UNIT 5

QUADRATIC EQUATIONS

- **Quadratic Equation**
- **Solution of Quadratic Equation**
- **Quadratic Formula**

After completion of this unit, the students will be able to:

- define quadratic equation.
- solve a quadratic equation in one variable by
  - Factorization.
  - Completing Square.
- use method of completing square to derive quadratic formula.
- use quadratic formula to solve quadratic equations.
- solve simple real life problems.

5.1 QUADRATIC EQUATIONS

A quadratic equation in one variable is an equation that can be written in the form:

$$ax^2 + bx + c = 0, \quad a \neq 0,$$

where x is a variable and a, b and c are real numbers. We refer to this form as the **standard form** of the quadratic equation.

A quadratic equation is also a polynomial equation in which the highest power of the unknown variable is two.

5.2 SOLUTION OF A QUADRATIC EQUATION

We can solve a quadratic equation by the following two methods:

(i) Factorization *(ii)* Completing the Square *(iii)* The Quadratic Formula

5.2.1 Solution of a Quadratic Equation by Factorization

The general form of a quadratic equation is $ax^2 + bx + c = 0, a \neq 0$. We can solve this equation algebraically to find x by using Null Factor Law.

If $a \times b = 0$ then $a = 0$ or $b = 0$ (or both a and b equal zero).
The Null Factor Law works only for expressions in factor form.

EXAMPLE-1 Solve $x^2 + 4x - 77 = 0$

SOLUTION:

$$x^2 + 4x - 77 = 0$$

$$(x-7)(x+11) = 0$$

$$x - 7 = 0 \text{ or } x + 11 = 0$$

Write the equation and check that the right hand side equals zero. The left hand side is factorized, so use the Null Factor Law to find two liner equations.

Equations that are not in factor form will need to factorized first before the Null Factor Law can be applied.

Remember that the right hand side of the equation must be zero.

"A second degree polynomial $ax^2 + bx + c$ with integral coefficients has linear factors if and only if "ac" has integral factors whose sum is b."

EXAMPLE-2

Solve $6x^2 - 19x - 7 = 0$ *using factorization.*

SOLUTION:

Compare with standard form

$$ax^2 + bx + c = 0 \ , \ a = 6 \ , \ b = -19 \ , \ c = -7$$

$$ac = 6(-7) = -42$$

$$-42 = (-21)2 \text{ and } -21 + 2 = -19 = b$$

$$\text{Thus } 6x^2 - 19x - 7 = 0$$

$$6x^2 - 21x + 2x - 7 = 0$$

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

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

$$\text{either } 2x - 7 = 0 \quad \text{or} \quad 3x + 1 = 0$$

$$x = \frac{7}{2} \quad \text{or} \quad x = \frac{-1}{3}$$

$$\text{Solution set} = \left\{\frac{-1}{3}, \frac{7}{2}\right\}$$

EXAMPLE-3

Solve $2x^2 = 3x$

SOLUTION:

$$2x^2 = 3x$$

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

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

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

$$x = \frac{3}{2}$$

$$\text{Solution set} = \left\{0, \frac{3}{2}\right\}$$

Note: $x = 0 , \frac{3}{2}$ *are also called roots of the quadratic equation of* $2x^2 = 3x$.

EXAMPLE-4

If $x = 3$ is a solution of the equation $x^2 + kx + 15 = 0$. Find the value of 'k'. Also find the other solution of the equation.

SOLUTION: Substitute $x = 3$ in $x^2 + kx + 15 = 0$

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

$$3k + 24 = 0 \Rightarrow k = -8$$

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

$$15 = (-5)\times(-3) \text{ and } (-5)+(-3) = -8 = b$$

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

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

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

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

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

Solution set $= \{3, 5\}$

5.2.2 Solution of a Quadratic Equation by Completing the Square Method

The method of completing the square is based on the process of transforming the standard quadratic equation into the form

$ax^2 + bx + c = 0$ ______ (1)

$(x+a)^2 = b$ ______ (2), where a and b are constants.

Equation *(2)* can easily be solved by completing the square method. But how do we transform equation *(1)* into the form of equation *(2)*?

To complete the square of a quadratic equation of the form $x^2 + bx$, add the square of one-half of the coefficient of x that is $\left(\frac{b}{2}\right)^2$

It is important to note that the rule stated above applies only to quadratic forms where the coefficients of the second degree term is *1*.

> Important formulas used in completing the square are:
>
> (i) $(x+m)^2 = x^2 + 2mx + m^2$
>
> (ii) $(x-m)^2 = x^2 - 2mx + m^2$

EXAMPLE-1

Solve $x^2 + 6x - 2 = 0$ *by completing the square method.*

SOLUTION: $x^2 + 6x - 2 = 0$

$x^2 + 6x - 2 + 2 = 2$ ← *Adding 2 to both sides*

$x^2 + 6x = 2$

$x^2 + 6x + (3)^2 = 2 + 3^2$ ← *To complete the square of the left side, add the square of one half of the coefficient of x to each side of the equation.*

$(x+3)^2 = 11$

$x + 3 = \pm\sqrt{11}$

$x = -3 \pm \sqrt{11}$

Solution set $= \left\{-3+\sqrt{11}, -3-\sqrt{11}\right\}$

EXAMPLE-2

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

SOLUTION: $(x-3)^2 = 4$

$x^2 - 6x + 9 = 4$

$x^2 - 6x = -5$

$x^2 - 6x + (3)^2 = -5 + 9$

$(x-3)^2 = 4$

$x = 3 \pm 2$

either $x = 5$

or $x = 1$

Solution set $= \{1, 5\}$

EXAMPLE-3

Solve $3(x-2)^2 = x(x-2)$ by completing the square method.

SOLUTION:

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

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

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

$$2x^2-10x = -12$$

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

$$x^2-5x+\left(\frac{5}{2}\right)^2 = -6+\left(\frac{5}{2}\right)^2$$

$$\left(x-\frac{5}{2}\right)^2 = -6+\frac{25}{4} = \left(x-\frac{5}{2}\right)^2 = \frac{1}{4}$$

$$x^2-\frac{5}{2} = \pm\frac{1}{2}$$

$$x = \frac{5}{2}\pm\frac{1}{2}$$

either $x = \frac{5}{2}+\frac{1}{2} = \frac{6}{2} = 3$

or $x = \frac{5}{2}-\frac{1}{2} = \frac{4}{2} = 2$

Solution set $= \{2, 3\}$

EXAMPLE-4

Solve $10x^2-12x = 15$ by completing the square method.

SOLUTION:

$$10x^2-12x = 15$$

$$x^2-\frac{12}{10}x = \frac{15}{10} \quad \longleftarrow \text{Dividing by '10'}$$

$$x^2-\frac{6}{5}x = \frac{3}{2} \Rightarrow x^2-\frac{6}{5}x+\left(\frac{3}{5}\right)^2 = \left(\frac{3}{5}\right)^2+\frac{3}{2} \quad \longleftarrow \text{Adding } \left(\frac{3}{5}\right)^2 \text{ on both sides}$$

$$\left(x-\frac{3}{5}\right)^2 = \frac{9}{25}+\frac{3}{2} = \left(x-\frac{3}{5}\right)^2 = \frac{18+75}{50} \Rightarrow \left(x-\frac{3}{5}\right)^2 = \frac{93}{50}$$

$$x-\frac{3}{5} = \pm\sqrt{\frac{93}{50}} \quad \text{or} \quad x = \frac{3}{5}\pm\frac{\sqrt{93}}{5\sqrt{2}}$$

$$x = \frac{3\sqrt{2}\pm\sqrt{93}}{5\sqrt{2}} \Rightarrow x = \frac{3\sqrt{2}+\sqrt{93}}{5\sqrt{2}} \quad \text{or} \quad x = \frac{3\sqrt{2}-\sqrt{93}}{5\sqrt{2}}$$

Solution set $= \left\{\frac{3\sqrt{2}+\sqrt{93}}{5\sqrt{2}}, \frac{3\sqrt{2}-\sqrt{93}}{5\sqrt{2}}\right\}$

EXAMPLE-5 Solve $\frac{1}{x}+\frac{1}{x+8} = \frac{1}{3}$ by using factorisation.

SOLUTION:

$$\frac{1}{x}+\frac{1}{x+8} = \frac{1}{3}$$

$$\frac{x+8+x}{x(x+8)} = \frac{1}{3}$$

$$\frac{2x+8}{x^2+8x} = \frac{1}{3}$$

$$x^2+8x = 6x+24$$

$$x^2+2x-24 = 0$$

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

either $x+6 = 0$ or $x-4 = 0$

$x = -6$ or $x = 4$

Solution set $= \{4, -6\}$

EXAMPLE-6 Solve $2x+4 = \frac{7}{x}-1$

SOLUTION:

$$2x+4 = \frac{7}{x}-1$$

$$x(2x+4) = x(\frac{7}{x}-1)$$ ← Multiplying both sides by 'x'

$$2x^2 + 4x = 7 - x$$
$$2x^2 + 5x - 7 = 0$$
$$(2x+7)(x-1) = 0$$

either $2x + 7 = 0 \Rightarrow x = \frac{-7}{2}$

or $x - 1 = 0 \Rightarrow x = 1$

Solution set $= \left\{\frac{-7}{2}, 1\right\}$

$a \times c = 2 \times (-7) = -14$

$2x \quad 7$	$7x$
$\downarrow x \quad -1$	$-2x$
$2x^2 - 7$	$5x$

$(2x+7)(x-1)$

EXERCISE – 5.1

I- Solve by Using Factorization Method:

1. $x^2 - 4x - 12 = 0$
2. $x^2 - 6x + 5 = 0$
3. $x^2 = 8 - 7x$
4. $5x = x^2 + 6$
5. $3x^2 - 10x + 8 = 0$
6. $2x^2 + 15x - 8 = 0$
7. $\frac{x}{4}(x+1) = 3$
8. $3x^2 - 8x - 3 = 0$
9. $2x = \frac{2}{x} + 3$
10. $5x^2 - 6x - 8 = 0$
11. $(2x+3)(x-2) = 0$
12. $(2x+1)(5x-4) = 0$
13. $4x(3x-1) - 2 = (2x-1)(5x+1)$

II- Solve by Completing the Square Method:

14. $x^2 - 10x - 3 = 0$
15. $x^2 - 6x - 3 = 0$
16. $x^2 + x - 1 = 0$
17. $x^2 + 6x - 3 = 0$
18. $2x^2 - 4x + 1 = 0$
19. $2x^2 - 6x + 3 = 0$
20. $3x^2 + 5x - 4 = 0$
21. $x^2 + mx + n = 0$
22. $11x^2 = 6x + 21$
23. $2x^2 + 8x - 26 = 0$
24. $5x^2 - 20x - 28 = 0$
25. $x^2 - 11x - 26 = 0$

5.3 THE QUADRATIC FORMULA

Quadratic formula is one of the techniques to solve a quadratic equation. Usually this formula is used when the factorization is not possible or seems to be too difficult.

5.3.1 Derivation of Quadratic Formula

The general form of a quadratic equation is

$$ax^2 + bx + c = 0, \qquad a \neq 0$$

where a, b, c are real numbers.

Now, we use the method of completing the square to derive a formula for the solution of all quadratic equations,

$$ax^2 + bx + c = 0, \qquad a \neq 0$$

To make the leading coefficient that is of x^2 as 1, divide by a.

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0 \quad or \quad x^2 + \frac{b}{a}x = -\frac{c}{a}$$

Add the square of one-half of the coefficient of x, which is $\left(\frac{b}{2a}\right)^2$, to each side to complete the square of the left side.

$$x^2 + \frac{b}{a}x + \left(\frac{b}{2a}\right)^2 = \frac{b^2}{4a^2} - \frac{c}{a} \Rightarrow \left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$

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

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

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

Techniques to solve a Quadratic Equation

(i) Factorization
(ii) Completing the Square Method.
(iii) Use of Quadratic Formula

The last equation is called the **quadratic formula**.

EXAMPLE-1

Solve $2x+\frac{3}{2}=x^2$ by using the quadratic formula.

SOLUTION:

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

$$4x+3=2x^2$$

Dissolve the fractions by multiplying 2 on both sides and write the equation in standard form

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

Here $a=2$

$b=-4$

$c=-3$

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

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

$$=\frac{4\pm\sqrt{16+24}}{4}=\frac{4\pm\sqrt{40}}{4}$$

$$=\frac{4\pm2\sqrt{10}}{4}$$

$$x=\frac{2\pm\sqrt{10}}{2}$$

Solution set $$=\left\{\frac{2+\sqrt{10}}{2},\ \frac{2-\sqrt{10}}{2}\right\}$$

EXAMPLE-2

Solve $4x^2 + 3x - 2 = 0$ by using the quadratic formula.

SOLUTION: $4x^2 + 3x - 2 = 0$

Here $a = 4\ ,\ b = 3\ ,\ c = -2$

We have $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

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

$$= \frac{-3 \pm \sqrt{9 + 32}}{8}$$

$$= \frac{-3 \pm \sqrt{41}}{8}$$

Solution set $= \left\{ \dfrac{-3 + \sqrt{41}}{8}\ ,\ \dfrac{-3 - \sqrt{41}}{8} \right\}$

EXAMPLE-3

Solve $9x^2 - 42x + 49 = 0$. by using the quadratic formula.

SOLUTION: $9x^2 - 42x + 49 = 0$

Here $a = 9\ ,\ b = -42\ ,\ c = 49$

We have $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{-(-42) \pm \sqrt{(-42)^2 - 4(9)(49)}}{2(9)}$$

$$x = \frac{42 \pm \sqrt{1764 - 1764}}{18} \Rightarrow x = \frac{42}{18} = \frac{7}{3}$$

Solution set $= \left\{ \dfrac{7}{3} \right\}$

EXAMPLE-4

Solve $(x+5)^2+(2x-1)^2-67=(x+5)(2x-1)$ by using quadratic formula.

SOLUTION: $(x+5)^2+(2x-1)^2-67=(x+5)(2x-1)$

$$x^2+10x+25+4x^2-4x+1-67=2x^2+10x-x-5$$

$$5x^2+6x-41=2x^2+9x-5$$

$$3x^2-3x-36=0$$

$$x^2-x-12=0$$ ← Divide by '3'

Here $a=1,\ b=-1,\ c=-12$

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

Therefore $$x=\frac{-(-1)\pm\sqrt{(-1)^2-4(1)(-12)}}{2(1)}$$

$$=\frac{1\pm\sqrt{1+48}}{2}$$

$$=\frac{1\pm\sqrt{49}}{2}$$

$$x=\frac{1\pm7}{2}$$

either $x=\frac{1+7}{2}$ or $x=\frac{1-7}{2}$

$x=4$ or $x=-3$

Solution set $=\{4,-3\}$

EXAMPLE-5

Solve $\frac{x-5}{2x} = \frac{x-4}{3}$ by using quadratic formula.

SOLUTION:

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

$$3(x-5) = 2x(x-4)$$

$$3x-15 = 2x^2-8x$$

$$2x^2-11x+15 = 0$$

Here $a = 2$, $b = -11$, $c = 15$

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

$$= \frac{-(-11) \pm \sqrt{(-11)^2-4(2)(15)}}{2(2)}$$

$$= \frac{11 \pm \sqrt{121-120}}{4}$$

$$x = \frac{11 \pm \sqrt{1}}{4} = \frac{11 \pm 1}{4}$$

$x = \frac{11+1}{4}$ or $x = \frac{11-1}{4}$

$x = \frac{12}{4}$ or $x = \frac{10}{4}$

$x = 3$ or $x = \frac{5}{2}$

Solution set $= \left\{3, \frac{5}{2}\right\}$

EXERCISE – 5.2

Solve Using quadratic formula:

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

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

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

4. $10x^2 - 5x = 15$

5. $(x - 1)(x + 3) - 12 = 0$

6. $x(2x + 7) - 3(2x + 7) = 0$

7. $\frac{x+1}{x+4} = \frac{2x-1}{x+6}$, where $x \neq -4, -6$

8. $\frac{x}{6} + \frac{6}{x} = \frac{4}{x} + \frac{x}{4}$, where $x \neq 0$

9. $\frac{x+4}{x-4} + \frac{x-4}{x+4} = \frac{10}{3}$ where $x \neq -4$

10. $\frac{1}{x-1} + \frac{1}{x-2} = \frac{2}{x-3}$ where $x \neq 1, 2, 3$

11. $(x + 4)(x - 1) + (x + 5)(x + 2) = 6$

12. $(2x + 4)^2 - (4x - 6)^2 = 0$

5.3.3 Problems Involving Quadratic Equations

EXAMPLE-1

Find two consecutive positive odd numbers such that the sum of their squares is equal to 130.

SOLUTION: Let one odd number be x and the other number be $(x + 2)$

$$x^2 + (x+2)^2 = 130$$

$$x^2 + x^2 + 4x + 4 = 130$$

$$2x^2 + 4x - 126 = 0$$

$$x^2 + 2x - 63 = 0 \quad \leftarrow \text{Dividing by '2'}$$

$$x^2 + 9x - 7x - 63 = 0$$

$$x(x+9) - 7(x+9) = 0$$

$$(x+9)\,(x-7) = 0$$

$$x + 9 = 0 \quad \text{or} \quad x - 7 = 0$$

$$x = -9 \quad \text{or} \quad x = 7$$

$x = -9$ is not a solution, because it is a negative number.

When $x = 7$

$$x + 2 = 7 + 2 = 9$$

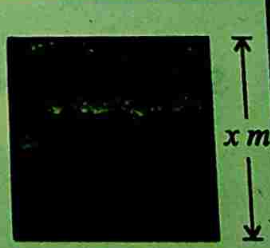
$\therefore$ The two consecutive positive odd numbers are 7 and 9.

The area of the square is $10m^2$

The side of the square is x m.

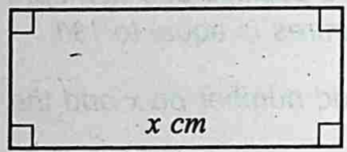
Write down an equation that tells us that the area is $10m^2$

Solve this equation for x.



EXAMPLE-2

The perimeter of a rectangle is $22cm$ and its area is $24cm$. Calculate the length and breadth of the rectangle.



SOLUTION: Let the length of the rectangle $= x\ cm$.

Perimeter of rectangle $= 2(length + breadth)$

$\therefore \quad 22 = 2(x + breadth)$

The breadth of the rectangle $= \dfrac{22 - 2x}{2}$

$= (11 - x)\ cm$

Area of the rectangle $= x(11 - x)$

$24 = 11x - x^2$

$x^2 - 11x + 24 = 0$

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

therefore $x = 3$ or $x = 8$

when $x = 3$, breadth $= 11 - 3$

$= 8\ cm$

when $x = 8$, breadth $= 11 - 8$

$= 3\ cm$

Since we assign the longer side to length,

thus length $= 8\ cm$

breadth $= 3\ cm$

EXAMPLE-3

A man is now 5 times as old as his son.
Four years ago, the product of their ages was 52.
Find their present ages.

SOLUTION: Let the boy be x years old now.
Then his father is $5x$ years old.
4 years ago, their ages were $(x - 4)$ and $(5x - 4)$.
respectively.

By the given condition

$$(x-4)(5x-4) = 52$$
$$5x^2 - 24x + 16 = 52$$
$$5x^2 - 24x - 36 = 0$$
$$5x^2 - 30x + 6x - 36 = 0$$
$$5x(x-6) + 6(x-6) = 0$$
$$(5x+6)(x-6) = 0$$

either $5x + 6 = 0$ or $x - 6 = 0$

$$\Rightarrow x = \frac{-6}{5}, \quad \Rightarrow x = 6$$

Since the boy cannot be $-\frac{6}{5}$ years old. Thus $x = 6$

Son's present age = 6 years
Father's present age = 30 years

EXAMPLE-4

Find two consecutive positive numbers such that the sum of their squares is equal to 113.

SOLUTION: Let x, $x + 1$ be two consecutive positive numbers.

By given condition

$$x^2 + (x+1)^2 = 113$$
$$x^2 + x^2 + 2x + 1 = 113$$
$$2x^2 + 2x - 112 = 0 \quad \leftarrow \text{Divide by '2'}$$
$$x^2 + x - 56 = 0$$
$$(x+8)(x-7) = 0$$
$$x + 8 = 0 \text{ or } x - 7 = 0$$
$$x = -8 \text{ or } x = 7$$
$$x + 1 = 7 + 1 = 8.$$

$\therefore$ Required numbers are 7 and 8

EXERCISE – 5.3

1. Find two consecutive positive odd numbers such that the sum of their squares is 74.

2. Find two consecutive positive even numbers such that the sum of their squares is 164.

3. The difference of two numbers is 9 and the product of the numbers is 162. Find the numbers.

4. The base and height of a triangle are $(x + 3)cm$ and $(2x - 5)cm$ respectively. If the area of the triangle is $20cm^2$, find x.

5. The perimeter and area of a rectangle are $22cm$ and $30cm^2$ respectively. Find the length and breadth of the rectangle.

6. The product of two consecutive positive numbers is 156. Find the numbers.

7. Find two consecutive positive odd numbers given that the difference between their reciprocals is $\frac{2}{63}$.

8. The sum of the two positive numbers is 12 and the sum of whose squares is 80. Find the numbers.

Review Exercise-5

I- Encircle the Correct Answer.

1. A quadratic equation has a degree:

(a) 2 (b) 1 (c) zero (d) 3

2. A linear equation in one variable is of degree:

(a) 2 (b) 1 (c) zero (d) 3

3. Factorization of $2x^2 = 3x$ is:

(a) 0 (b) $x(2x - 3)$

(c) $2x^2 - 3x$ (d) $3x - 2x^2$

4. Solution set of $(x-2)^2 = 4$ is:

(a) $\{0, 4\}$ (b) $\{-6, 2\}$

(c) $\{-6-2\}$ (d) $\{2, 6\}$

5. The number of techniques to solve a quadratic equation is:

(a) 1 (b) 2 (c) 3 (d) 4

6. Solution of $x^2 - 5x + 6 = 0$ is:

(a) $\{3\}$ (b) $\{2\}$ (c) $\{2,3\}$ (d) $\{-2, -3\}$

7. Solution of $x^2 - 9 = 0$ is:

(a) $\{9\}$ (b) $\{\pm 9\}$ (c) $\{\pm 3\}$ (d) $\{3\}$

8. Factorization of $x^4 - 16$ is:

(a) $(x-2)(x+2)$ (b) $(x-2)(x+2)(x-4)$

(c) $(x-2)(x+2)(x^2+4)$ (d) $(x-2)^2$

9. Solution of $x^2 = 1$ is:

(a) $\{1\}$ (b) $\{\pm 1\}$ (c) $\{\pm i\}$ (d) $\{-1\}$

10. $x^2 + 2x + 1 = 0$ has the solution:

(a) $\{-1, -1\}$ (b) $\{-1\}$ (c) $\{0\}$ (d) does not exist

II- **Fill in the blanks.**

An equation of degree 2 in one variable is called a ____________ equation.

$\frac{b \pm \sqrt{b^2 - 4ac}}{2a}$ is called a ____________.

of $2x^2 - 3x$ is: ____________.

$(x-1)^2 = 4$ is: ____________.

chniques to solve a quadratic equation

completing the square method cannot be ____ is used to solve a quadratic equation.

____________.

____________.

____________.

SUMMARY

Quadratic Equation: A quadratic equation in one variable is an equation that can be written in the form $ax^2 + bx + c = 0$, where $a \neq 0$. Here 'x' is a variable, whereas a, b and c are real numbers.

Solution of quadratic Equation: We can solve a quadratic equation by

(i) factorization *(ii)* completing the square method.

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