# Quadratic Equations

## Practice Set 2.1

**Q. 1. Write any two quadratic equations.**

**Answer :**

$y^2 + y + 8 = 0$ and $m^2 + 9 = 0$

**Q. 2. Decide which of the following are quadratic equations.**

(1) $x^2 + 5x - 2 = 0$
(2) $y^2 = 5y - 10$
(3) $y^2 + \frac{1}{y} = 2$
(4) $x + \frac{1}{x} = -2$
(5) $(m + 2)(m-5) = 0$
(6) $m^3 + 3m^2 - 2 = 3m^3$

**Answer :**

1. $x^2 + 5x - 2 = 0$ is a quadractic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

2. $y^2 = 5y - 10$

$y^2 - 5y + 10 = 0$ ∴ it is a quadratic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

3. $y^2 + \frac{1}{y} = 2$

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$\Rightarrow y^3 + 1 = 2y \Rightarrow y^3 - 2y + 1$

$\therefore$ it is not a quadratic equation because it is not in the form of $ax^2 + bc + c = 0$ and it does not have degree 2.

4. $x + \frac{1}{x} = -2$

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

$\therefore$ it is a quadratic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

5. $(m + 2)(m - 5) = 0$

$\Rightarrow m(m - 5) + 2(m - 5) \Rightarrow m^2 - 5m + 2m - 10 \Rightarrow m^2 - 3m - 10 = 0$

$\therefore$ it is a quadratic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

6. $m^3 + 3m^2 - 2 = 3m^3$

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

$\therefore$ it is not a quadratic equation because it is not in the form of $ax^2 + bc + c = 0$ and it does not have degree 2.

**Q. 3.Write the following equations in the form $ax^2 + bx + c = 0$, then write the values of a, b, c for each equation.**

**(1) $2y = 10 - y^2$**
**(2) $(x-1)^2 = 2x + 3$**

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**(3) $x^2 + 5x = - (3-x)$**
**(4) $3m^2 = 2m^2 - 9$**
**(5) P(3 + 6p) = - 5**
**(6) $x^2 – 9 = 13$**

**Answer :**

(1) $2y = 10 - y^2$

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

$y^2 + 2y - 10 = 0;$

$a = 1, b = 2, c = -10$

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

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

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

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

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

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

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

$a = 1, b = 4, c = 3$

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(4) $3m^2 = 2m^2 - 9 \Rightarrow 3m^2 - 2m^2 + 9 = 0$

$m^2 + 0m + 9 = 0$

a = 1, b = 0, c = 9

(5) $p(3 + 6p) = -5 \Rightarrow 3p + 6p^2 + 5 = 0$

$6p^2 + 3p + 5 = 0$;

a = 6, b = 3, c = 5

(6) $x^2 - 9 = 13 \Rightarrow x^2 - 9 - 13 = 0$

$x^2 + 0x - 22 = 0$

a = 1, b = 0, c = -22

**Q. 4. Determine whether the values given against each of the quadratic equation are the roots of the equation.**

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

**(2)** $2m^2 - 5m = 0, m = 2, \frac{5}{2}$

**Answer:**

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

Put $x = 1$

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$\Rightarrow 1^2 + 4 \times 1 - 5$

$\Rightarrow 1 + 4 - 5 = 0$

Put $x = -1$

$\Rightarrow (-1)^2 + 4(-1) - 5$

$\Rightarrow 1 - 4 - 5 = -8$

$\therefore x = 1$ is a root of the equation and $x = -1$ is not a root of the equation.

2) $2m^2 - 5m = 0$

Put $m = 2, \Rightarrow 2(2)^2 - 5 \times 2 \Rightarrow 2 \times 4 - 10 \Rightarrow 8 - 10 \Rightarrow -2$

Put $m = \frac{5}{2}, \Rightarrow 2\left(\frac{5}{2}\right)^2 - 5 \times \frac{5}{2} \Rightarrow 2 \times \frac{25}{4} - \frac{25}{2} \Rightarrow \frac{25}{2} - \frac{25}{2} = 0$

$\therefore m = 2$ is not root of the equation and $m = \frac{5}{2}$ is a root of the equation.

**Q. 5. Find k if x = 3 is a root of equation $kx^2 - 10x + 3 = 0$.**

**Answer :**

$kx^2 - 10x + 3 = 0$ Put $x = 3$

$\Rightarrow k(3)^2 - 10 \times 3 + 3 = 0$

$\Rightarrow 9k - 30 + 3 = 0$

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$\Rightarrow 9k = 30 - 3$

$\Rightarrow 9k = 27$

$\Rightarrow k = \frac{27}{9} = 3$

**Q. 6. One of the roots of equation $5m^2 + 2m + k = 0$ is $\frac{-7}{5}$. Complete the following activity to find the value of 'k'.**

**Answer :**

is a root of quadratic equation $kx^2 - 10x + 3 = 0$

$\therefore$ Put $m = -\frac{7}{5}$ in the equation.

$\Rightarrow 5 \times \left(-\frac{7}{5}\right)^2 + 2 \times \left(-\frac{7}{5}\right) + k = 0$

$\Rightarrow 5 \times \frac{49}{25} - \frac{14}{5} + k = 0$

$\Rightarrow \frac{35}{5} + k = 0$

$\Rightarrow k = -7$

## Practice Set 2.2

**Q. 1 A. Solve the following quadratic equation by factorization.**

**$x^2 - 15x + 54 = 0$**

**Answer :**

$x^2 - 15x + 54 = 0$

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$\Rightarrow x^2 - 6x - 9x + 54 = 0$

$\Rightarrow x(x-6) - 9(x-6) = 0$

$\Rightarrow (x-6)(x-9) = 0$

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

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

Hence, $x = 6 \text{ and } x = 9$ are roots of the equation.

**Q. 1 B. Solve the following quadratic equation by factorization.**

**$x^2 + x - 20 = 0$**

**Answer :**

$x^2 + x - 20 = 0$

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

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

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

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

$x - 4 = 0 \Rightarrow x = 4$

Hence, $x = -5 \text{ and } x = 4$ are roots of the equation.

**Q. 1 C. Solve the following quadratic equation by factorization.**

**$2y^2 + 27y + 13 = 0$**

**Answer :**

$2y^2 + 27y + 13 = 0$

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$\Rightarrow 2y^2 + 26y + y + 13 = 0$

$\Rightarrow 2y(y + 13) + (y + 13) = 0$

$\Rightarrow (2y + 1)(y + 13) = 0$

$2y + 1 = 0 \Rightarrow 2y = -1 \Rightarrow y = -\frac{1}{2}$

$y + 13 = 0 \Rightarrow y = -13$

Hence, $y = -13$ and $y = -\frac{1}{2}$ are roots of the equation.

**Q. 1 D. Solve the following quadratic equation by factorization.**

**$5m^2 = 22m + 15$**

**Answer :**

$5m^2 - 22m - 15 = 0$

$\Rightarrow 5m^2 - 3m + 25m - 15$

$\Rightarrow m(5m - 3) + 5(5m - 3)$

$\Rightarrow (m + 5)(5m - 3)$

$m + 5 = 0 \Rightarrow m = -5$

$5m - 3 = 0 \Rightarrow 5m = 3 \Rightarrow m = \frac{3}{5}$

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$\therefore$ Hence, $m = -5$ and $m = \frac{3}{5}$ are roots of the equation.

**Q. 1 E. Solve the following quadratic equation by factorization.**

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

**Answer :**

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

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

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

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

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

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

$$Hence\ x = \frac{1}{2}, \frac{1}{2}\ are\ roots\ of\ the\ equation$$

**Q. 1 F. Solve the following quadratic equation by factorization.**

$$6x - \frac{2}{x} = 1$$

**Answer :**

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

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

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

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

$3x-2 = 0 \Rightarrow 3x = 2 \Rightarrow x = \frac{2}{3}$

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

Hence, $x = \frac{2}{3}$ and $x = -\frac{1}{2}$ are roots of the equation.

**Q. 1 G. Solve the following quadratic equation by factorization.**

$\sqrt{2}x^2 + 7x + 5\sqrt{2} = 0$

**to solve this quadratic equation by factorization, complete the following activity.**

**Answer :**

$\sqrt{2x^2} + 7x + 5\sqrt{2} = 0$

$\sqrt{2}x^2 + 5x + 2x + 5\sqrt{2} = 0$

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

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

$(x + \sqrt{2}) = 0 \text{ or } (\sqrt{2}x + 5) = 0$

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

$\therefore -\frac{5}{\sqrt{2}}$ and $-\sqrt{2}$ are roots of the equation.

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**Q. 1 H. Solve the following quadratic equation by factorization.**

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

**Answer :**

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

$\Rightarrow \sqrt{3}x(\sqrt{3}x - \sqrt{2}) - \sqrt{2}(\sqrt{3}x - \sqrt{2}) = 0$

$\Rightarrow (\sqrt{3}x - \sqrt{2})(\sqrt{3}x - \sqrt{2}) = 0$

$\Rightarrow (\sqrt{3}x - \sqrt{2}) = 0 \text{ or } (\sqrt{3}x - \sqrt{2}) = 0$

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

**Q. 1 I. Solve the following quadratic equation by factorization.**

**2m (m-24) = 50**

**Answer :**

$2m(m - 24) = 50$

$2m^2 - 48m - 50 = 0$

$\Rightarrow 2m^2 - 50m + 2m - 50 = 0$

$\Rightarrow 2m(m - 25) + 2(m - 25) = 0$

$\Rightarrow (2m + 2)(m - 25) = 0$

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$\Rightarrow 2m + 2 = 0 \text{ or } m - 25 = 0$

$\Rightarrow m = -1 \text{ or } m = 25$

Hence, $m = -1 \text{ or } m = 25$ are roots of the equation.

**Q. 1 J. Solve the following quadratic equation by factorization.**

**$25m^2 = 9$**

**Answer :**

$25m^2 = 9$

$\Rightarrow m^2 = \frac{9}{25}$

$\Rightarrow m = \sqrt{\frac{9}{25}}$

$\Rightarrow m = \pm\frac{3}{5}$

Hence, $m = \pm\frac{3}{5}$ are roots of the equation.

**Q. 1 K. Solve the following quadratic equation by factorization.**

**$7m^2 = 21m$**

**Answer :**

$7m^2 - 21m = 0$

$\Rightarrow 7m(m - 3) = 0$

$\Rightarrow 7m = 0 \text{ or } m - 3 = 0$

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Hence, $m = 0$ or $m = 3$ are roots of the equation.

**Q. 1 L. Solve the following quadratic equation by factorization.**

**$m^2 - 11 = 0$**

**Answer :**

$m^2 - 11 = 0$

$\Rightarrow m^2 = 11$

$\Rightarrow m = \sqrt{11}$

$\Rightarrow m = \pm 11$

Hence , $m = \pm 11$ are roots of the equation.

## Practice Set 2.3

**Q. 1 A. Solve the following quadratic equation by completing the square method.**

**$x^2 + x - 20 = 0$**

**Answer :**

$x^2 + x - 20 = 0$

$\Rightarrow x^2 + x + \frac{1}{4} - \frac{1}{4} - 20 = 0$

$\Rightarrow (x^2 + x + \frac{1}{4}) + \left(\frac{1}{4} - 20\right) = 0$

$\Rightarrow \left(x + \frac{1}{2}\right)^2 - \frac{1 + 80}{4} = 0$

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$$\Rightarrow \left(x + \frac{1}{2}\right)^2 = \frac{81}{4}$$

$$\Rightarrow x + \frac{1}{2} = \sqrt{\frac{81}{4}}$$

$$\Rightarrow x + \frac{1}{2} = \pm\frac{9}{2}$$

$$\Rightarrow x + \frac{1}{2} = \frac{9}{2} \text{ or } x + \frac{1}{2} = -\frac{9}{2}$$

$$\Rightarrow x = \frac{9}{2} - \frac{1}{2} \text{ or } x = -\frac{9}{2} - \frac{1}{2}$$

$$\Rightarrow x = \frac{8}{2} \text{ or } x = -\frac{10}{2}$$

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

**Q. 1 B. Solve the following quadratic equation by completing the square method.**

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

**Answer :**

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

$$\Rightarrow x^2 + 2x + 1 - 1 - 5 = 0$$

$$\Rightarrow (x^2 + 2x + 1) - (1 + 5) = 0$$

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

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$\Rightarrow (x + 1)^2 = 6$

$\Rightarrow x + 1 = \sqrt{6}$

$\Rightarrow x + 1 = \pm\sqrt{6}$

$\Rightarrow x + 1 = \sqrt{6}\ or\ x + 1 = -\sqrt{6}$

$\Rightarrow x = \sqrt{6} - 1\ or\ x = -\sqrt{6} - 1$

**Q. 1 C. Solve the following quadratic equation by completing the square method.**

**$m^2$ – 5m = -3**

**Answer :**

$m^2 - 5m + 3 = 0$

$\Rightarrow m^2 - 5m + \frac{25}{4} - \frac{25}{4} + 3 = 0$ (Adding and Subtracting $\frac{25}{4}$ )

$\Rightarrow \left(m^2 - 5m + \frac{25}{4}\right) = \frac{25}{4} - 3$

$\Rightarrow \left(m - \frac{5}{2}\right)^2 = \frac{25-12}{4}$

$\Rightarrow \left(m - \frac{5}{2}\right)^2 = \frac{13}{4}$

$\Rightarrow m - \frac{5}{2} = \sqrt{\frac{13}{4}}$

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$$\Rightarrow m - \frac{5}{2} = \pm\frac{\sqrt{13}}{2}$$

$$\Rightarrow m - \frac{5}{2} = \frac{\sqrt{13}}{2} \text{ or } m - \frac{5}{2} = -\frac{\sqrt{13}}{2}$$

$$\Rightarrow m = \frac{\sqrt{13}}{2} + \frac{5}{2} \text{ or } m = -\frac{\sqrt{13}}{2} - \frac{5}{2}$$

$$\Rightarrow m = \frac{\sqrt{13}+5}{2} \text{ or } m = \frac{-\sqrt{13}-5}{2}$$

**Q. 1 D. Solve the following quadratic equation by completing the square method.**

**$9y^2 – 12y + 2 = 0$**

**Answer :**

$$9y^2 - 12y + 2 = 0$$

$(3y)^2 - 2 \times 3y \times 4 + (4)^2 - (4)^2 + 2 = 0$

$(3y)^2 - 2 \times 3y \times 4 + (4)^2 - 16 + 2 = 0$

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

$(3y - 4)^2 = 14$

$3y - 14 = \sqrt{143}y = 14 + \sqrt{14}y = (14 + \sqrt{14})/3$

**Q. 1 E. Solve the following quadratic equation by completing the square method.**

**$2y^2 + 9y + 10 = 0$**

**Answer :**

$$2y^2 + 9y + 10 = 0$$

Steps involved in solving quadratic equation by completing the square method are –

**1. Making the first variable free of coefficient**
Dividing by the coefficient of 2, we get,

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$$\Rightarrow y^2 + \frac{9}{2}y + 5 = 0$$

**2. The coefficient of linear variable(variable with degree 1) is then squared and then added and subtracted from the equation.**

$$\Rightarrow y^2 + \frac{9}{2}y + \frac{81}{16} - \frac{81}{16} + 5 = 0$$

**3. Take out the terms following the formula $(a + b)^2 = a^2 + b^2 + 2ab$**

$$\Rightarrow (y^2 + \frac{9}{2}y + \frac{81}{16}) - \left(\frac{81}{16} - 5\right) = 0$$

$$\Rightarrow \left(y + \frac{9}{4}\right)^2 = \frac{81}{16} - 5$$

$$\Rightarrow \left(y + \frac{9}{2}\right)^2 = \frac{81-80}{16}$$

$$\Rightarrow \left(y + \frac{9}{2}\right)^2 = \frac{1}{16}$$

$$\Rightarrow y + \frac{9}{2} = \sqrt{\frac{1}{16}}$$

$$\Rightarrow y + \frac{9}{2} = \pm\frac{1}{4}$$

$$\Rightarrow y + \frac{9}{2} = \frac{1}{4} \text{ or } y + \frac{9}{2} = -\frac{1}{4}$$

$$\Rightarrow y = \frac{1}{4} - \frac{9}{2} \text{ or } y = -\frac{1}{4} - \frac{9}{2}$$

$$\Rightarrow y = \frac{1 - 18}{4} \text{ or } y = \frac{-1 - 18}{4}$$

$$\Rightarrow y = -\frac{17}{4} \text{ or } y = -\frac{19}{4}$$

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**Q. 1 F. Solve the following quadratic equation by completing the square method.**

**$5x^2 = 4x + 7 = 0$**

**Answer :**

$$5x^2 - 4x - 7 = 0$$

$$\Rightarrow x^2 - \frac{4}{5}x - \frac{7}{5} = 0$$

$$\Rightarrow x^2 - \frac{4}{5}x + \frac{4}{25} = \frac{7}{5} + \frac{4}{25} \quad \text{(Adding and Subtracting } \frac{4}{25} \text{ )}$$

$$\Rightarrow \left(x + \frac{2}{5}\right)^2 = \frac{35+4}{25}$$

$$\Rightarrow \left(x + \frac{2}{5}\right)^2 = \frac{39}{25}$$

$$\Rightarrow x + \frac{2}{5} = \sqrt{\frac{39}{25}}$$

$$\Rightarrow x + \frac{2}{5} = \pm\frac{\sqrt{39}}{5}$$

$$x = \frac{\sqrt{39}}{5} - \frac{2}{5} \text{ or } x = -\frac{\sqrt{39}}{5} - \frac{2}{5}$$

$$x = \frac{\sqrt{39} - 2}{5} \text{ or } x = \frac{-\sqrt{39} - 2}{5}$$

## Practice Set 2.4

**Q. 1. Compare the given quadratic equations to the general form and write values of a, b, c.**

**(1) $x^2 - 7x + 5 = 0$**

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**(2) $2m^2 = 5m - 5$**
**(3) $y^2 = 7y$**

**Answer :**

**(1)**

$$x^2 - 7x + 5 = 0 \text{ and } ax^2 + bx + c = 0$$

a = 1, b = -7, c = 5

**(2)**

$$2m^2 - 5m + 5 = 0 \text{ and } ax^2 + bx + c$$

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

**(3)**

$$y^2 - 7y + 0 = 0 \text{ and } ax^2 + bx + c = 0$$

a = 1, b = -7, c = 0

**Q. 2 A. Solve using formula.**

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

**Answer :**

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

$$\Rightarrow x^2 + 6x + 5 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 1, b = 6 \text{ and } c = 5$$

$$\therefore b^2 - 4ac = 6^2 - 4(1)(5)$$

$$= 36 - 20$$

$$= 16$$

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

$$x = \frac{-6 \pm \sqrt{16}}{2 \times 1} = \frac{-6 \pm 4}{2}$$

$$\Rightarrow x = \frac{-6+4}{2} \text{ or } x = \frac{-6-4}{2}$$

$$\Rightarrow x = -\frac{2}{2} \text{ or } x = -\frac{10}{2}$$

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

**Q. 2 B. Solve using formula.**

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

**Answer :**

$$\Rightarrow x^2 + 3x - 2 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 1, b = 3 \text{ and } c = -2$$

$$\therefore b^2 - 4ac = 3^2 - 4(1)(-2)$$

$$= 9 + 8$$

$$= 17$$

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

$$\Rightarrow x = \frac{-3 \pm \sqrt{17}}{2 \times 1}$$

$$\Rightarrow x = \frac{-3 \pm \sqrt{17}}{2}$$

$$\Rightarrow x = \frac{-3 + \sqrt{17}}{2} \text{ or } x = \frac{-3 - \sqrt{17}}{2}$$

**Q. 2 C. Solve using formula.**

**$3m^2 + 2m - 7 = 0$**

**Answer :**

$$\Rightarrow 3m^2 + 2m - 7 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 3, b = 2 \text{ and } c = -7$$

$$\therefore b^2 - 4ac = 2^2 - 4(3)(-7)$$

$$= 4 + 84$$

$$= 88$$

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

$$\Rightarrow m = \frac{-2 \pm \sqrt{88}}{2 \times 3}$$

$$\Rightarrow m = \frac{-2 \pm \sqrt{88}}{6}$$

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$$\Rightarrow m = \frac{-2+2\sqrt{22}}{6} \text{ or } m = \frac{-2-2\sqrt{22}}{6}$$

$$\Rightarrow m = \frac{-1+\sqrt{22}}{3} \text{ or } m = \frac{-1-\sqrt{22}}{3}$$

**Q. 2 D. Solve using formula.**

**$5m^2 - 4m - 2 = 0$**

**Answer :**

$$\Rightarrow 5m^2 - 4m - 2 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 5, b = -4 \text{ and } c = -2$$

$$\therefore b^2 - 4ac = (-4)^2 - 4(5)(-2)$$

$$= 16 + 40$$

$$= 56$$

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

$$\Rightarrow m = \frac{-(-4) \pm \sqrt{56}}{2 \times 5}$$

$$\Rightarrow m = \frac{4 \pm 2\sqrt{14}}{10}$$

$$\Rightarrow m = \frac{4+2\sqrt{14}}{10} \text{ or } m = \frac{4-2\sqrt{14}}{10}$$

$$\Rightarrow m = \frac{2+\sqrt{14}}{5} \text{ or } m = \frac{2-\sqrt{14}}{5}$$

**Q. 2 E. Solve using formula.**

$$y^2 + \frac{1}{3}y = 2$$

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**Answer :**

$3y^2 + y - 6 = 0$

$\Rightarrow 3y^2 + y - 6 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 3, b = 1$ and $c = -6$

$\therefore b^2 - 4ac = 1^2 - 4(3)(-6)$

$= 1 + 72$

$= 73$

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

$\Rightarrow y = \frac{-1 \pm \sqrt{73}}{2 \times 3}$

$\Rightarrow y = \frac{-1 \pm \sqrt{73}}{6}$

$\Rightarrow y = \frac{-1 + \sqrt{73}}{6}$ or $y = \frac{-1 - \sqrt{73}}{6}$

**Q. 2 F. Solve using formula.**

**$5x^2 + 13x + 8 = 0$**

**Answer :**

$\Rightarrow 5x^2 + 13x + 8 = 0$ compare with $ax^2 + bx + c = 0$

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$\Rightarrow a = 5, b = 13 \text{ and } c = 8$

$\therefore b^2 - 4ac = 13^2 - 4(5)(8)$

$= 169 - 160$

$= 9$

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

$$\Rightarrow x = \frac{-13 \pm \sqrt{9}}{2 \times 5}$$

$$\Rightarrow x = \frac{-13 \pm 3}{10}$$

$$\Rightarrow x = \frac{-13 + 3}{10} \text{ or } x = \frac{-13 - 3}{10}$$

$$\Rightarrow x = \frac{-10}{10} \text{ or } x = \frac{-16}{10}$$

$$\Rightarrow x = -1 \text{ or } x = -\frac{8}{5}$$

**Q. 3. With the help of the flow chart given below solve the equation $x^2 + 2\sqrt{3}x + 3 = 0$ using the formula.**

**Answer :**

$\Rightarrow x^2 + 2\sqrt{3}x + 3 = 0$ compare with $ax^2 + bx + c = 0$

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

$\therefore b^2 - 4ac = (2\sqrt{3})^2 - 4(1)(3)$

$= 12 - 12$

$= 0$

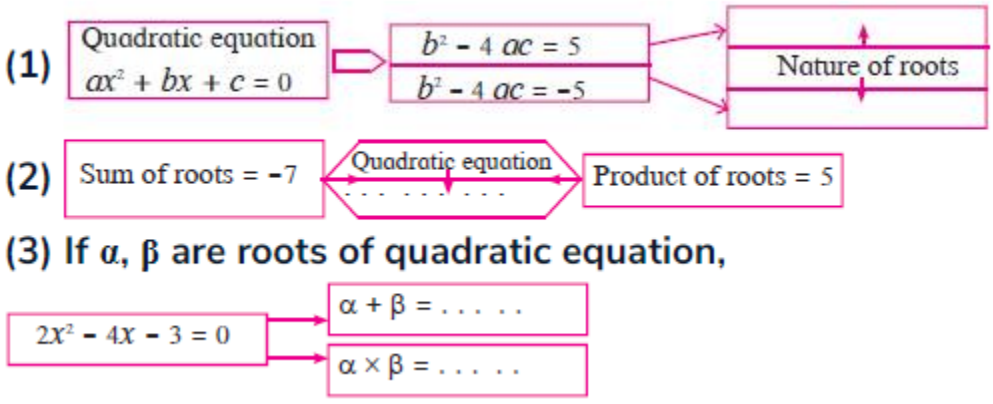
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\Rightarrow x = \frac{-2\sqrt{3} \pm \sqrt{0}}{2 \times 1}$$

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

## Practice Set 2.5

**Q. 1. Activity: Fill in the gaps and complete.**




**Answer :**

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**(1)** Roots are distinct and real when $b^2 - 4ac = 5$, not real when $b^2 - 4ac = -5$.

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

**(3)**

$$\alpha + \beta = 2, \alpha \times \beta = -\frac{3}{2}$$

**Q. 2 A. Find the value of discriminant.**

**$x^2 + 7x - 1 = 0$**

**Answer :**

$$\Rightarrow x^2 + 7x - 1 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 1, b = 7 \text{ and } c = -1$$

$$\therefore b^2 - 4ac = 7^2 - 4(1)(-1)$$

$$= 49 + 4$$

$$= 53$$

**Q. 2 B. Find the value of discriminant.**

**$2y^2 - 5y + 10 = 0$**

**Answer :**

$$\Rightarrow 2y^2 - 5y + 10 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 2, b = -5 \text{ and } c = 10$$

$$\therefore b^2 - 4ac = -5^2 - 4(2)(10)$$

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$= 25 - 80$

$= -55$

**Q. 2 C. Find the value of discriminant.**

$\sqrt{2}\,x^2 + 4x + 2\sqrt{2} = 0$

**Answer :**

$\Rightarrow \sqrt{2}x^2 + 4x + 2\sqrt{2} = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = \sqrt{2}, b = 4$ and $c = 2\sqrt{2}$

$\therefore b^2 - 4ac = 4^2 - 4(\sqrt{2})(2\sqrt{2})$

$= 16 - 16$

$= 0$

**Q. 3 A. Determine the nature of roots of the following quadratic equation.**

**$x^2 – 4x + 4 = 0$**

**Answer :**

$\Rightarrow x^2 - 4x + 4 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = -4$ and $c = 4$

$\therefore b^2 - 4ac = -4^2 - 4(1)(4)$

$= 16 - 16$

$= 0$

$\therefore b^2 - 4ac = 0$. hence, roots are real and equal

**Q. 3 B. Determine the nature of roots of the following quadratic equation.**

**$2y^2 – 7y + 2 = 0$**

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**Answer :**

$\Rightarrow 2y^2 - 7y + 2 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 2, b = -7$ and $c = 2$

$\therefore b^2 - 4ac = -7^2 - 4(2)(2)$

$= 49 - 16$

$= 23$

$\therefore b^2 - 4ac > 0$. Hence, roots are real and unequal

**Q. 3 C. Determine the nature of roots of the following quadratic equation.**

**$m^2 + 2m + 9 = 0$**

**Answer :**

$\Rightarrow m^2 + 2m + 9 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = 2$ and $c = 9$

$\therefore b^2 - 4ac = 2^2 - 4(1)(9)$

$= 4 - 36$

$= -32$

$\therefore b^2 - 4ac < 0$ . hence, roots are not real.

**Q. 4. Form the quadratic equation from the roots given below.**

**(1) 0 and 4**
**(2) 3 and -10**
**(3)** $\frac{1}{2}, -\frac{1}{2}$
**(4)** $2-\sqrt{5}, 2+\sqrt{5}$

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(1) Let $\alpha = 0$ and $\beta = 4$

$\therefore \alpha + \beta = 0 + 4 = 4$ and $\alpha\beta = 0 \times 4 = 0$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$\therefore x^2 - (4)x + (0) = 0$

$\therefore x^2 - 4x = 0$

(2) Let $\alpha = 3$ and $\beta = -10$

$\therefore \alpha + \beta = 3 - 10 = -7$ and $\alpha\beta = 3 \times -10 = -30$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$\therefore x^2 - (-7)x + (-30) = 0$

$\therefore x^2 + 7x - 30 = 0$

(3) Let $\alpha = \frac{1}{2}$ and $\beta = -\frac{1}{2}$

$\therefore \alpha + \beta = \frac{1}{2} - \frac{1}{2} = 0$ and $\alpha\beta = \frac{1}{2} \times -\frac{1}{2} = -\frac{1}{4}$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

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$\therefore x^2 - (0)x + \left(-\frac{1}{4}\right) = 0$

$\therefore x^2 - \frac{1}{4} = 0$

$\therefore 4x^2 - 1 = 0$

(4) Let $\alpha = 2 - \sqrt{5}$ and $\beta = 2 + \sqrt{5}$

$\therefore \alpha + \beta = 2 - \sqrt{5} + 2 + \sqrt{5} = 4$ and $\alpha\beta = (2 - \sqrt{5})(2 + \sqrt{5}) = 4 - 5 = 1$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

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

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

**Q. 5. Sum of the roots of a quadratic equation is double their product. Find k if equation is**

**$x^2$ – 4kx + k + 3 = 0**

**Answer :** According to question

$\alpha + \beta = 2\alpha\beta$

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

$\Rightarrow 4k = 2k + 6$

$\Rightarrow 4k - 2k = 6$

$\Rightarrow 2k = 6$

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$\Rightarrow k = 3$

**Q. 6. α, β are roots of $y^2 - 2y - 7 = 0$ find,**

**(1) $\alpha^2 + \beta^2$**
**(2) $\alpha^3 + \beta^3$**

**Answer :**

$y^2 - 2y - 7 = 0$

$\alpha + \beta = 2 \text{ and } \alpha\beta = -7$

$(1).\ (\alpha + \beta)^2 = \alpha^2 + \beta^2 + 2\alpha\beta$

$\Rightarrow (2)^2 = \alpha^2 + \beta^2 + 2(-7)$

$\Rightarrow 4 + 14 = \alpha^2 + \beta^2$

$\Rightarrow \alpha^2 + \beta^2 = 18$

$(2).\ (\alpha + \beta)^3 = \alpha^3 + \beta^3 + 3\alpha\beta(\alpha + \beta)$

$\Rightarrow (2)^3 = \alpha^3 + \beta^3 + 3(-7)(2)$

$\Rightarrow 8 + 42 = \alpha^3 + \beta^3$

$\Rightarrow \alpha^3 + \beta^3 = 50$

**Q. 7 A. The roots of each of the following quadratic equation are real and equal, find k.**

**$3y^2 + ky + 12 = 0$**

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**Answer :**

$\Rightarrow 3y^2 - ky + 12 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 3, b = -k$ and $c = 12$

$\therefore b^2 - 4ac = -k^2 - 4(3)(12)$

$= k^2 - 144$

If roots are equal and real then, $\therefore b^2 - 4ac = 0$

$k^2 - 144 = 0$

$\Rightarrow k^2 = 144$

$\Rightarrow k = \pm 12$

$\therefore k = 12$ and $k = -12$

**Q. 7 B. The roots of each of the following quadratic equation are real and equal, find k.**

**kx (x-2) + 6 = 0**

**Answer :**

$kx(x-2) + 6 = 0 \Rightarrow kx^2 - 2kx + 6 = 0$

$\Rightarrow kx^2 - 2kx + 6 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = k, b = -2k$ and $c = 6$

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$\therefore b^2 - 4ac = (-2k)^2 - 4(k)(6)$

$= 4k^2 - 24k$

If roots are equal and real then, $\therefore b^2 - 4ac = 0$

$4k^2 - 24k = 0$

$\Rightarrow 4k(k - 6) = 0$

$\Rightarrow 4k = 0 \text{ and } k - 6 = 0$

$\therefore k = 0 \text{ and } k = 6$

## Practice Set 2.6

**Q. 1. Product of Pragati's age 2 years ago and 3 years hence is 84. Find her present age.**

**Answer :**

Let her present age be x

According to question,

$(x - 2)(x + 3) = 84$

$\Rightarrow x^2 + x - 6 = 84$

$\Rightarrow x^2 + x - 90 = 0$

$\Rightarrow x^2 + 10x - 9x - 90 = 0$

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$\Rightarrow x(x + 10) - 9(x + 10) = 0$

$\Rightarrow (x - 9)(x + 10) = 0$

$\Rightarrow x - 9 = 0 \text{ or } x + 10 = 0$

$\Rightarrow x = 9 \text{ or } x = -10$

As age cannot be in negative, ∴ Pragati′sage is 9 years.

**Q. 2. The sum of squares of two consecutive natural numbers is 244; find the numbers.**

**Answer :** Let the two consecutive natural numbers be x and x + 2. Then,

$x^2 + (x + 2)^2 = 244$

$\Rightarrow x^2 + x^2 + 4x + 4 = 244$

$\Rightarrow 2x^2 + 4x - 240 = 0$

$\Rightarrow x^2 + 2x - 120 = 0$

$\Rightarrow x^2 + 12x - 10x - 120 = 0$

$\Rightarrow x(x + 12) - 10(x + 12) = 0$

$\Rightarrow (x + 12)(x - 10) = 0$

$x + 12 = 0 \text{ or } x - 10 = 0$

$x = -12 \text{ or } x = 10$

No.s cannot be negative, ∴ numbers are 10 and 12

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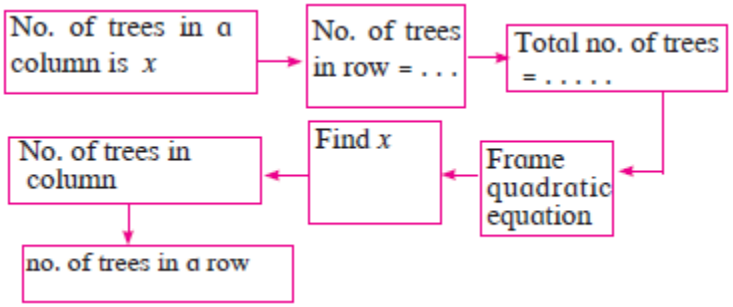
**Q. 3. In the orange garden of Mr. Madhusudan there are 150 orange trees. The number of trees in each row is 5 more than that in each column. Find the number of trees in each row and each column with the help of following flow chart.**




**Answer :** Let the number of columns be x

∴ rows = x + 5

$$x(x + 5) = 150$$

$$\Rightarrow x^2 + 5x - 150 = 0$$

$$\Rightarrow x^2 + 15x - 10x - 150 = 0$$

$$\Rightarrow x(x + 15) - 10(x + 15) = 0$$

$$\Rightarrow (x + 15)(x - 10) = 0$$

$$x + 15 = 0 \text{ or } x - 10 = 0$$

$$x = -15 \text{ or } x = 10$$

Hence, columns cannot be negative. ∴ columns are 10

and rows are 15.

**Q. 4. Vivek is older than Kishor by 5 years. The sum of the reciprocals of their ages is 1/6. Find their present ages.**

**Answer :**

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Let Kishor's present age be x. Then, vivek's age = x + 5

$$\therefore \frac{1}{x} + \frac{1}{x+5} = \frac{1}{6}$$

$$\Rightarrow \frac{x+5+x}{x(x+5)} = \frac{1}{6} \Rightarrow 6(5 + 2x) = x^2 + 5x$$

$$\Rightarrow 30 + 12x = x^2 + 5x$$

$$\Rightarrow x^2 + 5x - 12x - 30 = 0$$

$$\Rightarrow x^2 - 7x - 30 = 0$$

$$\Rightarrow x^2 - 10x + 3x - 30 = 0$$

$$\Rightarrow x(x - 10) + 3(x - 10) = 0$$

$$\Rightarrow (x - 10)(x + 3) = 0$$

$$x - 10 = 0 \text{ or } x + 3 = 0$$

$$x = 10 \text{ or } x = -3$$

Hence, age cannot be negative. ∴ age od Kishor is 10

and age of Vivek is 15.

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**Q. 5. Suyash scored 10 marks more in second test than that in the first. 5 times the score of the second test is the same as square of the score in the first test. Find his score in the first test.**

**Answer :** Let the score of first test be x. Then, second test score = x + 10.

$\therefore 5(x + 10) = x^2$

$\Rightarrow 5x + 50 = x^2$

$\Rightarrow x^2 - 5x - 50 = 0$

$\Rightarrow x^2 - 10x + 5x - 50 = 0$

$\Rightarrow x(x - 10) + 5(x - 10) = 0$

$\Rightarrow (x - 10)(x + 5) = 0$

$x - 10 = 0 \text{ or } x + 5 = 0$

$x = 10 \text{ or } x = -5$

Hence, score of first test is 10 as marks are not negative.

**Q. 6. Mr. Kasam runs a small business of making earthen pots. He makes certain number of pots on daily basis. Production cost of each pot is ₹40 more than 10 times total number of pots, he makes in one day. If production cost of all pots per day is ` 600, find production cost of one pot and number of pots he makes per day.**

**Answer :** Let the number of pots made by Mr. Kasam each day be x. Then, production cost of each pot =

$₹40 + 10(x)$

$\therefore \text{total cost} = (40 + 10x)x = 40x + 10x^2$

$10x^2 + 40x = 600$

$\Rightarrow 10x^2 + 40x - 600 = 0$

$\Rightarrow x^2 + 4x - 60 = 0$

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$\Rightarrow x^2 - 6x + 10x - 60 = 0$

$\Rightarrow x(x-6) + 10(x-6) = 0$

$\Rightarrow (x-6)(x+10) = 0$

$x - 6 = 0 \text{ or } x + 10 = 0$

$x = 6 \text{ or } x = -10$

Hence number of pots made cannot be negative. ∴ number of pots he made each day = 6

Cost of one pot = $40 + 10(6) = 40 + 60 = ₹100$

**Q. 7. Pratik takes 8 hours to travel 36 km downstream and return to the same spot. The speed of boat in still water is 12 km. per hour. Find the speed of water current.**

**Answer :**

Let the speed of water current be x.

$\therefore T_1 = \frac{D_1}{S_1} = \frac{36}{12+x} \text{hr}$

$T_2 = \frac{D_2}{S_2} = \frac{36}{12-x} \text{hr}$

$8\text{hr} = \frac{36}{12+x} + \frac{36}{12-x}$

$8 = \frac{[36(12-x) + 36(12+x)]}{144 - x^2}$

$8 = \frac{36(12-x+12+x)}{144-x^2}$

$144 - x^2 = \frac{36 \times 24}{8}$

$144 - x^2 = 108$

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$144 - 108 = x^2$

$\Rightarrow 36 = x^2$

$\Rightarrow x = \pm 6$

Speed od water current is 6km/hr

**Q. 8. Pintu takes 6 days more than those of Nishu to complete certain work. If they work together they finish it in 4 days. How many days would it take to complete the work if they work alone.**

**Answer :**

Suppose Nishu alone takes x days to finish work. Then , Pintu alone can finish in (x + 6)days.

$\Rightarrow$ Nishu's one day work + Pintu's one day work $= \frac{1}{x} + \frac{1}{x+6}$

(Nishu + Pintu)'s one day work $= \frac{1}{4}$

$\therefore \frac{1}{x} + \frac{1}{x+6} = \frac{1}{4}$

$\therefore \frac{1}{x} + \frac{1}{x+6} = \frac{1}{4}$

$$\Rightarrow \frac{x+6+x}{x(x+6)} = 4$$

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

$\Rightarrow 4x + 24 + 4x = x^2 + 6x$

$\Rightarrow x^2 + 6x - 8x - 24 = 0$

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

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

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

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

$x-6 = 0 \text{ or } x+4 = 0$

$x = 6 \text{ or } x = -4$

x = -4 is not possible, as no of days can't be negative.

Nishu will take 6 days alone and Pintu takes 12 days alone.

**Q. 9. If 460 is divided by a natural number, quotient is 6 more than five times the divisor and remainder is 1. Find quotient and diviser.**

**Answer :** Let the divisor be x. Then, Quotient be 6 + 5x

Now according to question,

$\text{dividend} = \text{divisor} \times \text{quotient} + \text{remainder.}$

$\Rightarrow 460 = x \times (6 + 5x) + 1$

$\Rightarrow 459 = 5x^2 + 6x$

$\Rightarrow 5x^2 + 6x - 459 = 0$

$\Rightarrow 5x^2 - 45x + 51x - 459 = 0$

$\Rightarrow 5x(x-9) + 51(x-9) = 0$

$\Rightarrow (5x-51)(x-9) = 0$

$5x-51 = 0 \text{ or } x-9 = 0$

$x = \frac{51}{5} \text{ or } x = 9$

$\therefore \text{divisor} = 9 \text{ and quotient} = 6 + 5 \times 9 = 6 + 45 = 51$

∴Divisor = 9, quotient = 51

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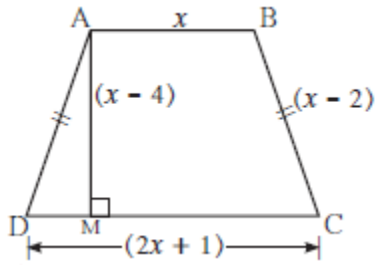
**Q. 10. In the adjoining fig. □ABCD is a trapezium AB||CD and its area is 33 cm$^2$. From the information given in the figure find the lengths of all sides of the □ABCD. Fill in the empty boxes to get the solution.**




**Answer :**

**□ ABCD is a trapezium.**

**AB||CD**

$$A(\square ABCD) = \frac{1}{2}(AB + CD) \times AM$$

$$33 = \frac{1}{2}(x + 2x + 1) \times (x - 4)$$

$$\therefore 3x(x - 7) + 10(x - 7) = 0$$

$$\therefore (3x + 10)(x - 7) = 0$$

$$\therefore 3x + 10 = 0 \text{ or } x - 7 = 0$$

$$\therefore x = -\frac{10}{3} \text{ or } x = 7$$

But length is never negative.

$$\therefore x \neq \frac{10}{3}$$

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$\therefore x = 7$

AB = 7 cm, CD = 15 cm, AD = BC = 5 cm.

## Problem Set 2

**Q. 1 A. Choose the correct answer for the following question.**

**Which one is the quadratic equation?**

**A.** $\frac{5}{x} - 3 = x^2$

**B. x (x + 5) = 2**

**C. n-1 = 2n**

**D.** $\frac{1}{x^2}(x+2) = x$

**Answer :**

In option A $\frac{5}{x} - 3 = x^2 \Rightarrow 5 - 3x = x^3$. hence , it is not a quadratic equation.

In Option B $x(x + 5) = 2 \Rightarrow x^2 + 5x - 2 = 0$, it is a quadratic equation.

In Option C $n - 1 = 2n \Rightarrow 2n - n = -1 \Rightarrow n = -1$, it is not a quadratic equation.

In Option D $\frac{1}{x^2}(x + 2) = x \Rightarrow x + 2 = x^3$, hence, it is not a quadratic equation.

**Q. 1 B. Choose the correct answer for the following question.**

**Out of the following equations which one is not a quadratic equation?**

**A. $x^2 + 4x = 11 + x^2$**
**B. $x^2 = 4x$**
**C. $5x^2 = 90$**
**D. $2x - x^2 = x^2 + 5$**

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**Answer :**

$x^2 + 4x - 11 - x^2 = 0 \Rightarrow 4x - 11 = 0$

In all other options highest degree of equation is 2, which also the degree of quadratic equation. But in Option A, degree of polynomial is 1

**Q. 1 C. Choose the correct answer for the following question.**

**The roots of $x^2 + kx + k = 0$ are real and equal, find k.**

**A. 0**
**B. 4**
**C. 0 or 4**
**D. 2**

**Answer :**

$x^2 + kx + k = 0$, equation has real and equal roots.

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

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

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

$k = 0$ or $k - 4 = 0 \Rightarrow k = 4$

$\therefore k = 0$ or $4$

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**Q. 1 D. Choose the correct answer for the following question.**

For $\sqrt{2}x^2 - 5x + \sqrt{2} = 0$ find the value of the discriminant.

A. -5

B. 17

C. 2

D. $2\sqrt{2} - 5$

**Answer :**

$\Rightarrow \sqrt{2}x^2 + 5x + \sqrt{2} = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = \sqrt{2}, b = 5$ and $c = \sqrt{2}$

$\therefore b^2 - 4ac = 5^2 - 4(\sqrt{2})(\sqrt{2})$

$= 25 - 8$

$= 17$

**Q. 1 E. Choose the correct answer for the following question.**

**Which of the following quadratic equations has roots 3, 5?**

**A. $x^2 - 15x + 8 = 0$**

**B. $x^2 - 8x + 15 = 0$**

**C. $x^2 + 3x + 5 = 0$**

**D. $x^2 + 8x - 15 = 0$**

**Answer :**

In option A,

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

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{15 \pm \sqrt{-15^2 - 4(1)(8)}}{2 \times 1} = \frac{15 \pm \sqrt{225 - 80}}{2} = \frac{15 \pm \sqrt{145}}{2}$$

In option B

$$x^2 - 8x + 15 = 0$$

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

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

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

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

$$x = 5 \text{ and } x = 3$$

In option c,

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

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-3 \pm \sqrt{3^2 - 4(1)(5)}}{2 \times 1} = \frac{-3 \pm \sqrt{9 - 20}}{2} = \frac{(-3 \pm \sqrt{-11})}{2}$$

In option d

$$x^2 + 8x - 15 = 0$$

$$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-8 \pm \sqrt{8^2 - 4(1)(15)}}{2 \times 1} = \frac{-8 \pm \sqrt{64 - 60}}{2} = \frac{(-8 \pm 2)}{2}$$

$$x = \frac{-8 + 2}{2} = -\frac{6}{2} = -3 \text{ or } x = \frac{-8 - 2}{2} = -\frac{10}{2} = -5$$

**Q. 1 F. Choose the correct answer for the following question.**

**Out of the following equations, find the equation having the sum of its roots -5.**

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**A. $3x^2 – 15x + 3 = 0$**
**B. $x^2 – 5x + 3 = 0$**
**C. $x^2 + 3x - 5 = 0$**
**D. $3x^2 + 15x + 3 = 0$**

**Answer :**

Sum of the roots i.e. $\alpha + \beta = -\frac{b}{a}$

$\therefore$ in option A, $\alpha + \beta = -\frac{-15}{3} = 5$

$\therefore$ in option B,$\alpha + \beta = -\frac{-5}{1} = 5$

$\therefore$ in option A, $\alpha + \beta = -\frac{3}{1} = 3$

$\therefore$ in option A, $\alpha + \beta = -\frac{15}{3} = -5$

**Q. 1 G. Choose the correct answer for the following question.**

$\sqrt{5}\,m^2 - \sqrt{5}\,m + \sqrt{5} = 0$ **which of the following statement is true for this given equation?**

**A. Real and uneual roots**
**B. Real and equal roots**
**C. Roots are not real**
**D. Three roots.**

**Answer :**

$\Rightarrow \sqrt{5}m^2 + \sqrt{5}m + \sqrt{5} = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = \sqrt{5}, b = \sqrt{5}$ and $c = \sqrt{5}$

$\therefore b^2 - 4ac = \sqrt{5}^2 - 4(\sqrt{5})(\sqrt{5})$

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$= 5 - 20$

$= -15$

$\therefore b^2 - 4ac < 0$ . hence, roots are not real.

**Q. 1 H. Choose the correct answer for the following question.**

**One of the roots of equation $x^2 + mx - 5 = 0$ is 2; find m.**

A. -2

B. $-\frac{1}{2}$

C. $\frac{1}{2}$

D. 2

**Answer :**

$x^2 + mx - 5 = 0$ , Put value of x = 2

$2^2 + 2m = 5 \Rightarrow 2m = 5 - 4 \Rightarrow m = \frac{1}{2}$

**Q. 2. Which of the following equations is quadratic?**

**(1) $x^2 + 2x + 11 = 0$**
**(2) $x^2 - 2x + 5 = x^2$**
**(3) $(x + 2)^2 = 2x^2$**

**Answer :**

1. $x^2 + 2x - 11 = 0$ is a quadractic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

2. $x^2 - 2x + 5 = x^2$

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$-2x + 5 = 0$ ∴ it is not a quadratic equation because it is not in the form of $ax^2 + bc + c = 0$ and it doesn't have degree 2.

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

$x^2 - 4x - 4 = 0$ is a quadractic equation because it is the form of $ax^2 + bc + c = 0$ and it has degree 2.

**Q. 3 A. Find the value of discriminant for each of the following equation.**

**$2y^2 - y + 2 = 0$**

**Answer :**

$\Rightarrow 2y^2 - y + 2 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 2, b = -1$ and $c = 2$

$\therefore b^2 - 4ac = -1^2 - 4(2)(2)$

$= 1 - 16$

$= -15$

**Q. 3 B. Find the value of discriminant for each of the following equation.**

**$5m^2 - m = 0$**

**Answer :**

$\Rightarrow 5m^2 - m = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 5, b = -1$ and $c = 0$

$\therefore b^2 - 4ac = -1^2 - 4(5)(0)$

$= 1$

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**Q. 3 C. Find the value of discriminant for each of the following equation.**

$$\sqrt{5}\,x^2 - x - \sqrt{5} = 0$$

**Answer :**

$$\Rightarrow \sqrt{5}x^2 - x - \sqrt{5} = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = \sqrt{5}, b = -1 \text{ and } c = -\sqrt{5}$$

$$\therefore b^2 - 4ac = -1^2 - 4(\sqrt{5})(-\sqrt{5})$$

$$= 1 + 20$$

$$= 21$$

**Q. 4. One of the roots of quadratic equation $2x^2 + kx - 2 = 0$ is -2, find k.**

**Answer :**

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

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

$$\Rightarrow 8 - 2 - 2k = 0$$

$$\Rightarrow 6 = 2k$$

$$k = 3$$

**Q. 5 A. Two roots of quadratic equations are given ; frame the equation.**

**10 and -10**

**Answer :**

Let α = 10 and β = -10

∴ α + β = 10 - 10 = 0α β = 10(-10) = - 100

$$\therefore \text{and quadratic equation is, } x^2 - (\alpha + \beta)x + \alpha\beta = 0$$

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$\Rightarrow x^2 - 0(x) - 100 = 0$

$\Rightarrow x^2 - 100 = 0$

**Q. 5 B. Two roots of quadratic equations are given ; frame the equation.**

**$1–3\sqrt{5}$ and $1 + 3\sqrt{5}$**

**Answer :**

Let $\alpha = 1 - 3\sqrt{5}$ and $\beta = 1 + 3\sqrt{5}$

$\therefore \alpha + \beta = 1 - 3\sqrt{5} + 1 + 3\sqrt{5} = 2$ and $\alpha\beta = (1 - 3\sqrt{5}) \times (1 + 3\sqrt{5})$

$= 1 - 45 = -44$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$\therefore x^2 - (2)x + (-44) = 0$

$\therefore x^2 - 2x - 44 = 0$

**Q. 5 C. Two roots of quadratic equations are given ; frame the equation.**

**0 and 7**

**Answer :**

: Let $\alpha = 0$ and $\beta = 7$

$\therefore \alpha + \beta = 0 + 7 = 7$ and $\alpha\beta = 0 \times 7 = 0$

$\therefore$ and quadratic equation is, $x^2 - (\alpha + \beta)x + \alpha\beta = 0$

$\therefore x^2 - (27)x + (0) = 0$

$\therefore x^2 - 7x = 0$

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**Q. 6 A. Determine the nature of roots for each of the quadratic equation.**

**$3x^2 – 5x + 7 = 0$**

**Answer :**

$\Rightarrow 3x^2 - 5x + 7 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 3, b = -5$ and $c = 7$

$\therefore b^2 - 4ac = -5^2 - 4(3)(7)$

$= 25 - 147$

$= -122$

$\therefore b^2 - 4ac < 0$ .hence, roots are not real.

**Q. 6 B. Determine the nature of roots for each of the quadratic equation.**

$\sqrt{3}x^2 + \sqrt{2}x - 2\sqrt{3} = 0$

**Answer :**

$\Rightarrow \sqrt{3}x^2 + \sqrt{2}x + 2\sqrt{3} = 0$ compare with $ax^2 + bx + c = 0$

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

$\therefore b^2 - 4ac = \sqrt{2}^2 - 4(\sqrt{3})(-2\sqrt{3})$

$= 2 + 24$

$= 26$

$\therefore b^2 - 4ac > 0$ .hence, roots are real and umequal .

**Q. 6 C. Determine the nature of roots for each of the quadratic equation.**

**$m^2 – 2m + 1 = 0$**

**Answer :**

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$\Rightarrow m^2 - 2m + 1 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = -2$ and $c = 1$

$\therefore b^2 - 4ac = -2^2 - 4(1)(1)$

$= 4 - 4$

$= 0$

$\therefore b^2 - 4ac = 0$ . hence, roots are real and equal.

**Q. 7 A. Solve the following quadratic equation.**

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

**Answer :**

$x^2 = x + 5$

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

$\Rightarrow x^2 - x - 5 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = -1$ and $c = -5$

$\therefore b^2 - 4ac = -1^2 - 4(1)(-5)$

$= 1 + 20$

$= 21$

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

$$\Rightarrow x = \frac{1 \pm \sqrt{21}}{2 \times 1}$$

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$$\Rightarrow x = \frac{1 \pm \sqrt{21}}{2}$$

$$\Rightarrow x = \frac{1+\sqrt{21}}{2} \text{ or } x = \frac{1+\sqrt{21}}{2}$$

**Q. 7 B. Solve the following quadratic equation.**

$$x^2 - \frac{3x}{10} - \frac{1}{10} = 0$$

**Answer :**

$$10x^2 - 3x - 1 = 0$$

$$\Rightarrow 10x^2 - 3x - 1 = 0 \text{ compare with } ax^2 + bx + c = 0$$

$$\Rightarrow a = 10, b = -3 \text{ and } c = -1$$

$$\therefore b^2 - 4ac = -3^2 - 4(10)(-1)$$

$$= 9 + 40$$

$$= 49$$

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

$$\Rightarrow x = \frac{3 \pm \sqrt{49}}{2 \times 10}$$

$$\Rightarrow x = \frac{3 \pm 7}{20}$$

$$\Rightarrow x = \frac{3+7}{20} \text{ or } x = \frac{3-7}{20}$$

$$\Rightarrow x = \frac{10}{20} \text{ or } x = \frac{-4}{20}$$

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

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**Q. 7 C. Solve the following quadratic equation.**

**$(2x + 3)^2 = 25$**

**Answer :**

$4x^2 + 12x + 9 - 25 = 0 \Rightarrow 4x^2 + 12x - 16 = 0$

$\Rightarrow x^2 + 3x - 4 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = 3$ and $c = -4$

$\therefore b^2 - 4ac = 3^2 - 4(1)(-4)$

$= 9 + 16$

$= 25$

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

$$\Rightarrow x = \frac{-3 \pm \sqrt{25}}{2 \times 1}$$

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

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

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

$\Rightarrow x = 1$ or $x = -4$

**Q. 7 D. Solve the following quadratic equation.**

**$m^2 + 5m + 5 = 0$**

**Answer :**

$\Rightarrow m^2 + 5m + 5 = 0$ compare with $ax^2 + bx + c = 0$

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$\Rightarrow a = 1, b = 5 \text{ and } c = 5$

$\therefore b^2 - 4ac = 5^2 - 4(1)(5)$

$= 25 - 20$

$= 5$

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

$\Rightarrow x = \frac{-5 \pm \sqrt{5}}{2 \times 1}$

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

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

**Q. 7 E. Solve the following quadratic equation.**

**$5m^2 + 2m + 1 = 0$**

**Answer :**

$\Rightarrow 5m^2 + 2m + 1 = 0 \text{ compare with } ax^2 + bx + c = 0$

$\Rightarrow a = 5, b = 2 \text{ and } c = 1$

$\therefore b^2 - 4ac = 2^2 - 4(5)(1)$

$= 4 - 20$

$= -16$

Hence , roots are not real.

**Q. 7 F. Solve the following quadratic equation.**

**$x^2 – 4x – 3 = 0$**

**Answer :**

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$\Rightarrow x^2 - 4x - 3 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = 1, b = -4$ and $c = -3$

$\therefore b^2 - 4ac = -4^2 - 4(1)(-3)$

$= 16 + 12$

$= 28$

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

$\Rightarrow x = \frac{4 \pm \sqrt{28}}{2 \times 1}$

$$\Rightarrow x = \frac{4 \pm 2\sqrt{7}}{2}$$

$\Rightarrow x = \frac{4 + 2\sqrt{7}}{2}$ or $x = \frac{4 - 2\sqrt{7}}{2}$

$$\Rightarrow x = \frac{2(2 + \sqrt{7})}{2} \text{ or } x = \frac{2(2 - \sqrt{7})}{2}$$

$\Rightarrow x = 2 + \sqrt{7}$ or $x = 2 - \sqrt{7}$

**Q. 8. Find m if $(m-12)x^2 + 2(m - 12)x + 2 = 0$ has real and equal roots.**

**Answer :**

$\Rightarrow (m - 12)x^2 - (2m - 24)x + 2 = 0$ compare with $ax^2 + bx + c = 0$

$\Rightarrow a = m - 12, b = -2m + 24$ and $c = 2$

$\therefore b^2 - 4ac = (-2m + 24)^2 - 4(m - 12)(2)$

$= 4m^2 - 96m + 576 - 8m + 96$

$= 4m^2 - 104m + 672$

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$= m^2 - 26m + 168$

If roots are equal and real then, $\therefore b^2 - 4ac = 0$

$m^2 - 26m + 168 = 0$

$\Rightarrow m^2 - 12m - 14m + 168 = 0$

$\Rightarrow m(m - 12) - 14(m - 12) = 0$

$\Rightarrow (m - 12)(m - 14) = 0$

m = 12 or m = 14

**Q. 9. The sum of two roots of a quadratic equation is 5 and sum of their cubes is 35, find the equation.**

**Answer :**

$\alpha + \beta = 5$

$\Rightarrow \alpha^3 + \beta^3 = 35$

$\because \alpha^3 + \beta^3 = (\alpha + \beta)(\alpha^2 - \alpha\beta + \beta^2)$

$\Rightarrow 35 = 5(\alpha^2 + \beta^2 + 2\alpha\beta - 3\alpha\beta)$

$\Rightarrow 35 = 5\{(\alpha + \beta)^2 - 3\alpha\beta\}$

$\Rightarrow 7 = 25 - 3\alpha\beta$

$\Rightarrow 3\alpha\beta = 18$

$\Rightarrow \alpha\beta = 6$

$x^2 - (\alpha + \beta)x + \alpha\beta \Rightarrow x^2 - 5x + 6 = 0$

**Q. 10. Find quadratic equation such that its roots are square of sum of the roots and square of difference of the roots of equation**

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**$2x^2 + 2(p + q)x + p^2 + q^2 = 0$**

**Answer :**

Let's assume roots are m and n.

So, we want the equation whose roots would be $(m + n)^2$ and $(m - n)^2$

So, the sum of the roots of our desired equation would be $2(m + n)^2$ and product of the roots would be $(m + n)^2(m - n)^2$

What we know from given equation are:

$$m + n = -(p + q)$$

and $mn = \frac{p^2 + q^2}{2}$

the sum and product are:

$$s = 2(m^2 + n^2) = 2(m + n)^2 - 2mn$$

$$= 2(p + q)^2 - (p^2 + q^2) = 2 \times 2pq = 4pq$$

and

$$P = (m + n)^2(m - n)^2$$

$$= (p + q)^2 (m + n)^2 - 4mn$$

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

$$= (p + q)^2(2pq - p^2 - q^2)$$

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

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$= -(p^2 - q^2)^2$

Our desired equation would be $x^2 - sx + P = 0$

So, $x^2 - 4pqx - (p^2 - q^2)^2 = 0$ is our desired equation

**Q. 11. Mukund possesses ₹50 more than what Sagar possesses. The product of the amount they have is 15,000. Find the amount each one has.**

**Answer :** Let Sagar has x amount

Mukund's amount = $x + 50$

$x(x + 50) = 15000$

$\Rightarrow x^2 + 50x - 15000 = 0$

Splitting the middle term we get:-

$\Rightarrow x^2 - 100x + 150x - 15000 = 0$

$\Rightarrow x(x - 100) + 150(x - 100) \Rightarrow (x - 100)(x+150) \therefore x = (-150)$ , $100x = 100$ as money cant be negative therefore we ignore $(-150) \therefore$ Sagar has 100Rs and Mukund has 150Rs

**Q. 12. The difference between squares of two numbers is 120. The square of smaller number is twice the greater number. Find the numbers.**

**Answer :** Let the two numbers be a and b, such that, $a > b$.

As per the given conditions,

The difference of the square of the two numbers is 120.

$a^2 - b^2 = 120 \ldots I$

The square of smaller number is 2 times the larger number.

$b^2 = 2a \ldots II$

Put the value of $b^2$ from eq. II in Eq. I, it gives

$a^2 - 2a = 120$

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$a^2 - 2a - 120 = 0$

$\Rightarrow a^2 + 10a - 12a - 120 = 0$

$\Rightarrow a(a + 10) - 12(a + 10) = 0$

$\Rightarrow (a + 10)(a - 12) = 0$

$a + 10 = 0 \text{ or } a - 12 = 0$

$a = -10 \text{ or } a = 12$

$b = \sqrt{2a} \Rightarrow b = \sqrt{2(12)} \Rightarrow b = \sqrt{24}$

$b = \pm\sqrt{24}$

12 and $\sqrt{24}$ or 12 and - $\sqrt{24}$

**Q. 13. Ranjana wants to distribute 540 oranges among some students. If 30 students were more each would get 3 oranges less. Find the number of students.**

**Answer :** Total oranges = 540

Initial student = x

Initial orange for 1 student = n

$nx = 540$

$(n - 3)(x + 30) = 540$

$nx = (n - 3)(x + 30)$

$nx = nx + 30n - 3x - 90$

$30n = 3x + 90$

$x = \frac{30n - 90}{3}$

$x = 10n - 30$

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$\therefore nx = 540$

$n(10n - 30) = 540$

$n(n - 3) = 54$

$n^2 - 3n - 54 = 0$

$n^2 - 9n + 6n - 54 = 0$

$n(n - 9) + 6(n - 9) = 0$

$(n - 9)(n + 6) = 0$

$\Rightarrow n - 9 = 0 \text{ or } n + 6 = 0$

$\Rightarrow n = 9 \text{ or } n = -6$ ($\because$

$nx = 540 \Rightarrow x = \frac{540}{9} \Rightarrow x = 60$

$\therefore$ number of students = 60 students.

**Q. 14. Mr. Dinesh owns an agricultural farm at village Talvel. The length of the farm is 10 meter more than twice the breadth. In order to harvest rain water, he dug a square shaped pond inside the farm. The side of pond is 1/3 of the breadth of the farm. The area of the farm is 20 times the area of the pond. Find the length and breadth of the farm and of the pond.**

**Answer :**

Let the breadth of the farm be x.

$\therefore \text{length of the farm} = 2x + 10$

$\text{side of the pond} = \frac{x}{3}$

According to the question,

$\text{area of farm} = 20(\text{area of pond})$

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$\Rightarrow x(2x + 10) = 20\left(\frac{x}{3}\right)^2$

$\Rightarrow 2x^2 + 10x = \frac{20x^2}{9}$

$\Rightarrow 10x = \frac{20x^2}{9} - 2x^2$

$\Rightarrow 10x = \frac{20x^2 - 18x^2}{9}$

$\Rightarrow 90x = 2x^2 \Rightarrow 2x^2 - 90x$

$\Rightarrow x(2x - 90) = 0$

$\Rightarrow x = 0 \text{ or } 2x - 90 = 0$

$x = \frac{90}{2} = 45$

$\therefore$ length of the farm $= 2x + 10 = 2(45) + 10 = 100$

side of the pond $= \frac{x}{3} = \frac{45}{3} = 15$

Breadth 45 m. length 100 m, side of the pond 15 m.

**Q. 15. A tank fills completely in 2 hours if both the taps are open. If only one of the taps is open at the given time, the smaller tap takes 3 hours more than the larger one to fill the tank. How much time does each tap take to fill the tank completely?**

**Answer :**

Let the time taken by larger tap alone be x hr. Then ,

Time taken by smaller tap be x + 3 hr

In an hour, the larger tap can fill $\frac{1}{x}$ tank.

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$\therefore$ In an hour, the larger tap can fill $\frac{1}{x+3}$ tank.

Two taps together can fill a tank in 2 hr.

But in an hour, taps fill in $\frac{1}{2}$hr of the tank.

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

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

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

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

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

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

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

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

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

$x = 3$ or $x = -2$

$x = 3$ because time taken cannot be negative

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For larger tap 3 hours and for smaller tap 6 hours.

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