac{48}{n} - \frac{48}{n+4} = 1$$

$$\frac{48[(n+4)-n]}{n(n+4)} = 1$$

$$48[4] = n(n+4) \Rightarrow 192 = n^2 + 4n$$

$$n^2 + 4n - 192 = 0$$

Factoring by splitting the middle term:

$$n^2 + 16n - 12n - 192 = 0$$

$$n(n+16) - 12(n+16) = 0$$

$$\Rightarrow (n-12)(n+16) = 0$$

Since count cannot be negative, $n = 12$.

The original number of books is 12.

[Q9. CBSE 2025] Find the values of p for which the quadratic equation $2x^2 + px + 8 = 0$ has distinct real roots.

Solution:

For an equation to have distinct real roots, its discriminant must be strictly greater than zero ($D > 0$).

Here, $a = 2$, $b = p$, $c = 8$.

$$D = p^2 - 4(2)(8) > 0$$

$$p^2 - 64 > 0$$

$$p^2 > 64$$

Taking the square root on both sides reveals the interval:

$$p > 8 \text{ or } p < -8$$

Thus, p belongs to $(-\infty, -8) \cup (8, \infty)$.

[Q10. CBSE 2023] Solve for x : $4x^2 - 4ax + (a^2 - b^2) = 0$.

Solution:

Rearrange and group the first three terms as a perfect square expression:

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

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

Applying identity $a^2 - b^2 = (a - b)(a + b)$:

$$[(2x - a) - b][(2x - a) + b] = 0$$

Setting each factor to zero:

$$1) 2x - a - b = 0 \Rightarrow 2x = a + b \Rightarrow x = \frac{a+b}{2}$$

$$2) 2x - a + b = 0 \Rightarrow 2x = a - b \Rightarrow x = \frac{a-b}{2}$$

The values of x are $(a + b)/2$ and $\frac{a-b}{2}$

Section B: Basic Mathematics (10 Questions & Solutions)

[Q1. CBSE 2023] Find the discriminant of the quadratic equation $2x^2 - 4x + 3 = 0$ and hence find the nature of its roots.

Solution:

Given: $a = 2$, $b = -4$, $c = 3$.

Discriminant formula: $D = b^2 - 4ac$

$$D = (-4)^2 - 4(2)(3)$$

$$D = 16 - 24 = -8$$

Since $D < 0$ (negative value), the quadratic equation has no real roots (imaginary roots).

[Q2. CBSE 2020] If $x = 3$ is one root of the quadratic equation $x^2 - 2kx - 6 = 0$, then find the value of k .

Solution:

Since $x = 3$ is a root, substituting $x = 3$ must satisfy the equation:

$$(3)^2 - 2k(3) - 6 = 0$$

$$9 - 6k - 6 = 0$$

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

$$k = \frac{3}{6} = \frac{1}{2}$$

The value of k is $\frac{1}{2}$.

[Q3. CBSE 2024] Find the roots of the quadratic equation $x^2 - 3x - 10 = 0$ by factorization.

Solution:

We need two numbers whose product is -10 and sum is -3 . These are -5 and 2 .

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

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

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

Setting each term to 0 gives:

$$x - 5 = 0 \Rightarrow x = 5 \text{ or } x + 2 = 0 \Rightarrow x = -2.$$

The roots are 5 and -2 .

[Q4. CBSE 2022] Find the roots of the quadratic equation $2x^2 - x - 6 = 0$ using the quadratic formula.

Solution:

Coefficients are: $a = 2$, $b = -1$, $c = -6$.

Discriminant $D = b^2 - 4ac$:

$$D = (-1)^2 - 4(2)(-6) = 1 + 48 = 49$$

Using the quadratic formula:

$$X = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$X = \frac{-(-1) \pm \sqrt{49}}{2 \times 2}$$

$$x = \frac{1 \pm 7}{4}$$

Calculating the two cases:

$$\text{Case 1: } x = \frac{1+7}{4} = \frac{8}{4} = 2$$

$$\text{Case 2: } x = \frac{1-7}{4} = \frac{-6}{4} = \frac{-3}{2}$$

The roots are 2 and $\frac{-3}{2}$

[Q5. CBSE 2023] Divide 27 into two parts such that the sum of their reciprocals is $\frac{3}{20}$.

Solution:

Let the first part be x . The second part will be $(27 - x)$.

According to the question:

$$\frac{1}{x} + \frac{1}{27-x} = \frac{3}{20}$$

$$\frac{(27-x)+x}{x(27-x)} = \frac{3}{20}$$

$$\frac{27}{x(27-x)} = \frac{3}{20}$$

Divide numerators by 3:

$$\frac{9}{x(27-x)} = \frac{1}{20}$$

Cross-multiplying:

$$180 = 27x - x^2 \Rightarrow x^2 - 27x + 180 = 0$$

Factoring the equation:

$$x^2 - 15x - 12x + 180 = 0$$

$$x(x - 15) - 12(x - 15) = 0 \Rightarrow (x - 15)(x - 12) = 0$$

Thus, $x = 15$ or $x = 12$.

The two parts are 15 and 12.

[Q6. CBSE 2020] The product of two consecutive positive integers is 306. Formulate the quadratic equation to find the integers.

Solution:

Let the first positive integer be x .

Since they are consecutive integers, the next positive integer is $(x + 1)$.

According to the given condition, their product is 306:

$$x * (x + 1) = 306$$

$$x^2 + x = 306$$

Bringing all terms to one side:

$$x^2 + x - 306 = 0$$

This is the required quadratic equation.

[Q7. CBSE 2024] Find the value of k so that the quadratic equation $2x^2 + kx + 3 = 0$ has two equal roots.

Solution:

For real and equal roots, the Discriminant must equal zero ($D = 0$).

Here, $a = 2$, $b = k$, $c = 3$.

Formula: $b^2 - 4ac = 0$

$$k^2 - 4(2)(3) = 0$$

$$k^2 - 24 = 0 \Rightarrow k^2 = 24$$

$$k = \pm\sqrt{24} = \pm 2\sqrt{6}$$

The values of k are $2\sqrt{6}$ or $-2\sqrt{6}$.

[Q8. CBSE 2021] If the discriminant of the quadratic equation $x^2 - kx + 4 = 0$ is 0, find the value(s) of k .

Solution:

Given equation coefficients: $a = 1$, $b = -k$, $c = 4$.

Discriminant is given as 0:

$$b^2 - 4ac = 0$$

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

$$k^2 - 16 = 0 \Rightarrow k^2 = 16$$

$$k = \pm 4$$

The values of k are 4 and -4.

[Q9. CBSE 2025] Find the roots of the equation $x^2 - 7x + 12 = 0$.

Solution:

Factorize by splitting the middle term. We want a product of 12 and sum of -7. These numbers are -4 and -3.

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

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

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

Equating to zero:

$$x - 4 = 0 \Rightarrow x = 4 \text{ or } x - 3 = 0 \Rightarrow x = 3.$$

The roots are 4 and 3.

[Q10. CBSE 2023] The sum of a number and its reciprocal is $\frac{10}{3}$. Find the number.

Solution:

Let the number be x . Its reciprocal is $\frac{1}{x}$.

According to the problem statement:

$$x + \frac{1}{x} = \frac{10}{3}$$

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

Cross-multiplying:

$$3(x^2 + 1) = 10x$$

$$3x^2 + 3 = 10x \Rightarrow 3x^2 - 10x + 3 = 0$$

Splitting the middle term:

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

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

Equating factors to 0:

$$x = 3 \text{ or } x = \frac{1}{3}$$

The required number is either 3 or $\frac{1}{3}$.
