RS Aggarwal Solutions for Class 10 Maths Chapter 10 Exercise 10.4: A step-by-step solution to the chapter 10 quadratic equations in the textbook RS Aggarwal class 10 has been developed by the Physics Wallah academic team. Before examining the chapter-10 Quadratic Equations Exercise-10D solution, it is necessary to have a thorough understanding of the chapter-10 Quadratic Equations.

To do this, read the chapter-10 Quadratic Equations Theory and then attempt to solve all of the numerical problems in Exercise-10D. The chapter-10 Quadratic Equations solution is provided by RS Aggarwal class 10. Please use Exercise 10D strictly as a reference; do not duplicate the solutions. Use Physics Wallah NCERT Solutions to help you answer class 10 maths NCERT questions from the NCERT textbook.

RS Aggarwal Solutions for Class 10 Maths Chapter 10 Exercise 10.4 Overview

RS Aggarwal's Solutions for Class 10 Maths Chapter 10 Exercise 10.4 on Quadratic Equations provide detailed, step-by-step guidance on solving quadratic equations. This exercise typically covers various methods such as factoring, completing the square, and using the quadratic formula.

The solutions help students understand and apply these techniques to different types of problems, reinforcing their problem-solving skills and preparing them for exams. By comparing their answers with the solutions, students can identify mistakes, improve their understanding, and build confidence in handling quadratic equations.

What are Quadratic Equations?

A polynomial equation of second degree is referred to as a quadratic, meaning that it has at least one squared element. Quadratic equations is another name for it. The quadratic equation can be expressed generally as:

$$ax^2 + bx + c = 0$$

where the numerical coefficients a, b, and c correspond to the unknown variable x. An instance of a quadratic equation is x2 + 2x +1. This case, $a \neq 0$ because if it equals zero, the equation will no longer be quadratic and instead become linear, as in the following example:

$$bx+c=0$$

RS Aggarwal Solutions for Class 10 Maths Chapter 10 Exercise 10.4

Below we have provided RS Aggarwal Solutions for Class 10 Maths Chapter 10 Exercise 10.4 for the ease of the students –

Q. Find the nature of the roots of the following quadratic equations:

(i) $2x^2 - 8x + 5 = 0$

(ii) $3x^2 - 2\sqrt{6}x + 2 = 0$

(iii) $5x^2 - 4x + 1 = 0$

(iv) $5x(x - 2) + 6 = 0$

(v) $12x^2 - 4\sqrt{15}x + 5 = 0$

(vi) $x^2 - x + 2 = 0$

Solution

The given quadratic equations are in the form ofax^2 +bx +c =0\)

We know, determinant (D) = $b^2 - 4ac$

(i)$2x^2 - 8x + 5 = 0$

So, a = 2, b = -8, c = 5

Determinant(D) = $b^2 - 4ac$

$= (-8)^2 - 4(2)(5)$

$= 64 - 40$

$= 24 > 0$

Since D>0, the determinant of the equation is positive, so the expression does having any real and distinct roots.

(ii)$3x^2 - 2\sqrt{6}x + 2 = 0$

So, a = 3b = $-2\sqrt{6}$c = 2

(D) = $b^2 - 4ac$

$= (-2\sqrt{6})^2 - 4(3)(2)$

$= 24 - 24$

$= 0$

since D=0 two equal real roots

(iii)$5x^2 - 4x + 1 = 0$

a = 5b = −4c = 1

D = $b^2 - 4ac$

$= (-4)^2 - 4(5)(1)$

$= 16 - 20$

$= -4$

D<0

Since D<0, the determinant of the equation is negative, so the expression does not have any real roots.

(iv) $5x(x-2)+6=0$

$5x^2-10x+6=0$

$a=5$ $b=-10$ $c=6$

$D=b^2-4ac$

$=(-10)^2-4(5)(6)$

$=100-120$

$=-20$

since D<0 there is no real roots

(v) $12x^2-4\sqrt{15}x+5=0$

$a=12$ $b=-4\sqrt{15}$ $c=5$

$D=b^2-4ac$

$=(-4\sqrt{15})^2-4(12)(5)$

$=240-240$

$=0$

since D =0

so there are two equal real roots

(vi) $x^2-x+2=0$

$a=1$ $b=-1$ $c=2$

$D=b^2-4ac$

$=(-1)2-4(1)(2)$

$=1-8$

$=-7$

Since D<0

so ther are no real roots

Q. If a and b are distinct real numbers, show that the quadratic equation $2(a^2+b^2)x^2+2(a+b)x+1=0$ has no real roots.

Solution

The equation is $2(a^2 + b^2)x^2 + 2(a + b)x + 1 = 0$

$A = 2(a^2 + b^2)$

$B = 2(a + b)$

$C = 1$

Calculating Determinant, $D = B^2 - 4AC$

$(2(a + b))^2 - 4(2(a^2 + b^2))(1)$

$= 4a^2 + 4b^2 + 8ab - 8a^2 - 8b^2$

$= -4a^2 - 4b^2 + 8ab$

$= -4(a^2 + b^2 - 2ab)$

$= -4(a - b)^2$

Since squared quantity is always positive,

hence $(a - b)^2 \geq 0$

But $-4(a - b)^2 < 0$

Hence equation has no real roots.

Q. Show that the roots of the equation $x^2 + px - q^2 = 0$ are real for all real values of p and q

Solution

Given equation is:

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

The discriminant of the given equation is given by

$D = p^2 - 4 \times (1) \times (-q^2)$

$= p^2 + 4q^2$

Clearly, $D = p^2 + 4q^2 > 0$ for all $p, q \in R$.

Hence, the given equation has real roots.

Q. For what values of k are the roots of the quadratic equation $3x^2 + 2kx + 27 = 0$ real and equal?

Solution

As we know, for reak equal roots we have

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

here, **$b = 2k$, $a = 3$, $c = 27$**

putting the values

= **$D = (2k)^2 - (4 \times 3 \times 27) = 0$**

$0 = 4k^2 - 324$

$4k^2 = 324$

$k^2 = 324/4$

$k^2 = 81$

$k = \quad 9$

Q. For what value of k are the roots of the quadratic equation $kx(x - 2\sqrt{5}) + 10 = 0$ real and equal?

Solution

D= b^2-4ac is called discriminant.

The nature of roots depend upon the value of the discriminant D. Since D can be zero, positive or negative.

When D=0, Roots are real and equal.

$kx(x-2\sqrt{5})+10=0$

$kx^2-2\sqrt{5}kx+10=0$

Here, a= k, b= $-2\sqrt{5}k$, c= 10

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

$(-2\sqrt{5}k)^2 - 4\times k\times 10=0$

$4\times 5k^2 - 40k = 0$

$20k^2-40k=0$

$20k(k-2)=0$

Q. For what values of p are the roots of the equations $4x^2 + px + 3 = 0$ real and equal?

Solution

$4x^2 + px + 3$ has real roots.

Here, a = 4 , b = p , c = 3

$b^2 - 4ac = 0$,

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

$p^2 - 48 = 0$

$p^2 = 48$

$p = \sqrt{48}$

\($p = \pm 4\sqrt{3}$\)

Q. Find the nonzero value of k for which the roots of the quadratic equation $9x^2 - 3kx + k = 0$ are real and equal.

Solution

For real and equal roots, $b^2 - 4ac = 0$

$\Rightarrow (-3k)^2 - 4 \times 9 \times k = 0$

$\Rightarrow 9k^2 - 36k = 0$

$\Rightarrow 9k(k - 4) = 0$

$\therefore k = 4$ or $k = 0$

Q. (i) Find the values of k for which the quadratic equation $(3k + 1)x^2 + 2(k + 1)x + 1 = 0$ has real and equal roots.

(ii) Find the value of k for which the equations $x^2 + k(2x + k - 1) + 2 = 0$ has real and equal roots.

Solution

(i) $(3k + 1)x^2 + 2(k + 1)x + 1 = 0$

here, $a = 3k + 1$ and $b = 2[k + 1] = 2k + 2$ and $c = 1$

roots are equal and real and so discriminant will be zero

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

$\Rightarrow [2k + 2]^2 - 4[3k + 1][1] = 0$

$\Rightarrow 4k^2 + 8k + 4 - 12k - 4 = 0$

$\Rightarrow 4k^2 - 4k = 0$

$\Rightarrow 4k[k - 1] = 0$

$\Rightarrow k = 0$ and 1

(ii) $x^2 + k(2x + k - 1) + 2 = 0$

$x^2 + 2kx + k^2 \quad k + 2 = 0$

$x^2 + 2kx + (k^2 - k + 2) = 0$

$a = 1$ and $b = 2k$ and $c = k^2 - k + 2$

Roots are equal and real and so discriminant will be zero

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

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

$\Rightarrow 4k^2 \quad 4k^2 + 4k - 8 = 0$

$\Rightarrow 4k \quad 8 = 0$

$\Rightarrow 4k = 8$

$\Rightarrow k = 2$

Q. Find the values of p for which the quadratic equation $(2p + 1)x^2 - (7p + 2)x + (7p - 3) = 0$ has real and equal roots.

Solution

$(2p + 1)x^2 - (7p + 2)x + (7p - 3) = 0$

If they have equal roots, $b^2 - 4ac = 0$

$\Rightarrow (7p + 2)^2 - 4(7p - 3)(2p + 1) = 0$

$\Rightarrow (7p+2)^2 - 4(2p + 1)(7p-3)=0$

$\Rightarrow 49p^2 + 4 + 28p - 4(14p^2 + p - 3)=0$

After simplification, $7p^2-24p-16=0$

Solving the equation, we get $p=4$ and $-4/7$.

Q. If-5 is a root of the quadratic equation $2x^2 + px - 15 = 0$ and the quadratic equation $p(x^2 + x) + k = 0$ has equal roots, find the value of k.

Solution

-5 is a root of quadratic equation $2x^2 + px - 15 = 0$

so, $2(-5)^2 + p(-5) - 15 = 0$

=> $50 - 5p - 15 = 0$

=> $35 - 5p = 0$

$p = 7$

now, put p = 7 in second quadratic equation,

$p(x^2 + x) + k = 0$

=> $7(x^2 + x) + k = 0$

=> $7x^2 + 7x + k = 0$

above equation has equal roots

so, $D = b^2 - 4ac = 0$

=> $7^2 - 4 \times 7 \times k = 0$

=> $7 - 4k = 0$

=> $k = 7/4 = 1.75$

hence, the value of k = 1.75

Q. If-4 is a root of the equation $x^2 + 2x + 4p = 0$, find the value of k for which the quadratic $x^2 + k(2x + k + 2) + p = 0$ are equal.

Solution

The given quadratic equation is

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

Since −4 is a root of the above equation,

then it must satisfy it.Now,

$(-4)^2 + 2(-4) + 4p$

$\Rightarrow 16 - 8 + 4p = 0$

$\Rightarrow 4p = -8$

$\Rightarrow p = -2$

Now, the other quadratic equation is :

$x^2 + k(2x + k + 2) + p = 0$

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

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

$x^2 + 2kx + (k^2 + 2k - 2) = 0$

if roots are equal then

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

$= (2k)^2 - 4 \times 1 \times (k^2 + 2k - 2)$

$= 4k^2 - 4k^2 - 8k + 8 = 0$

$= 8k = 8$

$k = 1$

Q. If the quadratic equation $(1 + m^2)x^2 + 2mcx + c^2 - a^2 = 0$ has equal roots, prove that $c^2 = a^2(1 + m^2)$.

Solution

$(1 + m^2)x^2 + 2mcx + c^2 - a^2 = 0$ has equal roots

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

$\Rightarrow (2mc)^2 - 4(1 + m^2)(c^2 - a^2) = 0$

$\Rightarrow 4m^2c^2 - 4(c^2 - a^2 + m^2c^2 - m^2a^2) = 0$

$\Rightarrow 4m^2c^2 - 4c^2 + 4a^2 - 4m^2c^2 + 4m^2a^2 = 0$

$\Rightarrow 4m^2a^2 - 4c^2 + 4a^2 = 0$

$\Rightarrow m^2a^2 - c^2 + a^2 = 0$

$\Rightarrow a^2(1 + m^2) - c^2 = 0$

$\Rightarrow c^2 = a^2(1 + m^2)$

hence proved.

Q. If the roots of the equation $(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$ are real ane equal, show that either $a = 0$ or $(a^3 + b^3 + c^3) = 3abc$.

Solution

Given, equation is:

$(c^2 - ab)x^2 - 2(a^2 - bc)x + (b^2 - ac) = 0$

To prove : $a = 0$ or $a^3 + b^3 + c^3 = 3abc$

Proof: From the given equation, we have

$A = (c^2 - ab)$

$B = -2(a^2 - bc)$

$C = (b^2 - ac)$

It is being given that the equation has real and equal roots

$\therefore D = 0$

$\Rightarrow B^2 - 4AC = 0$

On substituting respective values of a, b and c in the above equation, we get

$[-2(a^2 - bc)]^2 - 4(c^2 - ab)(b^2 - ac) = 0$

$4(a^2 - bc)^2 - 4(c^2b^2 - ac^3 - ab^3 + a^2bc) = 0$

$4(a^4 + b^2c^2 - 2a^2bc) - 4(c^2b^2 - ac^3 - ab^3 + a^2bc) = 0$

$\Rightarrow a^4 + b^2c^2 - 2a^2bc - b^2c^2 + ac^3 + ab^3 - a^2bc = 0$

$\Rightarrow a^4 + ab^3 + ac^3 - 3a^2bc = 0$

$\Rightarrow a[a^3 + b^3 + c^3 - 3abc] = 0$

$\Rightarrow a = 0$ or $a^3 + b^3 + c^3 = 3abc$

Q. Find the value of k for which the roots of $9x^2 + 8kx + 16 = 0$ are real and equal.

Solution

The given quadratic equation is $9x^2 + 8kx + 16 = 0$

The equation has equal root if its discriminant is zero.

$D = b^2 - 4ac$

$(8k)^2 - 4(9)(16)$

$64k^2 - 576$

$64k^2 = 576$

$k^2 = 576/64$

$k = 24/8$

$k = 3$

Q. Find the values of k for which the given quadratic equation has real and distinct roots:

(i) $kx^2 + 6x + 1 = 0$

(ii) $x^2 - kx + 9 = 0$

(iii) $9x^2 + 3kx + 4 = 0$

(iv) $5x^2 - kx + 1 = 0$

Solution

1)

$Kx^2 + 6x + 1 = 0$

The given equation is $Kx^2 + 6x + 1 = 0$

Here, a= k, b= 6, c= 1

The discriminant (D) $= b^2 - 4ac \geq 0$

$\rightarrow 36 - 4k \geq 0$

$\rightarrow 4k \leq 36$

$\rightarrow k \leq 9$

The value of $k \leq 9$

for which the quadratic equation is having real and equal roots.

2) $x^2 - kx + 9 = 0$

The given equation is $x^2 - kx + 9 = 0$

Here, a= 1, b= -k, c= 9

Given that the equation is having real and distinct roots.

Hence, the discriminant(D) $= b^2 - 4ac \geq 0$

$\rightarrow k^2 - 4(1)(9) \geq 0$

$k^2 \cdot\cdot 36 \geq 0$

$\rightarrow k \geq 6$ and $k \leq 6$

The value of k lies between -6 and 6 respectively to have the real and distinct roots.

(iii) Given equation is $9x^2 + 3kx + 4 = 0$

$a=9$, $b = 3k$, $c=4$

the discriminant(D) $=b^2 - 4ac \geq 0$

$\rightarrow (3k)^2 - 4 \times 9 \times 4 \geq 0$

$\rightarrow 9k^2 - 144 \geq 0$

$\rightarrow k^2 - 16 \geq 0$

For values $k \geq 4$ and $k \leq -4$ the equation will have real and distinct roots

(iv) Given equation is $5x^2 - kx + 1 = 0$

$a=5$, $b = -k$, $c=1$

the discriminant(D) $=b^2 - 4ac \geq 0$

$\rightarrow (-k)^2 - 4 \times 5 \times 1 \geq 0$

$\rightarrow k^2 - 20 \geq 0$

$\rightarrow k^2 \geq 20$

For values $k \geq 2\sqrt{5}$ and $k \leq -2\sqrt{5}$ the equation will have real and distinct roots

Q. If a and b are real and $a \neq b$ then show that the roots of the equation

$(a - b)x^2 + 5(a + b)x - 2(a - b) = 0$ are real and unequal.

Solution

The given equation is $(a - b)x^2 + 5(a + b)x - 2(a - b) = 0$

Given, a, b are real and $a \neq b$.

Compare given equation with the standard form $Ax^2 + Bx + C = 0$

We get,

$A = (a - b), B = 5(a + b), C = -2(a - b)$

Then, Discriminant $(D) = B^2 - 4AC$

$= [5(a + b)]^2 - 4(a - b)(-2(a - b))$

$= 25(a + b)^2 + 8(a - b)^2$

We know that the square of any integer is always positive that is, greater than zero.

Hence, $(D) = B^2 - 4AC \geq 0$

As given, a, b are real and $a \neq b$.

Therefore,

$= 25(a + b)^2 + (a - b)^2 > 0 = D > 0$

Therefore, the roots of this equation are real and unequal.

Q. If the roots of the equation $ax^2 + 2bx + c = 0$ and $bx^2 - 2\sqrt{ac}x + b = 0$ are simultaneously real then prove that $b^2 = ac$.

Solution

Given, the roots of both the equations are real.

First equation:

$ax^2 + 2bx + c = 0$

Its discriminant, $D \geq 0$

$\Rightarrow (2b)^2 - 4(ac) \geq 0$

$\Rightarrow 4b^2 - 4ac \geq 0$

$\Rightarrow 4b^2 \geq 4ac$

$\Rightarrow b^2 \geq ac$ ... (1)

Second equation:

$bx^2 - 2\sqrt{ac}x + b = 0$

Its discriminant, $D \geq 0$

$\Rightarrow (2\sqrt{ac})^2 - 4(b^2) \geq 0$

$\Rightarrow 4ac - 4b^2 \geq 0$

$\Rightarrow 4ac \geq 4b^2$

$\Rightarrow ac \geq b^2$... (2)

The results of equation (1) and (2) are simultaneously possible in only one case when $b^2 = ac$.

Benefits of RS Aggarwal Solutions for Class 10 Maths Chapter 10 Exercise 10.4

RS Aggarwal's Solutions for Class 10 Maths, specifically Chapter 10 Exercise 10.4 on Quadratic Equations, can provide several benefits for students. Here's a detailed look at these benefits:

1. **Clarification of Concepts:**

Step-by-Step Solutions: The solutions offer detailed, step-by-step explanations of how to solve each problem. This helps students understand the process of solving quadratic equations, including methods like factoring, completing the square, and using the quadratic formula.

Concept Reinforcement: By working through the solutions, students can reinforce their understanding of key concepts related to quadratic equations, such as roots, discriminants, and the nature of solutions.

2. **Practice and Application:**

Variety of Problems: Exercise 10.4 typically contains a range of problems that challenge students to apply different techniques for solving quadratic equations. This variety ensures that students practice and master various methods.

Application of Theorems: The exercise allows students to apply theorems and formulas in different scenarios, which enhances their problem-solving skills and helps them learn to choose the appropriate method for different types of problems.

3. **Improvement in Problem-Solving Skills:**

Understanding Mistakes: By comparing their answers with the provided solutions, students can identify and understand their mistakes. This helps in correcting misunderstandings and improving problem-solving techniques.

Strategy Development: Seeing how problems are approached and solved can help students develop their strategies for tackling similar problems on their own.