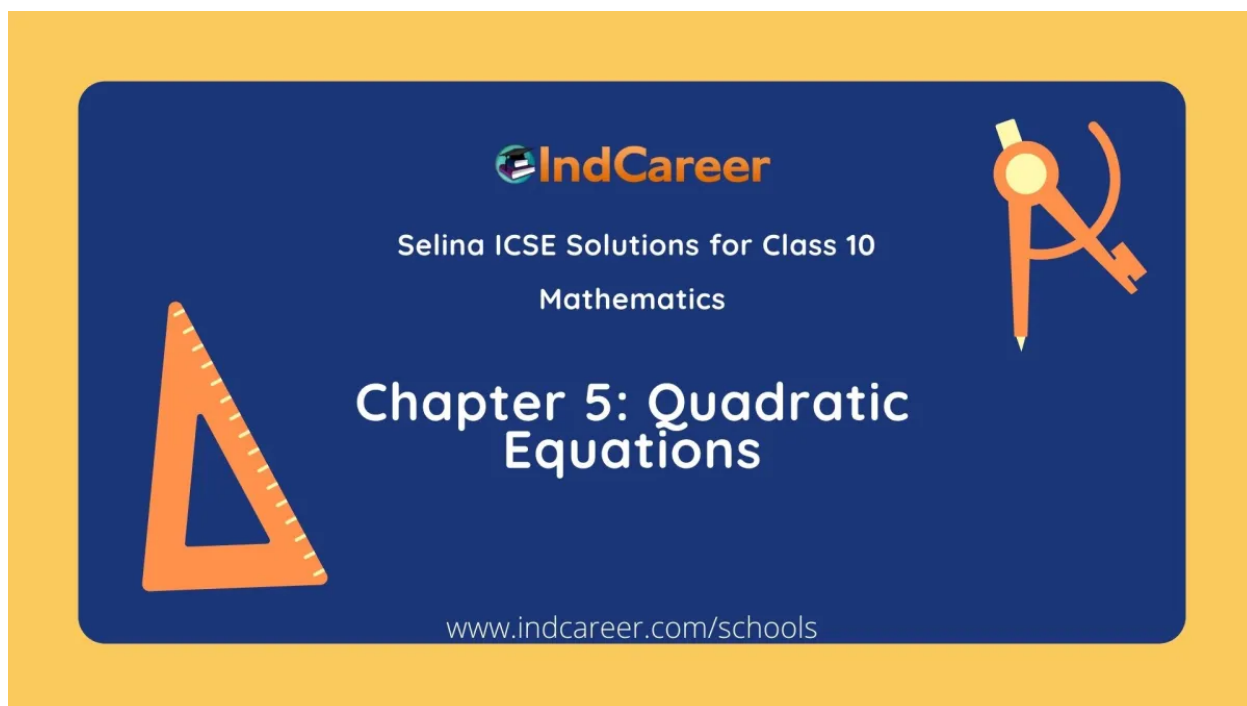


Selina Class 10 ICSE Solutions Mathematics :

Chapter 5 - Quadratic Equations



For any clarifications or questions you can write to **info@indcareer.com**

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Selina Class 10 ICSE Solutions Mathematics :

Chapter 5 - Quadratic Equations

Class 10: Maths Chapter 5 solutions. Complete Class 10 Maths Chapter 5 Notes.

Selina Class 10 ICSE Solutions Mathematics : Chapter 5 - Quadratic Equations

Selina 10th Maths Chapter 5, Class 10 Maths Chapter 5 solutions

Exercise 5A

Find which of the following equations are quadratic:

Solution 1(i)

$$(3x - 1)^2 = 5(x + 8)$$

$$\Rightarrow (9x^2 - 6x + 1) = 5x + 40$$

$$\Rightarrow 9x^2 - 11x - 39 = 0; \text{ which is of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is a quadratic equation.

Solution 1(ii)

$$5x^2 - 8x = -3(7 - 2x)$$

$$\Rightarrow 5x^2 - 8x = 6x - 21$$

$$\Rightarrow 5x^2 - 14x + 21 = 0; \text{ which is of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is a quadratic equation.

Solution 1(iii)

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

$$\Rightarrow 3x^2 + x - 12x - 4 = 3x^2 + 6x - x - 2$$

$$\Rightarrow 16x + 2 = 0; \text{ which is not of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is not a quadratic equation.

Solution 1(iv)

$$x^2 + 5x - 5 = (x - 3)^2$$

$$\Rightarrow x^2 + 5x - 5 = x^2 - 6x + 9$$

$$\Rightarrow 11x - 14 = 0; \text{ which is not of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is not a quadratic equation.

Solution 1(v)

$$7x^3 - 2x^2 + 10 = (2x - 5)^2$$

$$\Rightarrow 7x^3 - 2x^2 + 10 = 4x^2 - 20x + 25$$

$$\Rightarrow 7x^3 - 6x^2 + 20x - 15 = 0; \text{ which is not of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is not a quadratic equation.

Solution 1(vi)

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

$$\Rightarrow x^2 - 2x + 1 + x^2 + 4x + 4 + 3x + 3 = 0$$

$$\Rightarrow 2x^2 + 5x + 8 = 0; \text{ which is of the form } ax^2 + bx + c = 0.$$

$\therefore$ Given equation is a quadratic equation.

Question 2(i)

Is $x = 5$ a solution of the quadratic equation $x^2 - 2x - 15 = 0$?

Solution:

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$$x^2 - 2x - 15 = 0$$

For $x = 5$ to be solution of the given quadratic equation it should satisfy the equation.

So, substituting $x = 5$ in the given equation, we get

$$\text{L.H.S} = (5)^2 - 2(5) - 15$$

$$= 25 - 10 - 15$$

$$= 0$$

$$= \text{R.H.S}$$

Hence, $x = 5$ is a solution of the quadratic equation $x^2 - 2x - 15 = 0$.

Question 2(ii).

Is $x = -3$ a solution of the quadratic equation $2x^2 - 7x + 9 = 0$?

Solution:

$$2x^2 - 7x + 9 = 0$$

For $x = -3$ to be solution of the given quadratic equation it should satisfy the equation

So, substituting $x = 5$ in the given equation, we get

$$\text{L.H.S} = 2(-3)^2 - 7(-3) + 9$$

$$= 18 + 21 + 9$$

$$= 48$$

$$\neq \text{R.H.S}$$

Hence, $x = -3$ is not a solution of the quadratic equation $2x^2 - 7x + 9 = 0$.

Question 3.

If $23 - \sqrt{5}$ is a solution of equation $3x^2 + mx + 2 = 0$, find the value of m .

Solution:

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For $x = \frac{2}{3}$ to be solution of the given quadratic equation it should satisfy the equation

So, substituting $x = \frac{2}{3}$ in the given equation, we get

$$3\left(\frac{2}{3}\right)^2 + m\left(\frac{2}{3}\right) + 2 = 0$$

$$\Rightarrow 3\left(\frac{4}{9}\right) + m\left(\frac{2}{3}\right) + 2 = 0$$

$$\Rightarrow m = -4 \times \frac{3}{2} = -2\sqrt{6}$$

$$\therefore m = -2\sqrt{6}$$

Question 4.

23 and 1 are the solutions of equation $mx^2 + nx + 6 = 0$. Find the values of m and n.

Solution:

For $x = \frac{2}{3}$ and $x = 1$ to be solutions of the given quadratic equation it should satisfy the equation

So, substituting $x = \frac{2}{3}$ and $x = 1$ in the given equation, we get

$$\begin{array}{l|l} m\left(\frac{2}{3}\right)^2 + n\left(\frac{2}{3}\right) + 6 = 0 & m(1)^2 + n(1) + 6 = 0 \\ \Rightarrow m\left(\frac{4}{9}\right) + n\left(\frac{2}{3}\right) + 6 = 0 & \Rightarrow m + n + 6 = 0 \\ \Rightarrow 4m + 6n + 54 = 0 \dots (1) & \Rightarrow m + n + 6 = 0 \dots (2) \end{array}$$

Solving equations (1) and (2) simultaneously,

$$4m + 6n + 54 = 0 \dots (1)$$

$$m + n + 6 = 0 \dots (2)$$

$$(1) - (2) \times 6$$

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$$\Rightarrow -2m + 18 = 0$$

$$\Rightarrow m = 9$$

Substitute in (2)

$$\Rightarrow n = -15$$

Question 5.

If 3 and -3 are the solutions of equation $ax^2 + bx - 9 = 0$. Find the values of a and b.

Solution:

For $x = 3$ and $x = -3$ to be solutions of the given quadratic equation it should satisfy the equation

So, substituting $x = 3$ and $x = -3$ in the given equation, we get

$$\begin{array}{l|l} a(3)^2 + b(3) - 9 = 0 & a(-3)^2 + b(-3) - 9 = 0 \\ \Rightarrow a(9) + b(3) - 9 = 0 & \Rightarrow a(9) - b(3) - 9 = 0 \\ \Rightarrow 9a + 3b - 9 = 0 \dots (1) & \Rightarrow 9a - 3b - 9 = 0 \dots (2) \end{array}$$

Solving equations (1) and (2) simultaneously,

$$9a + 3b - 9 = 0 \dots (1)$$

$$9a - 3b - 9 = 0 \dots (2)$$

$$(1) + (2)$$

$$\Rightarrow 18a - 18 = 0$$

$$\Rightarrow a = 1$$

Substitute in (2)

$$\Rightarrow b = 0$$

Exercise 5B

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Question 1.

Without solving, comment upon the nature of roots of each of the following equations :

(i) $7x^2 - 9x + 2 = 0$

(ii) $6x^2 - 13x + 4 = 0$

(iii) $25x^2 - 10x + 1 = 0$

(iv) $x^2 + 2\sqrt{3}x - 9 = 0$

(v) $x^2 - ax - b^2 = 0$

(vi) $2x^2 + 8x + 9 = 0$

Solution:

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(i) $7x^2 - 9x + 2 = 0$

$a = 7$, $b = -9$ and $c = 2$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-9)^2 - 4(7)(2) \\ &= 81 - 56 = 25\end{aligned}$$

Since $D > 0$, then equation has two real and unequal roots.

(ii) $6x^2 - 13x + 4 = 0$

$a = 6$, $b = -13$ and $c = 4$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-13)^2 - 4(6)(4) \\ &= 169 - 96 = 73\end{aligned}$$

Since 73 is not a perfect square, roots are irrational

Since $D > 0$, then equation has two irrational and unequal roots.

(iii) $25x^2 - 10x + 1 = 0$

$a = 25$, $b = -10$ and $c = 1$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (-10)^2 - 4(25)(1) \\ &= 100 - 100 = 0\end{aligned}$$

Since $D = 0$, then equation has two real and equal roots.

(iv) $x^2 + 2\sqrt{3}x - 9 = 0$

$a = 1$, $b = 2\sqrt{3}$ and $c = -9$

$$\begin{aligned}\therefore \text{Discriminant} &= b^2 - 4ac \\ &= (2\sqrt{3})^2 - 4(1)(-9) \\ &= 12 + 36 = 48\end{aligned}$$

Since 48 is not a perfect square, roots are irrational

Since $D > 0$, then equation has two irrational and unequal roots.

$$(v) x^2 - ax - b^2 = 0$$

$$A = 1, B = -a \text{ and } C = -b^2$$

$$\therefore \text{Discriminant} = B^2 - 4AC$$

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

$$= a^2 + 4b^2 = \text{a positive value}$$

Since $a^2 + 4b^2$ is not a perfect square, roots are irrational.

Since $D > 0$, then equation has two irrational and unequal roots.

$$(vi) 2x^2 + 8x + 9 = 0$$

$$a = 2, b = 8 \text{ and } c = 9$$

$$\therefore \text{Discriminant} = b^2 - 4ac$$

$$= (8)^2 - 4(2)(9)$$

$$= 64 - 72 = -18 = \text{a negative value}$$

Since $D < 0$, then equation has no real roots.

Question 2.

Find the value of p , if the following quadratic equation has equal roots : $4x^2 - (p - 2)x + 1 = 0$

Solution:

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

Here $a = 4$, $b = -(p - 2)$ and $c = 1$

Given: equation has equal roots

Then $D = 0$

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

$$\Rightarrow [-(p - 2)]^2 - 4(4)(1) = 0$$

$$\Rightarrow p^2 + 4 - 4p - 16 = 0$$

$$\Rightarrow p^2 - 4p - 12 = 0$$

$$\Rightarrow p^2 - 6p + 2p - 12 = 0$$

$$\Rightarrow p(p - 6) + 2(p - 6) = 0$$

$$\Rightarrow (p - 6)(p + 2) = 0$$

$$\text{then } p - 6 = 0 \quad \text{or } p + 2 = 0$$

$$\Rightarrow p = 6 \quad \text{or } p = -2$$

Question 3.

Find the value of 'p', if the following quadratic equations have equal roots : $x^2 + (p - 3)x + p = 0$

Solution:

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

Here, $a = 1$, $b = (p - 3)$, $c = p$

Since, the roots are equal,

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

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

$$\Rightarrow p^2 + 9 - 6p - 4p = 0$$

$$\Rightarrow p^2 - 10p + 9 = 0$$

$$\Rightarrow p^2 - 9p - p + 9 = 0$$

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$$\Rightarrow p(p - 9) - 1(p - 9) = 0$$

$$\Rightarrow (p - 9)(p - 1) = 0$$

$$\Rightarrow p - 9 = 0 \text{ or } p - 1 = 0$$

$$\Rightarrow p = 9 \text{ or } p = 1$$

Question 4.

The equation $3x^2 - 12x + (n - 5) = 0$ has equal roots. Find the value of n .

Solution:

$$3x^2 - 12x + (n - 5) = 0$$

Here $a = 3$, $b = -12$ and $c = n - 5$

Given: equation has equal roots

Then $D = 0$

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

$$\Rightarrow [-12]^2 - 4(3)(n - 5) = 0$$

$$\Rightarrow 144 - 12n + 60 = 0$$

$$\Rightarrow -12n = -204$$

$$\Rightarrow n = \frac{-204}{-12} = 17$$

Question 5.

Find the value of m , if the following equation has equal roots : $(m - 2)x^2 - (5 + m)x + 16 = 0$

Solution:

$$(m-2)x^2 - (5+m)x + 16 = 0$$

Here $a = m-2$, $b = -(5+m)$ and $c = 16$

Given: equation has equal roots

Then $D=0$

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

$$\Rightarrow [-(5+m)]^2 - 4(m-2)(16) = 0$$

$$\Rightarrow 25 + m^2 + 10m - 64m + 128 = 0$$

$$\Rightarrow m^2 - 54m + 153 = 0$$

$$\Rightarrow m^2 - 51m - 3m + 153 = 0$$

$$\Rightarrow m(m-51) - 3(m-51) = 0$$

$$\Rightarrow (m-51)(m-3) = 0$$

then $m-51=0$ or $m-3=0$

$$\Rightarrow m=51 \text{ or } m=3$$

Question 6.

Find the value of p for which the equation $3x^2 - 6x + k = 0$ has distinct and real roots.

Solution:

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

Here, $a = 3$, $b = -6$ and $c = k$

Since the roots are distinct and real,

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

$$\Rightarrow (-6)^2 - 4 \times 3 \times k > 0$$

$$\Rightarrow 36 - 12k > 0$$

$$\Rightarrow 36 > 12k$$

$$\Rightarrow 3 > k$$

$$\Rightarrow k < 3$$

Exercise 5C

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Question 1.

Solve : $x^2 - 10x - 24 = 0$

Solution:

$$\begin{aligned}x^2 - 10x - 24 &= 0 \\ \Rightarrow x^2 - 12x + 2x - 24 &= 0 \\ \Rightarrow x(x - 12) + 2(x - 12) &= 0 \\ \Rightarrow (x - 12)(x + 2) &= 0 \\ \text{since } x - 12 &= 0 \text{ or } x + 2 = 0 \\ \text{then } x &= 12 \text{ or } x = -2\end{aligned}$$

Question 2.

Solve : $x^2 - 16 = 0$

Solution:

$$\begin{aligned}x^2 - 16 &= 0 \\ \Rightarrow x^2 - 4^2 &= 0 \\ \Rightarrow (x + 4)(x - 4) &= 0 \\ \text{Since } x + 4 &= 0 \text{ or } x - 4 = 0 \\ \text{then } x &= -4 \text{ or } x = 4\end{aligned}$$

Question 3.

Solve : $2x^2 - \frac{1}{2}x = 0$

Solution:

$$2x^2 - \frac{1}{2}x = 0$$

$$\Rightarrow x(2x - \frac{1}{2}) = 0$$

$$\text{since } x=0 \text{ or } 2x - \frac{1}{2} = 0$$

$$\text{then } x=0 \text{ or } x=\frac{1}{4}$$

Question 4.

Solve : $x(x - 5) = 24$

Solution:

$$x(x-5)=24$$

$$\Rightarrow x^2 - 5x - 24 = 0$$

$$\Rightarrow x^2 - 8x + 3x - 24 = 0$$

$$\Rightarrow x(x-8) + 3(x-8) = 0$$

$$\Rightarrow (x-8)(x+3) = 0$$

$$\text{Since } x-8=0 \text{ or } x+3=0$$

$$\text{then } x=8 \text{ or } x=-3$$

Question 5.

$$\text{Solve: } \frac{9}{2}x = 5 + x^2$$

Solution:

$$\frac{9}{2}x = 5 + x^2$$

$$\Rightarrow 9x = 10 + 2x^2$$

$$\Rightarrow 2x^2 - 9x + 10 = 0$$

$$\Rightarrow 2x^2 - 5x - 4x + 10 = 0$$

$$\Rightarrow x(2x-5) - 2(2x-5) = 0$$

$$\Rightarrow (2x-5)(x-2) = 0$$

$$\text{Since } 2x-5=0 \quad \text{or} \quad x-2=0$$

$$\text{then } x = \frac{5}{2} \quad \text{or} \quad x = 2$$

Question 6.

$$\text{Solve: } \frac{6}{x} = 1 + x$$

Solution:

$$\frac{6}{x} = 1 + x$$

$$\Rightarrow 6 = x + x^2$$

$$\Rightarrow x^2 + x - 6 = 0$$

$$\Rightarrow x^2 + 3x - 2x - 6 = 0$$

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

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

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

$$\text{then } x = -3 \quad \text{or} \quad x = 2$$

Question 7.

$$\text{Solve: } x = \frac{3x+1}{4x}$$

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Solution:

$$x = \frac{3x + 1}{4x}$$

$$\Rightarrow 4x^2 = 3x + 1$$

$$\Rightarrow 4x^2 - 3x - 1 = 0$$

$$\Rightarrow 4x^2 - 4x + x - 1 = 0$$

$$\Rightarrow 4x(x-1) + 1(x-1) = 0$$

$$\Rightarrow (x-1)(4x+1) = 0$$

$$\text{Since } x-1=0 \quad \text{or} \quad 4x+1=0$$

$$\text{then } x=1 \quad \text{or} \quad x = \frac{-1}{4}$$

Question 8.

$$\text{Solve: } x + \frac{1}{x} = 2.5$$

Solution:

$$x + \frac{1}{x} = 2.5$$

$$\Rightarrow \frac{x^2 + 1}{x} = \frac{5}{2}$$

$$\Rightarrow 2x^2 + 2 = 5x$$

$$\Rightarrow 2x^2 - 5x + 2 = 0$$

$$\Rightarrow 2x^2 - 4x - x + 2 = 0$$

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

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

$$\text{Since } x-2=0 \quad \text{or} \quad 2x-1=0$$

$$\text{then } x=2 \quad \text{or} \quad x = \frac{1}{2}$$

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Question 9.

Solve : $(2x - 3)^2 = 49$

Solution:

$$(2x-3)^2 = 49$$

Taking square root on both sides

$$2x-3=\pm 7$$

$$\text{When } 2x-3=7 \Rightarrow 2x=10 \Rightarrow x=5$$

$$\text{and, when } 2x-3=-7 \Rightarrow 2x=-4 \Rightarrow x=-2$$

Question 10.

Solve : $2(x^2 - 6) = 3(x - 4)$

Solution:

$$2(x^2 - 6) = 3(x - 4)$$

$$\Rightarrow 2x^2 - 12 = 3x - 12$$

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

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

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

$$\text{then } x=0 \text{ or } x=\frac{3}{2}$$

Question 11.

Solve : $(x + 1)(2x + 8) = (x + 7)(x + 3)$

Solution:

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$$\begin{aligned}(x+1)(2x+8) &= (x+7)(x+3) \\ \Rightarrow 2x^2 + 8x + 2x + 8 &= x^2 + 3x + 7x + 21 \\ \Rightarrow 2x^2 + 10x + 8 &= x^2 + 10x + 21 \\ \Rightarrow x^2 - 13 &= 0 \\ \Rightarrow x^2 - (\sqrt{13})^2 &= 0 \\ \Rightarrow (x + \sqrt{13})(x - \sqrt{13}) &= 0 \\ \text{If } x + \sqrt{13} = 0 &\quad \text{or} \quad x - \sqrt{13} = 0 \\ \Rightarrow x = -\sqrt{13} &\quad \text{or} \quad x = \sqrt{13}\end{aligned}$$

Question 12.

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

Solution:

$$\begin{aligned}x^2 - (a + b)x + ab &= 0 \\ \Rightarrow x^2 - ax - bx + ab &= 0 \\ \Rightarrow x(x - a) - b(x - a) &= 0 \\ \Rightarrow (x - a)(x - b) &= 0 \\ \text{since } x - a = 0 &\quad \text{or} \quad x - b = 0 \\ \text{then } x = a &\quad \text{or} \quad x = b\end{aligned}$$

Question 13.

$(x + 3)^2 - 4(x + 3) - 5 = 0$

Solution:

$$(x+3)^2 - 4(x+3) - 5 = 0$$

$$\text{Let } x+3=y$$

$$\text{then } y^2 - 4y - 5 = 0$$

$$\Rightarrow y^2 - 5y + y - 5 = 0$$

$$\Rightarrow y(y-5)+1(y-5)=0$$

$$\Rightarrow (y-5)(y+1)=0$$

$$\text{If } y-5=0 \quad \text{or} \quad y+1=0$$

$$\text{then } y=5 \quad \text{or} \quad y=-1$$

$$\Rightarrow x+3=5 \quad \text{or} \quad x+3=-1$$

$$\Rightarrow x=2 \quad \text{or} \quad x=-4$$

Question 14.

$$4(2x-3)^2 - (2x-3) - 14 = 0$$

Solution:

$$4(2x-3)^2 - (2x-3) - 14 = 0$$

$$\text{Let } 2x-3=y$$

$$\text{then } 4y^2 - y - 14 = 0$$

$$\Rightarrow 4y^2 - 8y + 7y - 14 = 0$$

$$\Rightarrow 4y(y-2)+7(y-2)=0$$

$$\Rightarrow (y-2)(4y+7)=0$$

$$\text{If } y-2=0 \quad \text{or} \quad 4y+7=0$$

$$\Rightarrow y=2 \quad \text{or} \quad y=-\frac{7}{4}$$

$$\Rightarrow 2x-3=2 \quad \text{or} \quad 2x-3=-\frac{7}{4}$$

$$\Rightarrow 2x=5 \quad \text{or} \quad 2x=\frac{5}{4}$$

$$\Rightarrow x=\frac{5}{2} \quad \text{or} \quad x=\frac{5}{8}$$

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Question 15.

Solve: $\frac{3x-2}{2x-3} = \frac{3x-8}{x+4}$

Solution:

$$\begin{aligned}\frac{3x-2}{2x-3} &= \frac{3x-8}{x+4} \\ \Rightarrow (3x-2)(x+4) &= (2x-3)(3x-8) \\ \Rightarrow 3x^2 + 12x - 2x - 8 &= 6x^2 - 16x - 9x + 24 \\ \Rightarrow 3x^2 + 10x - 8 &= 6x^2 - 25x + 24 \\ \Rightarrow 3x^2 - 35x + 32 &= 0 \\ \Rightarrow 3x^2 - 32x - 3x + 32 &= 0 \\ \Rightarrow x(3x-32) - 1(3x-32) &= 0 \\ \Rightarrow (x-1)(3x-32) &= 0 \\ \text{If } x-1=0 &\quad \text{or} \quad 3x-32=0 \\ \Rightarrow x=1 &\quad \text{or} \quad x=\frac{32}{3} = 10\frac{2}{3}\end{aligned}$$

Question 16.

$2x^2 - 9x + 10 = 0$, When

(i) $x \in \mathbb{N}$

(ii) $x \in \mathbb{Q}$

Solution:

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$$2x^2 - 9x + 10 = 0$$

$$\Rightarrow 2x^2 - 5x - 4x + 10 = 0$$

$$\Rightarrow x(2x - 5) - 2(2x - 5) = 0$$

$$\Rightarrow (2x - 5)(x - 2) = 0$$

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

$$\Rightarrow x = \frac{5}{2} \text{ or } x = 2$$

(i) When $x \in \mathbb{N}$, we have $x = 2$

(ii) When $x \in \mathbb{Q}$, we have $x = 2, \frac{5}{2}$

Question 17.

Solve: $\frac{x-3}{x+3} + \frac{x+3}{x-3} = 2\frac{1}{2}$

Solution:

$$\frac{x-3}{x+3} + \frac{x+3}{x-3} = 2\frac{1}{2}$$

$$\Rightarrow \frac{(x-3)^2 + (x+3)^2}{(x+3)(x-3)} = \frac{5}{2}$$

$$\Rightarrow \frac{x^2 - 6x + 9 + x^2 + 6x + 9}{x^2 - 9} = \frac{5}{2}$$

$$\Rightarrow 2(2x^2 + 18) = 5(x^2 - 9)$$

$$\Rightarrow 4x^2 + 36 = 5x^2 - 45$$

$$\Rightarrow x^2 - 81 = 0$$

$$\Rightarrow x^2 - 9^2 = 0$$

$$\Rightarrow (x+9)(x-9) = 0$$

$$\text{If } x+9=0 \quad \text{or} \quad x-9=0$$

$$\text{then } x=-9 \quad \text{or} \quad x=9$$

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Question 18.

Solve: $\frac{4}{x+2} - \frac{1}{x+3} = \frac{4}{2x+1}$

Solution:

$$\begin{aligned}\frac{4}{x+2} - \frac{1}{x+3} &= \frac{4}{2x+1} \\ \Rightarrow \frac{4(x+3) - 1(x+2)}{(x+2)(x+3)} &= \frac{4}{2x+1} \\ \Rightarrow \frac{4x+12-x-2}{x^2+2x+3x+6} &= \frac{4}{2x+1} \\ \Rightarrow \frac{3x+10}{x^2+5x+6} &= \frac{4}{2x+1} \\ \Rightarrow (3x+10)(2x+1) &= 4(x^2+5x+6) \\ \Rightarrow 6x^2+3x+20x+10 &= 4x^2+20x+24 \\ \Rightarrow 2x^2+3x-14 &= 0 \\ \Rightarrow 2x^2+7x-4x-14 &= 0 \\ \Rightarrow x(2x+7)-2(2x+7) &= 0 \\ \Rightarrow (2x+7)(x-2) &= 0 \\ \text{If } 2x+7=0 &\text{ or } x-2=0 \\ \text{then } x &= \frac{-7}{2} \text{ or } x=2\end{aligned}$$

Question 19.

Solve: $\frac{5}{x-2} - \frac{3}{x+6} = \frac{4}{x}$

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

$$\begin{aligned}\frac{5}{x-2} - \frac{3}{x+6} &= \frac{4}{x} \\ \Rightarrow \frac{5(x+6) - 3(x-2)}{(x-2)(x+6)} &= \frac{4}{x} \\ \Rightarrow \frac{5x+30-3x+6}{x^2+6x-2x-12} &= \frac{4}{x} \\ \Rightarrow \frac{2x+36}{x^2+4x-12} &= \frac{4}{x} \\ \Rightarrow 4x^2+16x-48 &= 2x^2+36x \\ \Rightarrow 2x^2-20x-48 &= 0 \\ \Rightarrow x^2-10x-24 &= 0 \\ \Rightarrow x^2-12x+2x-24 &= 0 \\ \Rightarrow x(x-12)+2(x-12) &= 0 \\ \Rightarrow (x-12)(x+2) &= 0 \\ \text{If } x-12=0 &\text{ or } x+2=0 \\ \text{then } x=12 &\text{ or } x=-2\end{aligned}$$

Question 20.

Solve: $\left(1 + \frac{1}{x+1}\right)\left(1 - \frac{1}{x-1}\right) = \frac{7}{8}$

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

$$\begin{aligned}\left(1 + \frac{1}{x+1}\right)\left(1 - \frac{1}{x-1}\right) &= \frac{7}{8} \\ \Rightarrow \left(\frac{x+1+1}{x+1}\right)\left(\frac{x-1-1}{x-1}\right) &= \frac{7}{8} \\ \Rightarrow \left(\frac{x+2}{x+1}\right)\left(\frac{x-2}{x-1}\right) &= \frac{7}{8} \\ \Rightarrow \frac{x^2 - 4}{x^2 - 1} &= \frac{7}{8} \\ \Rightarrow 8x^2 - 32 &= 7x^2 - 7 \\ \Rightarrow x^2 &= 25 \\ \Rightarrow x &= \pm 5\end{aligned}$$

Question 21.

Find the quadratic equation, whose solution set is :

(i) {3, 5} (ii) {-2, 3}

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

(i) Since solution set is $\{3, 5\}$

$$\Rightarrow x=3 \text{ or } x=5$$

$$\Rightarrow x-3=0 \text{ or } x-5=0$$

$$\Rightarrow (x-3)(x-5)=0$$

$$\Rightarrow x^2 - 5x - 3x + 15 = 0$$

$$\Rightarrow x^2 - 8x + 15 = 0 \text{ which is the required equation.}$$

(ii) Since solution set is $\{-2, 3\}$

$$\Rightarrow x=-2 \text{ or } x=3$$

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

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

$$\Rightarrow x^2 - 3x + 2x - 6 = 0$$

$$\Rightarrow x^2 - x - 6 = 0 \text{ which is the required equation.}$$

(iii) Since solution set is $\{5, -4\}$

$$\Rightarrow x=5 \text{ or } x=-4$$

$$\Rightarrow x-5=0 \text{ or } x+4=0$$

$$\Rightarrow (x-5)(x+4)=0$$

$$\Rightarrow x^2 - 5x + 4x - 20 = 0$$

$$\Rightarrow x^2 - x - 20 = 0 \text{ which is the required equation.}$$

(iv) Since solution set is $\left\{-3, \frac{-2}{5}\right\}$

$$\Rightarrow x=-3 \text{ or } x=\frac{-2}{5}$$

$$\Rightarrow x+3=0 \text{ or } 5x+2=0$$

$$\Rightarrow (x+3)(5x+2)=0$$

$$\Rightarrow 5x^2 + 2x + 15x + 6 = 0$$

$$\Rightarrow 5x^2 + 17x + 6 = 0 \text{ which is the required equation.}$$

Question 22.

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

Solve : $\frac{x}{3} + \frac{3}{6-x} = \frac{2(6+x)}{15}; (x \neq 6)$

Solution:

$$\begin{aligned}\frac{x}{3} + \frac{3}{6-x} &= \frac{2(6+x)}{15} \\ \Rightarrow \frac{x(6-x) + 3 \times 3}{3(6-x)} &= \frac{12+2x}{15} \\ \Rightarrow \frac{x(6-x) + 3 \times 3}{6-x} &= \frac{12+2x}{5} \\ \Rightarrow \frac{6x - x^2 + 9}{6-x} &= \frac{12+2x}{5} \\ \Rightarrow 30x - 5x^2 + 45 &= 72 + 12x - 12x - 2x^2 \\ \Rightarrow 30x - 5x^2 + 45 &= 72 - 2x^2 \\ \Rightarrow 3x^2 - 30x + 27 &= 0 \\ \Rightarrow x^2 - 10x + 9 &= 0 \\ \Rightarrow x^2 - 9x - x + 9 &= 0 \\ \Rightarrow x(x-9) - 1(x-9) &= 0 \\ \Rightarrow (x-9)(x-1) &= 0 \\ \Rightarrow x-9=0 \text{ or } x-1=0 \\ \Rightarrow x=9 \text{ or } x=1\end{aligned}$$

Question 23.

Solve the equation $9x^2 + \frac{3x}{4} + 2 = 0$, if possible, for real values of x .

Solution:

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$$9x^2 + \frac{3x}{4} + 2 = 0$$

$$\Rightarrow \frac{36x^2 + 3x + 8}{4} = 0$$

$$\Rightarrow 36x^2 + 3x + 8 = 0$$

Here, $a = 36$, $b = 3$ and $c = 8$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-3 \pm \sqrt{(3)^2 - 4 \times 36 \times 8}}{2 \times 36} \\ &= \frac{-3 \pm \sqrt{9 - 1152}}{72} \\ &= \frac{-3 \pm \sqrt{-1143}}{72}\end{aligned}$$

Since $\sqrt{-1143}$ is not possible, we cannot solve the given equation for x .

Question 24.

Find the value of x , if $a + 1 = 0$ and $x^2 + ax - 6 = 0$.

Solution:

If $a + 1 = 0$, then $a = -1$

Put this value in the given equation $x^2 + ax - 6 = 0$

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

$$\Rightarrow x^2 - 3x + 2x - 6 = 0$$

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

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

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

$$\text{then } x = 3 \quad \text{or} \quad x = -2$$

Question 25.

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

Find the value of x , if $a + 7 = 0$; $b + 10 = 0$ and $12x^2 = ax - b$.

Solution:

If $a + 7 = 0$, then $a = -7$

and $b + 10 = 0$, then $b = -10$

Put these values of a and b in the given equation

$$12x^2 = (-7)x - (-10)$$

$$\Rightarrow 12x^2 + 7x - 10 = 0$$

$$\Rightarrow 12x^2 + 15x - 8x - 10 = 0$$

$$\Rightarrow 3x(4x + 5) - 2(4x + 5) = 0$$

$$\Rightarrow (4x + 5)(3x - 2) = 0$$

$$\text{If } 4x + 5 = 0 \quad \text{or} \quad 3x - 2 = 0$$

$$\text{then } x = -\frac{5}{4} \quad \text{or} \quad x = \frac{2}{3}$$

Question 26.

Use the substitution $y = 2x + 3$ to solve for x , if $4(2x+3)^2 - (2x+3) - 14 = 0$.

Solution:

$$4(2x+3)^2 - (2x+3) - 14 = 0$$

Put $2x+3 = y$

$$4y^2 - y - 14 = 0$$

$$\Rightarrow 4y^2 - 8y + 7y - 14 = 0$$

$$\Rightarrow 4y(y-2) + 7(y-2) = 0$$

$$\Rightarrow (y-2)(4y+7) = 0$$

$$\text{If } y-2=0 \text{ or } 4y+7=0$$

$$\text{then } 2x+3-2=0 \text{ or } 4(2x+3)+7=0$$

$$\Rightarrow 2x = -1 \text{ or } 8x = -19$$

$$\Rightarrow x = \frac{-1}{2} \text{ or } x = \frac{-19}{8}$$

Question 27.

Without solving the quadratic equation $6x^2 - x - 2 = 0$, find whether $x = 2/3$ is a solution of this equation or not.

Solution:

Consider the equation, $6x^2 - x - 2 = 0$

Put $x = \frac{2}{3}$ in L.H.S.

$$\text{L.H.S.} = 6\left(\frac{2}{3}\right)^2 - \left(\frac{2}{3}\right) - 2$$

$$= \frac{24}{9} - \frac{2}{3} - 2$$

$$= \frac{24 - 6 - 18}{9} = 0 = \text{R.H.S.}$$

Since L.H.S. = R.H.S., then $x = \frac{2}{3}$ is a solution of the given equation.

Question 28.

Determine whether $x = -1$ is a root of the equation $x^2 - 3x + 2 = 0$ or not.

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Solution:

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

Put $x = -1$ in L.H.S.

$$\text{L.H.S.} = (-1)^2 - 3(-1) + 2$$

$$= 1 + 3 + 2 = 6 \neq \text{R.H.S}$$

Then $x = -1$ is not the solution of the given equation.

Question 29.

If $x = \frac{2}{3}$ is a solution of the quadratic equation $7x^2 + mx - 3 = 0$; Find the value of m .

Solution:

$$7x^2 + mx - 3 = 0$$

Given $x = \frac{2}{3}$ is the solution of the given equation.

Put given value of x in the given equation

$$7\left(\frac{2}{3}\right)^2 + m\left(\frac{2}{3}\right) - 3 = 0$$

$$\Rightarrow \frac{28}{9} + \frac{2m}{3} - 3 = 0$$

$$\Rightarrow 28 + 6m - 27 = 0$$

$$\Rightarrow 6m = -1$$

$$\Rightarrow m = \frac{-1}{6}$$

Question 30.

If $x = -3$ and $x = \frac{2}{3}$ are solutions of quadratic equation $mx^2 + 7x + n = 0$, find the values of m and n .

Solution:

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$$mx^2 + 7x + n = 0$$

Put $x = -3$ in given equation

$$m(-3)^2 + 7(-3) + n = 0$$

$$\Rightarrow 9m - 21 + n = 0$$

$$\Rightarrow 9m + n = 21 \text{ --- (1)}$$

Put $x = \frac{2}{3}$ in given equation

$$m\left(\frac{2}{3}\right)^2 + 7\left(\frac{2}{3}\right) + n = 0$$

$$\Rightarrow \frac{4m}{9} + \frac{14}{3} + n = 0$$

$$\Rightarrow 4m + 9n = -42 \text{ --- (2)}$$

solving these equations we get

$$m = 3 \text{ and } n = -6$$

Question 31.

If quadratic equation $x^2 - (m + 1)x + 6 = 0$ has one root as $x = 3$; find the value of m and the root of the equation.

Solution:

$$x^2 - (m + 1)x + 6 = 0$$

Put $x=3$ in the given equation

$$(3)^2 - (m + 1)(3) + 6 = 0$$

$$\Rightarrow 9 - 3m - 3 + 6 = 0$$

$$\Rightarrow -3m = -12$$

$$\Rightarrow m = 4$$

Put this value of m in the given equation, we get

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

$$\Rightarrow x^2 - 3x - 2x + 6 = 0$$

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

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

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

$$\text{then } x = 3 \quad \text{or} \quad x = 2$$

$\therefore 2$ is the other root of the given equation.

Question 32.

Given that 2 is a root of the equation $3x^2 - p(x + 1) = 0$ and that the equation $px^2 - qx + 9 = 0$ has equal roots, find the values of p and q .

Solution:

Since 2 is a root of the equation $3x^2 - p(x + 1) = 0$

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

$$\Rightarrow 3 \times 4 - 3p = 0$$

$$\Rightarrow 12 - 3p = 0$$

$$\Rightarrow 3p = 12$$

$$\Rightarrow p = 4$$

Now, the other equation becomes $4x^2 - qx + 9 = 0$

Here, $a = 4$, $b = -q$ and $c = 9$

Since the roots are equal, we have

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

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

$$\Rightarrow q^2 - 144 = 0$$

$$\Rightarrow q^2 = 144$$

$$\Rightarrow q = 12$$

Hence, $p = 4$ and $q = 12$.

Question 33.

$$\text{Solve : } \frac{x}{a} - \frac{a+b}{x} = \frac{b(a+b)}{ax}$$

Solution:

$$\begin{aligned}\frac{x}{a} - \frac{a+b}{x} &= \frac{b(a+b)}{ax} \\ \Rightarrow \frac{x^2 - a^2 - ab}{ax} &= \frac{ab + b^2}{ax} \\ \Rightarrow x^2 - a^2 - ab &= ab + b^2 \\ \Rightarrow x^2 &= a^2 + b^2 + 2ab \\ \Rightarrow x^2 &= (a+b)^2 \\ \Rightarrow x &= a+b\end{aligned}$$

Question 34.

$$\text{Solve : } \left(\frac{1200}{x} + 2 \right) (x - 10) - 1200 = 60$$

Solution:

$$\begin{aligned}\left(\frac{1200}{x} + 2 \right) (x - 10) - 1200 &= 60 \\ \Rightarrow 2 \left(\frac{600}{x} + 1 \right) (x - 10) &= 1260 \\ \Rightarrow \left(\frac{600}{x} + 1 \right) (x - 10) &= 630 \\ \Rightarrow \left(\frac{600 + x}{x} \right) (x - 10) &= 630 \\ \Rightarrow 600x - 6000 + x^2 - 10x &= 630x \\ \Rightarrow x^2 - 40x - 6000 &= 0 \\ \Rightarrow x^2 - 100x + 60x - 6000 &= 0 \\ \Rightarrow x(x - 100) + 60(x - 100) &= 0 \\ \Rightarrow (x - 100)(x + 60) &= 0 \\ \Rightarrow x - 100 = 0 \text{ or } x + 60 &= 0 \\ \Rightarrow x = 100 \text{ or } x = -60\end{aligned}$$

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Question 35.

If -1 and 3 are the roots of $x^2 + px + q = 0$, find the values of p and q.

Solution:

Since -1 is a root of $x^2 + px + q = 0$, we have

$$(-1)^2 + p(-1) + q = 0$$

$$\Rightarrow 1 - p + q = 0$$

$$\Rightarrow -p + q = -1 \quad \dots (i)$$

Also, 3 is a root of $x^2 + px + q = 0$.

$$\Rightarrow (3)^2 + p(3) + q = 0$$

$$\Rightarrow 9 + 3p + q = 0$$

$$\Rightarrow 3p + q = -9 \quad \dots (ii)$$

Subtracting equation (ii) from (i), we get

$$-4p = 8$$

$$\Rightarrow p = -2$$

$$\Rightarrow -(-2) + q = -1 \quad \dots [\text{From (i)}]$$

$$\Rightarrow 2 + q = -1$$

$$\Rightarrow q = -3$$

Hence, $p = -2$ and $q = -3$.

Exercise 5D**Question 1.**

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Solve each of the following equations using the formula :

(i) $x^2 - 6x = 27$ (ii) $x^2 - 10x + 21 = 0$

(iii) $x^2 + 6x - 10 = 0$ (iv) $x^2 + 2x - 6 = 0$

(v) $3x^2 + 2x - 1 = 0$ (vi) $2x^2 + 7x + 5 = 0$

(vii) $\frac{2}{3}x = -\frac{1}{6}x^2 - \frac{1}{3}$ (viii) $\frac{1}{15}x^2 + \frac{5}{3} = \frac{2}{3}x$

(ix) $x^2 - 6 = 2\sqrt{2}x$ (x) $\frac{4}{x} - 3 = \frac{5}{2x+3}$

(xi) $\frac{2x+3}{x+3} = \frac{x+4}{x+2}$ (xii) $\sqrt{6}x^2 - 4x - 2\sqrt{6} = 0$

(xiii) $\frac{2x}{x-4} + \frac{2x-5}{x-3} = 8\frac{1}{3}$ (xiv) $\frac{x-1}{x-2} + \frac{x-3}{x-4} = 3\frac{1}{3}$

Solution:

$$(i) x^2 - 6x = 27$$

$$\Rightarrow x^2 - 6x - 27 = 0$$

Here $a=1$, $b=-6$ and $c=-27$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-6) \pm \sqrt{(-6)^2 - 4(1)(-27)}}{2(1)} \\ &= \frac{6 \pm 12}{2} = \frac{6+12}{2} \text{ and } \frac{6-12}{2} = 9 \text{ and } -3\end{aligned}$$

$$(ii) x^2 - 10x + 21 = 0$$

Here $a=1$, $b=-10$ and $c=21$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(21)}}{2(1)} \\ &= \frac{10 \pm 4}{2} = \frac{10+4}{2} \text{ and } \frac{10-4}{2} = 7 \text{ and } 3\end{aligned}$$

$$(iii) x^2 + 6x - 10 = 0$$

Here $a=1$, $b=6$ and $c=-10$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(6) \pm \sqrt{(6)^2 - 4(1)(-10)}}{2(1)} \\ &= \frac{-6 \pm \sqrt{76}}{2} = \frac{-6 + 2\sqrt{19}}{2} \text{ and } \frac{-6 - 2\sqrt{19}}{2} = -3 + \sqrt{19} \text{ and } -3 - \sqrt{19}\end{aligned}$$

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

Here $a=1$, $b=2$ and $c=-6$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-6)}}{2(1)} \\ &= \frac{-2 \pm \sqrt{28}}{2} = \frac{-2 \pm 2\sqrt{7}}{2} = -1 \pm \sqrt{7}\end{aligned}$$

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

Here $a=3$, $b=2$ and $c=-1$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(2) \pm \sqrt{(2)^2 - 4(3)(-1)}}{2(3)} \\ &= \frac{-2 \pm 4}{6} = \frac{-2+4}{6} \text{ and } \frac{-2-4}{6} = \frac{1}{3} \text{ and } -1\end{aligned}$$

$$(vi) 2x^2 + 7x + 5 = 0$$

Here $a=2$, $b=7$ and $c=5$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(7) \pm \sqrt{(7)^2 - 4(2)(5)}}{2(2)} \\ &= \frac{-7 \pm 3}{4} = \frac{-7+3}{4} \text{ and } \frac{-7-3}{4} = -1 \text{ and } -\frac{5}{2}\end{aligned}$$

$$(vii) \frac{2}{3}x = -\frac{1}{6}x^2 - \frac{1}{3}$$

$$\Rightarrow 4x = -x^2 - 2$$

$$\Rightarrow x^2 + 4x + 2 = 0$$

Here $a=1$, $b=4$ and $c=2$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(4) \pm \sqrt{(4)^2 - 4(1)(2)}}{2(1)} \\ &= \frac{-4 \pm \sqrt{8}}{2} = \frac{-4 \pm 2\sqrt{2}}{2} = -2 \pm \sqrt{2}\end{aligned}$$

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$$(viii) \frac{1}{15}x^2 + \frac{5}{3} = \frac{2}{3}x$$

$$\Rightarrow x^2 + 25 = 10x$$

$$\Rightarrow x^2 - 10x + 25 = 0$$

Here $a=1$, $b=-10$ and $c=25$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(25)}}{2(1)} \\ &= \frac{10 \pm \sqrt{0}}{2} = 5\end{aligned}$$

$$(ix) \quad x^2 - 6 = 2\sqrt{2}x$$

$$\Rightarrow x^2 - 2\sqrt{2}x - 6 = 0$$

Here $a=1$, $b=-2\sqrt{2}$ and $c=-6$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-2\sqrt{2}) \pm \sqrt{(-2\sqrt{2})^2 - 4(1)(-6)}}{2(1)} \\ &= \frac{2\sqrt{2} \pm \sqrt{32}}{2} = \frac{2\sqrt{2} \pm 4\sqrt{2}}{2} = \frac{2\sqrt{2} + 4\sqrt{2}}{2} \text{ and } \frac{2\sqrt{2} - 4\sqrt{2}}{2} \\ &= \frac{6\sqrt{2}}{2} \text{ and } \frac{-2\sqrt{2}}{2} = 3\sqrt{2} \text{ and } -\sqrt{2}\end{aligned}$$

$$(x) \quad \frac{4}{x} - 3 = \frac{5}{2x+3}$$

$$\Rightarrow \frac{4-3x}{x} = \frac{5}{2x+3}$$

$$\Rightarrow (4-3x)(2x+3) = 5x$$

$$\Rightarrow 8x + 12 - 6x^2 - 9x = 5x$$

$$\Rightarrow 6x^2 + 6x - 12 = 0$$

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

Here $a=1$, $b=1$ and $c=-2$

$$\text{Then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(1) \pm \sqrt{(1)^2 - 4(1)(-2)}}{2(1)}$$

$$= \frac{-1 \pm \sqrt{9}}{2} = \frac{-1 \pm 3}{2} = \frac{-1+3}{2} \text{ and } \frac{-1-3}{2} = 1 \text{ and } -2$$

$$(xi) \quad \frac{2x+3}{x+3} = \frac{x+4}{x+2}$$

$$\Rightarrow (2x+3)(x+2) = (x+3)(x+4)$$

$$\Rightarrow 2x^2 + 4x + 3x + 6 = x^2 + 4x + 3x + 12$$

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

Here $a=1$, $b=0$ and $c=-6$

$$\text{Then } x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-(0) \pm \sqrt{(0)^2 - 4(1)(-6)}}{2(1)}$$

$$= \frac{0 \pm \sqrt{24}}{2} = \frac{0 \pm 2\sqrt{6}}{2} = -\sqrt{6} \text{ and } \sqrt{6}$$

$$(xii) \sqrt{6}x^2 - 4x - 2\sqrt{6} = 0$$

Here $a = \sqrt{6}$, $b = -4$ and $c = -2\sqrt{6}$

$$\begin{aligned}\text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-4) \pm \sqrt{(-4)^2 - 4(\sqrt{6})(-2\sqrt{6})}}{2(\sqrt{6})} \\ &= \frac{4 \pm \sqrt{64}}{2\sqrt{6}} = \frac{4 \pm 8}{2\sqrt{6}} = \frac{4+8}{2\sqrt{6}} \text{ and } \frac{4-8}{2\sqrt{6}} \\ &= \frac{6}{\sqrt{6}} \text{ and } \frac{-2}{\sqrt{6}} = \sqrt{6} \text{ and } -\frac{\sqrt{6}}{3}\end{aligned}$$

$$\begin{aligned} \text{(xiii)} \quad & \frac{2x}{x-4} + \frac{2x-5}{x-3} = 8\frac{1}{3} \\ \Rightarrow & \frac{2x(x-3) + (x-4)(2x-5)}{(x-4)(x-3)} = \frac{25}{3} \\ \Rightarrow & \frac{2x^2 - 6x + 2x^2 - 5x - 8x + 20}{x^2 - 3x - 4x + 12} = \frac{25}{3} \\ \Rightarrow & \frac{4x^2 - 19x + 20}{x^2 - 7x + 12} = \frac{25}{3} \\ \Rightarrow & 25x^2 - 175x + 300 = 12x^2 - 57x + 60 \\ \Rightarrow & 13x^2 - 118x + 240 = 0 \end{aligned}$$

Here $a=13$, $b=-118$ and $c=240$

$$\begin{aligned} \text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-118) \pm \sqrt{(-118)^2 - 4(13)(240)}}{2(13)} \\ &= \frac{118 \pm \sqrt{1444}}{26} = \frac{118 \pm 38}{26} \\ &= \frac{118+38}{26} \text{ and } \frac{118-38}{26} = 6 \text{ and } \frac{40}{13} \end{aligned}$$

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$$\begin{aligned} \text{(xiv)} \quad \frac{x-1}{x-2} + \frac{x-3}{x-4} &= 3\frac{1}{3} \\ \Rightarrow \frac{(x-1)(x-4) + (x-2)(x-3)}{(x-2)(x-4)} &= \frac{10}{3} \\ \Rightarrow \frac{x^2 - 4x - x + 4 + x^2 - 3x - 2x + 6}{x^2 - 4x - 2x + 8} &= \frac{10}{3} \\ \Rightarrow \frac{2x^2 - 10x + 10}{x^2 - 6x + 8} &= \frac{10}{3} \\ \Rightarrow 10x^2 - 60x + 80 &= 6x^2 - 30x + 30 \\ \Rightarrow 4x^2 - 30x + 50 &= 0 \\ \Rightarrow 2x^2 - 15x + 25 &= 0 \\ \text{Here } a=2, b=-15 \text{ and } c=25 \\ \text{Then } x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-15) \pm \sqrt{(-15)^2 - 4(2)(25)}}{2(2)} \\ &= \frac{15 \pm \sqrt{25}}{4} = \frac{15 \pm 5}{4} \\ &= \frac{15+5}{4} \text{ and } \frac{15-5}{4} = 5 \text{ and } \frac{5}{2} \end{aligned}$$

Question 2.

Solve each of the following equations for x and give, in each case, your answer correct to one decimal place :

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

(ii) $5x^2 + 10x - 3 = 0$

Solution:

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

Here $a=1$, $b=-8$ and $c=5$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-8) \pm \sqrt{(-8)^2 - 4(1)(5)}}{2(1)} \\ &= \frac{8 \pm \sqrt{44}}{2} = \frac{8 \pm 2\sqrt{11}}{2} = 4 \pm \sqrt{11} = 4 \pm 3.3 = 7.3 \text{ and } 0.7\end{aligned}$$

(ii) $5x^2 + 10x - 3 = 0$

Here $a=5$, $b=10$ and $c=-3$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(10) \pm \sqrt{(10)^2 - 4(5)(-3)}}{2(5)} \\ &= \frac{-10 \pm \sqrt{160}}{10} = \frac{-10 \pm 12.6}{10} \\ &= \frac{-10 + 12.6}{10} \text{ and } \frac{-10 - 12.6}{10} = 0.26 \text{ and } -2.26 = 0.3 \text{ and } -2.3\end{aligned}$$

Question 3(i).

Solve each of the following equations for x and give, in each case, your answer correct to two decimal places :

(i) $2x^2 - 10x + 5 = 0$

Solution:

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

Here $a=2$, $b=-10$ and $c=5$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-10) \pm \sqrt{(-10)^2 - 4(2)(5)}}{2(2)} \\ &= \frac{10 \pm \sqrt{60}}{4} = \frac{10 \pm 7.75}{4} \\ &= \frac{10 + 7.75}{4} \text{ and } \frac{10 - 7.75}{4} = 4.44 \text{ and } 0.56\end{aligned}$$

Question 3(ii).

Solve each of the following equations for x and give, in each case, your answer correct to two decimal places :

$$4x + \frac{6}{x} + 13 = 0$$

Solution:

$$\begin{aligned}4x + \frac{6}{x} + 13 &= 0 \\ \Rightarrow 4x^2 + 6 + 13x &= 0 \\ \Rightarrow 4x^2 + 13x + 6 &= 0 \\ \text{Here } a=4, b=13 \text{ and } c=6 \\ \therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(13) \pm \sqrt{(13)^2 - 4(4)(6)}}{2(4)} \\ &= \frac{-13 \pm \sqrt{73}}{8} = \frac{-13 \pm 8.54}{8} \\ &= \frac{-13 + 8.54}{8} \text{ and } \frac{-13 - 8.54}{8} = -0.56 \text{ and } -2.69\end{aligned}$$

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Question 3(iii).

Solve each of the following equations for x and give, in each case, your answer correct to two decimal places :

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

Solution:

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

Here $a=1$, $b=-3$ and $c=-9$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-9)}}{2(1)} \\ &= \frac{3 \pm \sqrt{45}}{2} = \frac{3 \pm 6.70}{2} \\ &= \frac{3+6.70}{2} \text{ and } \frac{3-6.70}{2} = 4.85 \text{ and } -1.85\end{aligned}$$

Question 3(iv).

Solve each of the following equations for x and give, in each case, your answer correct to two decimal places :

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

Solution:

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

Here, $a = 1$, $b = -5$ and $c = -10$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 1 \times (-10)}}{2 \times 1} \\ &= \frac{5 \pm \sqrt{25 + 40}}{2} \\ &= \frac{5 \pm \sqrt{65}}{2} \\ &= \frac{5 \pm 8.06}{2} \\ \therefore x &= \frac{5 + 8.06}{2} \text{ or } x = \frac{5 - 8.06}{2} \\ \Rightarrow x &= \frac{13.06}{2} \text{ or } x = -\frac{3.06}{2} \\ \Rightarrow x &= 6.53 \text{ or } x = -1.53\end{aligned}$$

Question 4.

Solve each of the following equations for x and give, in each case, your answer correct to 3 decimal places :

(i) $3x^2 - 12x - 1 = 0$

(ii) $x^2 - 16x + 6 = 0$

(iii) $2x^2 + 11x + 4 = 0$

Solution:

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(i) $3x^2 - 12x - 1 = 0$

Here $a=3$, $b=-12$ and $c=-1$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-12) \pm \sqrt{(-12)^2 - 4(3)(-1)}}{2(3)} \\ &= \frac{12 \pm \sqrt{156}}{6} = \frac{12 \pm 12.489}{6} \\ &= \frac{12 + 12.489}{6} \text{ and } \frac{12 - 12.489}{6} = 4.082 \text{ and } -0.082\end{aligned}$$

(ii) $x^2 - 16x + 6 = 0$

Here $a=1$, $b=-16$ and $c=6$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-16) \pm \sqrt{(-16)^2 - 4(1)(6)}}{2(1)} \\ &= \frac{16 \pm \sqrt{232}}{2} = \frac{16 \pm 15.231}{2} \\ &= \frac{16 + 15.231}{2} \text{ and } \frac{16 - 15.231}{2} = 15.616 \text{ and } 0.384\end{aligned}$$

(iii) $2x^2 + 11x + 4 = 0$

Here $a=2$, $b=11$ and $c=4$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(11) \pm \sqrt{(11)^2 - 4(2)(4)}}{2(2)} \\ &= \frac{-11 \pm \sqrt{89}}{4} = \frac{-11 \pm 9.433}{4} \\ &= \frac{-11 + 9.433}{4} \text{ and } \frac{-11 - 9.433}{4} = -0.392 \text{ and } -5.108\end{aligned}$$

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Question 5.

Solve:

(i) $x^4 - 2x^2 - 3 = 0$

(ii) $x^4 - 10x^2 + 9 = 0$

Solution:

(i) $x^4 - 2x^2 - 3 = 0$

$$\Rightarrow x^4 - 3x^2 + x^2 - 3 = 0$$

$$\Rightarrow x^2(x^2 - 3) + 1(x^2 - 3) = 0$$

$$\Rightarrow (x^2 - 3)(x^2 + 1) = 0$$

If $x^2 - 3 = 0$ or $x^2 + 1 = 0$

$$\Rightarrow x^2 = 3 \quad \text{or} \quad x^2 = -1(\text{reject})$$

$$\Rightarrow x = \pm\sqrt{3}$$

(ii) $x^4 - 10x^2 + 9 = 0$

$$\Rightarrow x^4 - 9x^2 - x^2 + 9 = 0$$

$$\Rightarrow x^2(x^2 - 9) - 1(x^2 - 9) = 0$$

$$\Rightarrow (x^2 - 9)(x^2 - 1) = 0$$

If $x^2 - 9 = 0$ or $x^2 - 1 = 0$

$$\Rightarrow x^2 = 9 \quad \text{or} \quad x^2 = 1$$

$$\Rightarrow x = \pm 3 \quad \text{or} \quad x = \pm 1$$

Question 6.

Solve :

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

(ii) $(x^2 - 3x)^2 - 16(x^2 - 3x) - 36 = 0$

Solution:

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

$$\text{Let } x^2 - x = y$$

$$\text{Then } y^2 + 5y + 4 = 0$$

$$\Rightarrow y^2 + 4y + y + 4 = 0$$

$$\Rightarrow y(y + 4) + 1(y + 4) = 0$$

$$\Rightarrow (y + 4)(y + 1) = 0$$

$$\text{If } y + 4 = 0 \text{ or } y + 1 = 0$$

$$\Rightarrow x^2 - x + 4 = 0 \text{ or } x^2 - x + 1 = 0$$

$$\Rightarrow x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(4)}}{2(1)} \text{ or } x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(1)(1)}}{2(1)}$$

$$\Rightarrow x = \frac{1 \pm \sqrt{-15}}{2} (\text{reject}) \text{ or } x = \frac{1 \pm \sqrt{-3}}{2} (\text{reject})$$

$\therefore$ Given equation has no real solution.

$$(ii) (x^2 - 3x)^2 - 16(x^2 - 3x) - 36 = 0$$

$$\text{Let } x^2 - 3x = y$$

$$\text{Then } y^2 - 16y - 36 = 0$$

$$\Rightarrow y^2 - 18y + 2y - 36 = 0$$

$$\Rightarrow y(y - 18) + 2(y - 18) = 0$$

$$\Rightarrow (y - 18)(y + 2) = 0$$

$$\text{If } y - 18 = 0 \text{ or } y + 2 = 0$$

$$\Rightarrow x^2 - 3x - 18 = 0 \text{ or } x^2 - 3x + 2 = 0$$

$$\Rightarrow x^2 - 6x + 3x - 18 = 0 \text{ or } x^2 - 2x - x + 2 = 0$$

$$\Rightarrow x(x - 6) + 3(x - 6) = 0 \text{ or } x(x - 2) - 1(x - 2) = 0$$

$$\Rightarrow (x - 6)(x + 3) = 0 \text{ or } (x - 2)(x - 1) = 0$$

$$\text{If } x - 6 = 0 \text{ or } x + 3 = 0 \text{ or } x - 2 = 0 \text{ or } x - 1 = 0$$

$$\text{then } x = 6 \text{ or } x = -3 \text{ or } x = 2 \text{ or } x = 1$$

Question 7.

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Solve :

$$(i) \sqrt{\frac{x}{x-3}} + \sqrt{\frac{x-3}{x}} = \frac{5}{2}$$

$$(ii) \left(\frac{2x-3}{x-1} \right) - 4 \left(\frac{x-1}{2x-3} \right) = 3$$

$$(iii) \left(\frac{3x+1}{x+1} \right) + \left(\frac{x+1}{3x+1} \right) = \frac{5}{2}$$

Solution:

$$(i) \sqrt{\frac{x}{x-3}} + \sqrt{\frac{x-3}{x}} = \frac{5}{2}$$

$$\text{Let } \sqrt{\frac{x}{x-3}} = y$$

$$\text{Then } y + \frac{1}{y} = \frac{5}{2}$$

$$\Rightarrow \frac{y^2 + 1}{y} = \frac{5}{2}$$

$$\Rightarrow 2y^2 + 2 = 5y$$

$$\Rightarrow 2y^2 - 5y + 2 = 0$$

$$\Rightarrow 2y^2 - 4y - y + 2 = 0$$

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

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

$$\text{If } y-2=0 \quad \text{or} \quad 2y-1=0$$

$$\text{then } y=2 \quad \text{or} \quad y=\frac{1}{2}$$

$$\Rightarrow \sqrt{\frac{x}{x-3}} = 2 \quad \text{or} \quad \sqrt{\frac{x}{x-3}} = \frac{1}{2}$$

$$\Rightarrow \frac{x}{x-3} = 4 \quad \text{or} \quad \frac{x}{x-3} = \frac{1}{4}$$

$$\Rightarrow x = 4 \quad \text{or} \quad x = -1$$

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$$(ii) \left(\frac{2x-3}{x-1} \right) - 4 \left(\frac{x-1}{2x-3} \right) = 3$$

$$\text{Let } \frac{2x-3}{x-1} = y$$

$$\text{then } y - \frac{4}{y} = 3$$

$$\Rightarrow \frac{y^2 - 4}{y} = 3$$

$$\Rightarrow y^2 - 4 = 3y$$

$$\Rightarrow y^2 - 3y - 4 = 0$$

$$\Rightarrow y^2 - 4y + y - 4 = 0$$

$$\Rightarrow y(y-4) + 1(y-4) = 0$$

$$\Rightarrow (y-4)(y+1) = 0$$

$$\text{If } y-4=0 \quad \text{or} \quad y+1=0$$

$$\text{then } y=4 \quad \text{or} \quad y=-1$$

$$\Rightarrow \frac{2x-3}{x-1} = 4 \quad \text{or} \quad \frac{2x-3}{x-1} = -1$$

$$\Rightarrow 4x-4=2x-3 \quad \text{or} \quad 2x-3=-x+1$$

$$\Rightarrow 2x=1 \quad \text{or} \quad 3x=4$$

$$\Rightarrow x = \frac{1}{2} \quad \text{or} \quad x = \frac{4}{3} = 1\frac{1}{3}$$

$$(iii) \left(\frac{3x+1}{x+1} \right) + \left(\frac{x+1}{3x+1} \right) = \frac{5}{2}$$

$$\text{Let } \frac{3x+1}{x+1} = y$$

$$\text{then } y + \frac{1}{y} = \frac{5}{2}$$

$$\Rightarrow \frac{y^2 + 1}{y} = \frac{5}{2}$$

$$\Rightarrow 2y^2 + 2 = 5y$$

$$\Rightarrow 2y^2 - 5y + 2 = 0$$

$$\Rightarrow 2y^2 - 4y - y + 2 = 0$$

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

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

$$\text{If } y-2=0 \quad \text{or} \quad 2y-1=0$$

$$\text{then } y=2 \quad \text{or} \quad y=\frac{1}{2}$$

$$\Rightarrow \frac{3x+1}{x+1} = 2 \quad \text{or} \quad \frac{3x+1}{x+1} = \frac{1}{2}$$

$$\Rightarrow 3x+1 = 2x+2 \quad \text{or} \quad 6x+2 = x+1$$

$$\Rightarrow x = 1 \quad \text{or} \quad 5x = -1$$

$$\Rightarrow x = 1 \quad \text{or} \quad x = -\frac{1}{5}$$

Question 8.

Solve the equation $2x - \frac{1}{x} = 7$. Write your answer correct to two decimal places.

Solution:

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$$2x - \frac{1}{x} = 7$$

$$\Rightarrow \frac{2x^2 - 1}{x} = 7$$

$$\Rightarrow 2x^2 - 1 = 7x$$

$$\Rightarrow 2x^2 - 7x - 1 = 0$$

Here $a=2$, $b=-7$ and $c=-1$

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

$$= \frac{-(-7) \pm \sqrt{(-7)^2 - 4(2)(-1)}}{2(2)}$$

$$= \frac{7 \pm \sqrt{57}}{4} = \frac{7 \pm 7.55}{4}$$

$$= \frac{7 + 7.55}{4} \text{ and } \frac{7 - 7.55}{4} = 3.64 \text{ and } -0.14$$

Question 9.

Solve the following equation and give your answer correct to 3 significant figures:

$$5x^2 - 3x - 4 = 0$$

Solution:

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Consider the given equation:

$$5x^2 - 3x - 4 = 0$$

Using quadratic formula, we have,

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

$$\Rightarrow x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4 \times 5 \times (-4)}}{2 \times 5}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{9 + 80}}{2 \times 5}$$

$$\Rightarrow x = \frac{3 \pm \sqrt{89}}{10}$$

$$\Rightarrow x = \frac{3 \pm 9.434}{10}$$

$$\Rightarrow x = 1.243 \text{ or } x = -0.643$$

Question 10.

Solve for x using the quadratic formula. Write your answer correct to two significant figures.

$$(x - 1)^2 - 3x + 4 = 0$$

Solution:

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$$(x-1)^2 - 3x + 4 = 0$$

$$\Rightarrow x^2 - 2x + 1 - 3x + 4 = 0$$

$$\Rightarrow x^2 - 5x + 5 = 0$$

Here, $a = 1$, $b = -5$ and $c = 5$

$$\begin{aligned}\therefore x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ &= \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 1 \times 5}}{2 \times 1} \\ &= \frac{5 \pm \sqrt{25 - 20}}{2} \\ &= \frac{5 \pm \sqrt{5}}{2} \\ &= \frac{5 \pm 2.24}{2} \\ \therefore x &= \frac{5 + 2.24}{2} \text{ or } x = \frac{5 - 2.24}{2} \\ \Rightarrow x &= \frac{7.24}{2} \text{ or } x = \frac{2.76}{2} \\ \Rightarrow x &= 3.6 \text{ or } x = 1.4\end{aligned}$$

Question 11.

Solve the quadratic equation $x^2 - 3(x+3) = 0$; Give your answer correct to two significant figures.

Solution:

Exercise 5E

Question 1.

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Solve:

$$\frac{2x}{x-3} + \frac{1}{2x+3} + \frac{3x+9}{(x-3)(2x+3)} = 0; x \neq 3, x \neq -\frac{3}{2}$$

Solution:

$$\frac{2x}{x-3} + \frac{1}{2x+3} + \frac{3x+9}{(x-3)(2x+3)} = 0; x \neq 3, x \neq -\frac{3}{2}$$

$$\Rightarrow \frac{2x(2x+3) + 1(x-3) + 3x+9}{(x-3)(2x+3)} = 0$$

$$\Rightarrow 4x^2 + 6x + x - 3 + 3x + 9 = 0$$

$$\Rightarrow 4x^2 + 10x + 6 = 0$$

$$\Rightarrow 4x^2 + 4x + 6x + 6 = 0$$

$$\Rightarrow 4x(x+1) + 6(x+1) = 0$$

$$\Rightarrow (x+1)(4x+6) = 0$$

$$\Rightarrow x+1=0 \quad \text{or} \quad 4x+6=0$$

$$\Rightarrow x = -1 \quad \text{or} \quad x = \frac{-6}{4} = \frac{-3}{2} \text{ (reject)}$$

Question 2.

Solve: $(2x+3)^2=81$

Solution:

$$(2x+3)^2 = 81$$

$$\Rightarrow 2x+3 = \pm 9$$

$$\Rightarrow 2x+3 = 9 \quad \text{and} \quad 2x+3 = -9$$

$$\Rightarrow 2x = 6 \quad \text{and} \quad 2x = -12$$

$$\Rightarrow x = 3 \quad \text{and} \quad x = -6$$

Question 3.

Solve: $a^2x^2 - b^2 = 0$

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Solution:

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

$$\Rightarrow (ax)^2 - b^2 = 0$$

$$\Rightarrow (ax + b)(ax - b) = 0$$

$$\text{If } ax + b = 0 \quad \text{and} \quad ax - b = 0$$

$$\text{then } x = \frac{-b}{a} \quad \text{and} \quad x = \frac{b}{a}$$

Question 4.

$$\text{Solve: } x^2 - \frac{11}{4}x + \frac{15}{8} = 0$$

Solution:

$$x^2 - \frac{11}{4}x + \frac{15}{8} = 0$$

$$\Rightarrow \frac{8x^2 - 22x + 15}{8} = 0$$

$$\Rightarrow 8x^2 - 22x + 15 = 0$$

$$\Rightarrow 8x^2 - 12x - 10x + 15 = 0$$

$$\Rightarrow 4x(2x - 3) - 5(2x - 3) = 0$$

$$\Rightarrow (2x - 3)(4x - 5) = 0$$

$$\Rightarrow 2x - 3 = 0 \quad \text{or} \quad 4x - 5 = 0$$

$$\Rightarrow x = \frac{3}{2} \quad \text{or} \quad x = \frac{5}{4}$$

Question 5.

$$x + \frac{4}{x} = -4; x \neq 0$$

Solution:

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$$x + \frac{4}{x} = -4$$

$$\Rightarrow \frac{x^2 + 4}{x} = -4$$

$$\Rightarrow x^2 + 4 = -4x$$

$$\Rightarrow x^2 + 4x + 4 = 0$$

$$\Rightarrow (x + 2)^2 = 0$$

$$\Rightarrow x + 2 = 0$$

$$\Rightarrow x = -2$$

Question 6.

Solve: $2x^4 - 5x^2 + 3 = 0$

Solution:

$$2x^4 - 5x^2 + 3 = 0$$

$$\Rightarrow 2x^4 - 3x^2 - 2x^2 + 3 = 0$$

$$\Rightarrow x^2(2x^2 - 3) - 1(2x^2 - 3) = 0$$

$$\Rightarrow (2x^2 - 3)(x^2 - 1) = 0$$

$$\text{If } 2x^2 - 3 = 0 \quad \text{or} \quad x^2 - 1 = 0$$

$$\text{then } x^2 = \frac{3}{2} \quad \text{or} \quad x^2 = 1$$

$$\Rightarrow x = \pm \sqrt{\frac{3}{2}} \quad \text{or} \quad x = \pm 1$$

Question 7.

Solve: $x^4 - 2x^2 - 3 = 0$.

Solution:

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

$$\Rightarrow x^4 - 3x^2 + x^2 - 3 = 0$$

$$\Rightarrow x^2(x^2 - 3) + 1(x^2 - 3) = 0$$

$$\Rightarrow (x^2 - 3)(x^2 + 1) = 0$$

$$\text{If } x^2 - 3 = 0 \quad \text{or} \quad x^2 + 1 = 0$$

$$\text{then } x^2 = 3 \quad \text{or} \quad x^2 = -1(\text{reject})$$

$$\Rightarrow x = \pm \sqrt{3}$$

Question 8.

$$\text{Solve : } 9\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) - 52 = 0$$

Solution:

$$9\left(x^2 + \frac{1}{x^2}\right) - 9\left(x + \frac{1}{x}\right) - 52 = 0$$

Let $x + \frac{1}{x} = y$

squaring on both sides

$$x^2 + \frac{1}{x^2} + 2 = y^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = y^2 - 2$$

Putting these values in the given equation

$$9(y^2 - 2) - 9y - 52 = 0$$

$$\Rightarrow 9y^2 - 18 - 9y - 52 = 0$$

$$\Rightarrow 9y^2 - 9y - 70 = 0$$

$$\Rightarrow 9y^2 - 30y + 21y - 70 = 0$$

$$\Rightarrow 3y(3y - 10) + 7(3y - 10) = 0$$

$$\Rightarrow (3y - 10)(3y + 7) = 0$$

$$\Rightarrow 3y - 10 = 0 \quad \text{or} \quad 3y + 7 = 0$$

$$\Rightarrow y = \frac{10}{3} \quad \text{or} \quad y = -\frac{7}{3}$$

$$\Rightarrow x + \frac{1}{x} = \frac{10}{3} \quad \text{or} \quad x + \frac{1}{x} = -\frac{7}{3}$$

$$\Rightarrow \frac{x^2 + 1}{x} = \frac{10}{3} \quad \text{or} \quad \frac{x^2 + 1}{x} = -\frac{7}{3}$$

$$\Rightarrow 3x^2 - 10x + 3 = 0 \quad \text{or} \quad 3x^2 + 7x + 3 = 0$$

$$\Rightarrow 3x^2 - 9x - x + 3 = 0 \quad \text{or} \quad x = \frac{-7 \pm \sqrt{(-7)^2 - 4(3)(3)}}{2(3)}$$

$$\Rightarrow 3x(x - 3) - 1(x - 3) = 0 \quad \text{or} \quad x = \frac{-7 \pm \sqrt{13}}{6}$$

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

$$\Rightarrow x = 3 \quad \text{and} \quad x = \frac{1}{3}$$

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Question 9.

$$\text{Solve : } 2\left(x^2 + \frac{1}{x^2}\right) - \left(x + \frac{1}{x}\right) = 11$$

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

$$2\left(x^2 + \frac{1}{x^2}\right) - \left(x + \frac{1}{x}\right) = 11$$

Let $x + \frac{1}{x} = y$

squaring on both sides

$$x^2 + \frac{1}{x^2} + 2 = y^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = y^2 - 2$$

Putting these values in the given equation

$$2(y^2 - 2) - y = 11$$

$$\Rightarrow 2y^2 - 4 - y - 11 = 0$$

$$\Rightarrow 2y^2 - y - 15 = 0$$

$$\Rightarrow 2y^2 - 6y + 5y - 15 = 0$$

$$\Rightarrow 2y(y - 3) + 5(y - 3) = 0$$

$$\Rightarrow (y - 3)(2y + 5) = 0$$

If $y - 3 = 0$ or $2y + 5 = 0$

then $y = 3$ or $y = -\frac{5}{2}$

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

$$\Rightarrow \frac{x^2 + 1}{x} = 3$$

$$\Rightarrow x^2 - 3x + 1 = 0$$

$$\Rightarrow x = \frac{-3 \pm \sqrt{(-3)^2 - 4(1)(1)}}{2(1)}$$

$$\Rightarrow x = \frac{-3 \pm \sqrt{5}}{2}$$

$$\text{or } x + \frac{1}{x} = -\frac{5}{2}$$

$$\text{or } \frac{x^2 + 1}{x} = -\frac{5}{2}$$

$$\text{or } 2x^2 + 5x + 2 = 0$$

$$\text{or } 2x^2 + 4x + x + 2 = 0$$

$$\text{or } 2x(x + 2) + 1(x + 2) = 0$$

$$\text{or } (x + 2)(2x + 1) = 0$$

$$\text{then } x = -2 \text{ and } x = -\frac{1}{2}$$

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Question 10.

$$\text{Solve : } \left(x^2 + \frac{1}{x^2}\right) - 3\left(x - \frac{1}{x}\right) - 2 = 0$$

Solution:

$$\left(x^2 + \frac{1}{x^2}\right) - 3\left(x - \frac{1}{x}\right) - 2 = 0$$

$$\text{Let } x - \frac{1}{x} = y$$

squaring on both sides

$$x^2 + \frac{1}{x^2} - 2 = y^2$$

$$\Rightarrow x^2 + \frac{1}{x^2} = y^2 + 2$$

Putting these values in the given equation

$$(y^2 + 2) - 3y - 2 = 0$$

$$\Rightarrow y^2 - 3y = 0$$

$$\Rightarrow y(y - 3) = 0$$

$$\text{If } y = 0$$

$$\text{then } y = 0$$

$$\Rightarrow x - \frac{1}{x} = 0$$

$$\Rightarrow \frac{x^2 - 1}{x} = 0$$

$$\Rightarrow x^2 - 1 = 0$$

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

$$\Rightarrow x = -1 \text{ and } x = 1$$

$$\text{or } y - 3 = 0$$

$$\text{or } y = 3$$

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

$$\text{or } \frac{x^2 - 1}{x} = 3$$

$$\text{or } x^2 - 3x - 1 = 0$$

$$\text{or } x = \frac{-(-3) \pm \sqrt{(-3)^2 - 4(1)(-1)}}{2(1)}$$

$$\text{or } x = \frac{3 \pm \sqrt{13}}{2}$$

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Question 11.

Solve : $(x^2 + 5x + 4)(x^2 + 5x + 6) = 120$

Solution:

$$(x^2 + 5x + 4)(x^2 + 5x + 6) = 120$$

$$\text{Let } x^2 + 5x = y$$

$$\text{then } (y+4)(y+6)=120$$

$$\Rightarrow y^2 + 6y + 4y + 24 - 120 = 0$$

$$\Rightarrow y^2 + 10y - 96 = 0$$

$$\Rightarrow y^2 + 16y - 6y - 96 = 0$$

$$\Rightarrow y(y + 16) - 6(y + 16) = 0$$

$$\Rightarrow (y + 16)(y - 6) = 0$$

$$\text{then } y = -16 \quad \text{or} \quad y = 6$$

$$\Rightarrow x^2 + 5x + 16 = 0 \quad \text{or} \quad x^2 + 5x - 6 = 0$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{(5)^2 - 4(1)(16)}}{2(1)} \quad \text{or} \quad x^2 + 6x - x - 6 = 0$$

$$\Rightarrow x = \frac{-5 \pm \sqrt{-39}}{2} \quad \text{or } x(x+6) - 1(x+6) = 0$$

(reject)

$$\text{or } (x+6)(x-1) = 0$$

$$\text{then } x = -6 \text{ and } x = 1$$

Question 12.

Solve each of the following equations, giving answer upto two decimal places.

(i) $x^2 - 5x - 10 = 0$ (ii) $3x^2 - x - 7 = 0$

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

$$(i) x^2 - 5x - 10 = 0$$

Here $a = 1$, $b = -5$ and $c = -10$

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

$$\Rightarrow x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4(1)(-10)}}{2(1)}$$

$$\Rightarrow x = \frac{5 \pm \sqrt{65}}{2} = \frac{5 \pm 8.06}{2}$$

$$\Rightarrow x = \frac{13.06}{2} \text{ and } \frac{-3.06}{2} = 6.53 \text{ and } -1.53$$

$$(ii) 3x^2 - x - 7 = 0$$

Here $a = 3$, $b = -1$ and $c = -7$

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

$$\Rightarrow x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(-7)}}{2(3)}$$

$$\Rightarrow x = \frac{1 \pm \sqrt{85}}{6} = \frac{1 \pm 9.22}{6}$$

$$\Rightarrow x = \frac{10.22}{6} \text{ and } \frac{-8.22}{6} = 1.70 \text{ and } -1.37$$

Question 13.

$$\text{Solve : } \left(\frac{x}{x+2} \right)^2 - 7 \left(\frac{x}{x+2} \right) + 12 = 0; x \neq -2$$

Solution:

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$$\left(\frac{x}{x+2}\right)^2 - 7\left(\frac{x}{x+2}\right) + 12 = 0; x \neq -2$$

$$\text{Let } \frac{x}{x+2} = y$$

$$\text{then } y^2 - 7y + 12 = 0$$

$$\Rightarrow y^2 - 4y - 3y + 12 = 0$$

$$\Rightarrow y(y - 4) - 3(y - 4) = 0$$

$$\Rightarrow (y - 4)(y - 3) = 0$$

$$\text{then } y = 4 \quad \text{and} \quad y = 3$$

$$\Rightarrow \frac{x}{x+2} = 4 \quad \text{and} \quad \frac{x}{x+2} = 3$$

$$\Rightarrow 4x + 8 = x \quad \text{and} \quad 3x + 6 = x$$

$$\Rightarrow x = \frac{-8}{3} \quad \text{and} \quad x = -3$$

Question 14.

Solve :

(i) $x^2 - 11x - 12 = 0$; when $x \in \mathbb{N}$

(ii) $x^2 - 4x - 12 = 0$; when $x \in \mathbb{I}$

(iii) $2x^2 - 9x + 10 = 0$; when $x \in \mathbb{Q}$

Solution:

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$$(i) x^2 - 11x - 12 = 0$$

$$\Rightarrow x^2 - 12x + x - 12 = 0$$

$$\Rightarrow x(x - 12) + 1(x - 12) = 0$$

$$\Rightarrow (x - 12)(x + 1) = 0$$

$$\text{then } x = 12 \text{ and } x = -1$$

$$\text{Since } x \in \mathbb{N}, \text{ then } x = 12$$

$$(ii) x^2 - 4x - 12 = 0$$

$$\Rightarrow x^2 - 6x + 2x - 12 = 0$$

$$\Rightarrow x(x - 6) + 2(x - 6) = 0$$

$$\Rightarrow (x - 6)(x + 2) = 0$$

$$\text{then } x = 6 \text{ and } x = -2$$

$$\text{Since } x \in \mathbb{I}, \text{ then } x = 6 \text{ and } -2$$

$$(iii) 2x^2 - 9x + 10 = 0$$

$$\Rightarrow 2x^2 - 5x - 4x - 10 = 0$$

$$\Rightarrow x(2x - 5) - 2(2x - 5) = 0$$

$$\Rightarrow (2x - 5)(x - 2) = 0$$

$$\text{then } x = \frac{5}{2} \text{ and } x = 2$$

$$\text{Since } x \in \mathbb{Q}, \text{ then } x = \frac{5}{2} \text{ and } 2$$

Question 15.

$$\text{Solve : } (a + b)^2 x^2 - (a + b)x - 6 = 0; a + b \neq 0$$

Solution:

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$$\begin{aligned}(a+b)^2x^2 - (a+b)x - 6 &= 0; a+b \neq 0 \\ \Rightarrow (a+b)^2x^2 - 3(a+b)x + 2(a+b)x - 6 &= 0 \\ \Rightarrow (a+b)x[(a+b)x - 3] + 2[(a+b)x - 3] &= 0 \\ \Rightarrow [(a+b)x - 3][(a+b)x + 2] &= 0 \\ \Rightarrow (a+b)x - 3 = 0 \quad \text{or} \quad (a+b)x + 2 &= 0 \\ \Rightarrow x = \frac{3}{a+b} \quad \text{or} \quad x = \frac{-2}{a+b}\end{aligned}$$

Question 16.

$$\text{Solve : } \frac{1}{p} + \frac{1}{q} + \frac{1}{x} = \frac{1}{x+p+q}$$

Solution:

<https://www.indcareer.com/schools/selina-class-10-icse-solutions-mathematics-chapter-5-quadratic-equations/>

$$\begin{aligned}\frac{1}{p} + \frac{1}{q} + \frac{1}{x} &= \frac{1}{x+p+q} \\ \Rightarrow \frac{1}{p} + \frac{1}{q} + \frac{1}{x} - \frac{1}{x+p+q} &= 0 \\ \Rightarrow \frac{q+p}{pq} + \frac{x+p+q-x}{x(x+p+q)} &= 0 \\ \Rightarrow \frac{q+p}{pq} + \frac{p+q}{x(x+p+q)} &= 0 \\ \Rightarrow (p+q) \left[\frac{1}{pq} + \frac{1}{x^2+px+qx} \right] &= 0 \\ \Rightarrow (p+q) \left[\frac{x^2+px+qx+pq}{pq(x^2+px+qx)} \right] &= 0 \\ \Rightarrow x^2+px+qx+pq &= 0 \\ \Rightarrow x(x+p)+q(x+p) &= 0 \\ \Rightarrow (x+p)(x+q) &= 0 \\ \Rightarrow x = -p \text{ and } x = -q\end{aligned}$$

Question 17.

Solve :

(i) $x(x+1) + (x+2)(x+3) = 42$

(ii) $\frac{1}{x+1} - \frac{2}{x+2} = \frac{3}{x+3} - \frac{4}{x+4}$

Solution:

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$$(i) x(x+1) + (x+2)(x+3) = 42$$

$$\Rightarrow x^2 + x + x^2 + 3x + 2x + 6 - 42 = 0$$

$$\Rightarrow 2x^2 + 6x - 36 = 0$$

$$\Rightarrow 2x^2 + 12x - 6x - 36 = 0$$

$$\Rightarrow 2x(x+6) - 6(x+6) = 0$$

$$\Rightarrow (x+6)(2x-6) = 0$$

$$\text{If } x+6 = 0 \text{ or } 2x-6 = 0$$

$$\text{then } x = -6 \text{ or } x = 3$$

$$(ii) \frac{1}{x+1} - \frac{2}{x+2} = \frac{3}{x+3} - \frac{4}{x+4}$$

$$\Rightarrow \frac{1(x+2) - 2(x+1)}{(x+1)(x+2)} = \frac{3(x+4) - 4(x+3)}{(x+3)(x+4)}$$

$$\Rightarrow \frac{-x}{x^2 + 3x + 2} = \frac{-x}{x^2 + 7x + 12}$$

$$\Rightarrow -x[x^2 + 3x + 2 = x^2 + 7x + 12]$$

$$\Rightarrow -x[-4x = 10]$$

$$\Rightarrow x = 0 \text{ and } x = \frac{-10}{4} = -2.5$$

Question 18.

For each equation, given below, find the value of m so that the equation has equal roots. Also, find the solution of each equation :

$$(i) (m-3)x^2 - 4x + 1 = 0$$

$$(ii) 3x^2 + 12x + (m+7) = 0$$

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

Solution:

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$$(i)(m-3)x^2 - 4x + 1 = 0$$

Here $a=(m-3)$, $b= -4$ and $c= 1$

Given equation has equal roots

then $D=0$

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

$$\Rightarrow (-4)^2 - 4(m-3)(1) = 0$$

$$\Rightarrow 16 - 4m + 12 = 0$$

$$\Rightarrow -4m = -28$$

$$\Rightarrow m = 7$$

Put value of m in given equation

$$4x^2 - 4x + 1 = 0$$

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

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

$$\Rightarrow x = \frac{1}{2}$$

$$(ii)3x^2 + 12x + (m+7) = 0$$

Here $a=3$, $b= 12$ and $c= m+7$

Given equation has equal roots

then $D=0$

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

$$\Rightarrow (12)^2 - 4(3)(m+7) = 0$$

$$\Rightarrow 144 - 12m - 84 = 0$$

$$\Rightarrow -12m = -60$$

$$\Rightarrow m = 5$$

Put value of m in given equation

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

$$\Rightarrow x^2 + 4x + 4 = 0$$

$$\Rightarrow (x + 2)^2 = 0$$

$$\Rightarrow x + 2 = 0$$

$$\Rightarrow x = -2$$

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

Here $a=1$, $b=-(m+2)$ and $c=m+5$

Given equation has equal roots

then $D=0$

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

$$\Rightarrow [-(m + 2)]^2 - 4(1)(m + 5) = 0$$

$$\Rightarrow m^2 + 4m + 4 - 4m - 20 = 0$$

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

$$\Rightarrow m^2 = 16$$

$$\Rightarrow m = \pm 4$$

Put value of m in given equation

$$x^2 - 6x + 9 = 0 \quad \text{or} \quad x^2 + 2x + 1 = 0$$

$$\Rightarrow (x - 3)^2 = 0 \quad \text{or} \quad (x + 1)^2 = 0$$

$$\Rightarrow x - 3 = 0 \quad \text{or} \quad x + 1 = 0$$

$$\Rightarrow x = 3 \quad \text{or} \quad x = -1$$

Question 19.

Without solving the following quadratic equation, find the value of p for which the roots are equal.

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

Solution:

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

Here $a=p$, $b=-4$ and $c=3$

Given equation has equal roots

then $D=0$

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

$$\Rightarrow [-4]^2 - 4(p)(3) = 0$$

$$\Rightarrow 16 - 12p = 0$$

$$\Rightarrow -12p = -16$$

$$\Rightarrow p = \frac{-16}{-12} = \frac{4}{3}$$

Question 20.

Without solving the following quadratic equation, find the value of 'm' for which the given equation has real and equal roots.

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

Solution:

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Consider the given equation:

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

The nature of the roots of a quadratic equation

$ax^2 + bx + c = 0$, depends entirely on the

value of its discriminant $b^2 - 4ac$.

If a , b and c are real numbers and $a \neq 0$,

then discriminant:

(i) $b^2 - 4ac = 0 \Rightarrow$ the roots are real and equal.

(ii) $b^2 - 4ac > 0 \Rightarrow$ the roots are real and unequal.

(i) $b^2 - 4ac < 0 \Rightarrow$ the roots are imaginary (not real).

Since the roots of the given equation are real and equal,
we have,

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

$$\Rightarrow \{2(m - 1)\}^2 - 4 \times 1 \times (m + 5) = 0$$

$$\Rightarrow 4\{m^2 + 1 - 2m\} - 4(m + 5) = 0$$

$$\Rightarrow 4m^2 + 4 - 8m - 4m - 20 = 0$$

$$\Rightarrow 4m^2 - 12m - 16 = 0$$

$$\Rightarrow m^2 - 3m - 4 = 0$$

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

$$\Rightarrow m(m - 4) + 1(m - 4) = 0$$

$$\Rightarrow (m + 1)(m - 4) = 0$$

$$\Rightarrow m + 1 = 0 \text{ or } m - 4 = 0$$

$$\Rightarrow m = -1 \text{ or } m = 4$$

Exercise 5F

Solution 1(i)

$$\text{Given: } (x + 5)(x - 5) = 24$$

$$\Rightarrow x^2 - 5^2 = 24 \quad \dots \text{ since } (a - b)(a + b) = a^2 - b^2$$

$$\Rightarrow x^2 - 25 = 24$$

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$$\Rightarrow x^2 = 49$$

$$\Rightarrow x = \pm 7$$

Solution 1(ii)

$$\text{Given: } 3x^2 - 26\sqrt{x} + 2 = 0$$

$$\Rightarrow 3x^2 - \sqrt{6}x - \sqrt{6}x + 2 = 0$$

$$\Rightarrow \sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$$

$$\Rightarrow (\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$$

$$\Rightarrow (\sqrt{3}x - \sqrt{2}) = 0 \text{ or } (\sqrt{3}x - \sqrt{2}) = 0$$

$$\Rightarrow x = \sqrt{\frac{2}{3}}, \sqrt{\frac{2}{3}}$$

Solution 1(iii)

$$\text{Given: } 32\sqrt{x^2} - 5x - 26\sqrt{x} = 0$$

$$\Rightarrow 3\sqrt{2}x^2 - 6x + x - \sqrt{2} = 0$$

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

$$\Rightarrow (3\sqrt{2}x + 1)(x - \sqrt{2}) = 0$$

$$\Rightarrow x = -\frac{1}{3\sqrt{2}} \text{ or } x = \sqrt{2}$$

Question 2.

One root of the quadratic equation $8x^2 + mx + 15$ is $\frac{3}{4}$. Find the value of m . Also, find the other root of the equation.

Solution:

$$\text{Given quadratic equation is } 8x^2 + mx + 15 = 0 \dots (i)$$

One of the roots of (i) is $\frac{3}{4}$, so it satisfies (i)

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$$\Rightarrow 8\left(\frac{3}{4}\right)^2 + m\left(\frac{3}{4}\right) + 15 = 0$$

$$\Rightarrow \frac{9}{2} + 15 + m\left(\frac{3}{4}\right) = 0$$

$$\Rightarrow m\left(\frac{3}{4}\right) = -\frac{39}{2}$$

$$\Rightarrow m = -26$$

So, the equation (i) becomes $8x^2 - 26x + 15 = 0$

$$\Rightarrow 8x^2 - 20x - 6x + 15 = 0$$

$$\Rightarrow 4x(2x - 5) - 3(2x - 5) = 0$$

$$\Rightarrow (4x - 3)(2x - 5) = 0$$

$$\Rightarrow x = 3/4 \text{ or } x = 5/2$$

$$\Rightarrow x = 3/4, 5/2$$

Hence, the other root is $5/2$

Question 3.

One root of the quadratic equation $x^2 - 3x - 2ax - 6a = 0$ is -3 , find its other root.

Solution:

Given quadratic equation is (i)

One of the roots of (i) is -3 , so it satisfies (i)

$$\Rightarrow x^2 - 3x - 2ax - 6a = 0$$

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

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

$$\Rightarrow x = -3, 2a$$

Hence, the other root is $2a$.

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Question 4.

If $p - 15 = 0$ and $2x^2 + 15x + 15 = 0$; find the values of x .

Solution:

Given i.e $p - 15 = 0$ i.e. $p = 15$

So, the given quadratic equation becomes

$$2x^2 + 15x + 15 = 0$$

$$\Rightarrow 2x^2 + 10x + 5x + 15 = 0$$

$$\Rightarrow 2x(x + 5) + 5(x + 5)$$

$$\Rightarrow (2x + 5)(x + 5) = 0$$

$$\Rightarrow x = -5, -52$$

Hence, the values of x are -5 and -52

Question 5.

Find the solution of the equation $2x^2 - mx - 25n = 0$; if $m + 5 = 0$ and $n - 1 = 0$.

Solution:

Given quadratic equation is $2x^2 - mx - 25n = 0$ (i)

Also, given and $m + 5 = 0$ and $n - 1 = 0$

$$\Rightarrow m = -5 \text{ and } n = 1$$

So, the equation (i) becomes

$$2x^2 + 5x + 25 = 0$$

$$\Rightarrow 2x^2 + 10x - 5x - 25 = 0$$

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

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

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$$\Rightarrow x = -5, 52$$

Hence, the solution of given quadratic equation are x and 52

Question 6.

If m and n are roots of the equation $1x-1x-2=3$ where $x \neq 0$ and $x \neq 2$; find $m \times n$.

Solution:

Given quadratic equation is $1x-1x-2=3$

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

$$\Rightarrow -2 = 3x^2 - 6x$$

$$\Rightarrow 3x^2 - 6x + 2 = 0$$

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

$$\Rightarrow x = \frac{6 \pm \sqrt{12}}{2 \times 3}$$

$$\Rightarrow x = \frac{\sqrt{3} \pm 1}{\sqrt{3}}$$

Since, m and n are roots of the equation, we have

$$\Rightarrow m = \frac{\sqrt{3} + 1}{\sqrt{3}} \quad \text{and} \quad n = \frac{\sqrt{3} - 1}{\sqrt{3}}$$

$$\Rightarrow m \times n = \left(\frac{\sqrt{3} + 1}{\sqrt{3}} \right) \left(\frac{\sqrt{3} - 1}{\sqrt{3}} \right) = \frac{2}{3}$$

$$m \times n = \frac{2}{3}$$

Question 7.

Solve, using formula :

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

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Solution:

Given quadratic equation is $x^2 + x - (a + 2)(a + 1) = 0$

Using quadratic formula,

$$\begin{aligned}\Rightarrow x &= \frac{-1 \pm \sqrt{1^2 + 4(a+2)(a+1)}}{2} \\ \Rightarrow x &= \frac{-1 \pm \sqrt{1 + 4(a^2 + 3a + 2)}}{2} \\ \Rightarrow x &= \frac{-1 \pm \sqrt{4a^2 + 12a + 9}}{2} \\ \Rightarrow x &= \frac{-1 \pm \sqrt{(2a+3)^2}}{2} \\ \Rightarrow x &= \frac{-1 \pm (2a+3)}{2} \\ \Rightarrow x &= \frac{-1 + (2a+3)}{2} \text{ or } x = \frac{-1 - (2a+3)}{2} \\ \Rightarrow x &= \frac{2a+2}{2} \text{ or } x = \frac{-2a-4}{2} \\ \Rightarrow x &= \frac{2(a+1)}{2} \text{ or } x = \frac{2(-a-2)}{2} \\ \Rightarrow x &= a+1 \text{ or } x = -a-2 = -(a+2)\end{aligned}$$

Question 8.

Solve the quadratic equation $8x^2 - 14x + 3 = 0$

(i) When $x \in \mathbb{I}$ (integers)

(ii) When $x \in \mathbb{Q}$ (rational numbers)

Solution:

Given quadratic equation is $8x^2 - 14x + 3 = 0$

$$\Rightarrow 8x^2 - 12x - 2x + 3 = 0$$

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$$\Rightarrow 4x(2x - 3) - (2x - 3) = 0$$

$$\Rightarrow (4x - 1)(2x - 3) = 0$$

$$\Rightarrow x = 32 \text{ or } x = 14$$

(i) When $x \in I$, the equation $8x^2 - 14x + 3 = 0$ has no roots

(ii) When $x \in Q$ the roots of $8x^2 - 14x + 3 = 0$ are

$$x = 32 \text{ } x = 14$$

Question 9.

Find the value of m for which the equation $(m + 4)^2 + (m + 1)x + 1 = 0$ has real and equal roots.

Solution:

Given quadratic equation is $(m + 4)^2 + (m + 1)x + 1 = 0$

The quadratic equation has real and equal roots if its discriminant is zero.

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

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

$$\Rightarrow m^2 + 2m + 1 - 4m - 16 = 0$$

$$\Rightarrow m^2 - 2m - 15 = 0$$

$$\Rightarrow m^2 - 5m + 3m - 15 = 0$$

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

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

$$\Rightarrow m = 5 \text{ or } m = -3$$

Question 10.

Find the values of m for which equation $3x^2 + mx + 2 = 0$ has equal roots. Also, find the roots of the given equation.

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Solution:

Given quadratic equation is $3x^2 + mx + 2 = 0$ (i)

The quadratic equation has equal roots if its discriminant is zero

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

$$\Rightarrow m^2 - 4(2)(3) = 0$$

$$\Rightarrow m^2 = 24$$

$$\Rightarrow m = \pm 2\sqrt{6}$$

When $m = 2\sqrt{6}$, equation (i) becomes

$$3x^2 + 2\sqrt{6}x + 2 = 0$$

$$\Rightarrow (\sqrt{3}x + \sqrt{2})^2 = 0$$

$$\Rightarrow x = -\frac{\sqrt{2}}{\sqrt{3}} = -\frac{\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = -\frac{\sqrt{6}}{3}$$

When $m = -2\sqrt{6}$, equation (i) becomes

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

$$\Rightarrow (\sqrt{3}x - \sqrt{2})^2 = 0$$

$$\Rightarrow x = \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{2}}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{6}}{3}$$

$$\therefore x = -\frac{\sqrt{6}}{3}, \frac{\sqrt{6}}{3}$$

Question 11.

Find the value of k for which equation $4x^2 + 8x - k = 0$ has real roots.

Solution:

Given quadratic equation is $4x^2 + 8x - k = 0$ (i)

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The quadratic equation has real roots if its discriminant is greater than or equal to zero

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

$$\Rightarrow 8^2 - 4(4)(-k) \geq 0$$

$$\Rightarrow 64 + 16k \geq 0$$

$$\Rightarrow 16k \geq -64$$

$$\Rightarrow k \geq -4$$

Hence, the given quadratic equation has real roots for $k \geq -4$

Question 12.

Find, using quadratic formula, the roots of the following quadratic equations, if they exist

(i) $3x^2 - 5x + 2 = 0$

(ii) $x^2 + 4x + 5 = 0$

Solution:

(i) Given quadratic equation is $3x^2 - 5x + 2 = 0$

$$D = b^2 - 4ac = (-5)^2 - 4(3)(2) = 25 - 24 = 1$$

Since $D > 0$, the roots of the given quadratic equation are real and distinct.

Using quadratic formula, we have

$$\begin{aligned}x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \\ \Rightarrow x &= \frac{5 \pm \sqrt{(-5)^2 - 4(3)(2)}}{2(3)} \\ \Rightarrow x &= \frac{5 \pm \sqrt{25 - 24}}{6} \\ \Rightarrow x &= \frac{5 \pm 1}{6} \\ \Rightarrow x &= \frac{5+1}{6} \text{ or } x = \frac{5-1}{6} \\ \Rightarrow x &= \frac{6}{6} \text{ or } x = \frac{4}{6}\end{aligned}$$

$$\Rightarrow x = 1 \text{ or } x = \frac{2}{3}$$

(ii) Given quadratic equation is $x^2 + 4x + 5 = 0$

$$D = b^2 - 4ac = (4)^2 - 4(1)(5) = 16 - 20 = -4$$

Since $D < 0$, the roots of the given quadratic equation does not exist.

Solution 13:

(i) Given quadratic equation is $18-x-18+x=124$

$$\begin{aligned}\Rightarrow \frac{(18+x) - (18-x)}{(18+x)(18-x)} &= \frac{1}{24} \\ \Rightarrow \frac{2x}{18^2 - x^2} &= \frac{1}{24}\end{aligned}$$

$$\Rightarrow 48x = 324 - x^2$$

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

$$\Rightarrow x^2 + 54x - 6x - 324 = 0$$

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

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

$$\Rightarrow x = -54 \text{ or } x = 6$$

But as $x > 0$, so x can't be negative.

Hence, $x = 6$.

(ii) Given quadratic equation is $(x-10)(1200x+2)=1260$

$$\Rightarrow (x - 10)(1200 + 2x) = 1260$$

$$\Rightarrow (x - 10)(1200 + 2x) = 1260x$$

$$\Rightarrow 1200x + 2x^2 - 12000 - 20x = 1260x$$

$$\Rightarrow 2x^2 - 12000 - 80x = 0$$

$$\Rightarrow x^2 - 40x - 6000 = 0$$

$$\Rightarrow x^2 - 100x + 60x - 6000 = 0$$

$$\Rightarrow (x - 100)(x - 60) = 0$$

$$\Rightarrow x = 100 \text{ or } x = -60$$

But as $x < 0$, so x can't be positive.

Hence, $x = -60$.



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