

Chapter 4. Quadratic Equation

Question-1

Check whether the following equation is quadratic or not: $x^2 - 6x - 4 = 0$.

Solution:

The degree of the equation is 2

$\therefore x^2 - 6x - 4 = 0$ is quadratic equation.

Question-2

Check whether the following equation is quadratic or not: $3x^2 - 7x - 2 = 0$.

Solution:

The degree of the equation is 2

$\therefore 3x^2 - 7x - 2 = 0$ is quadratic equation.

Question-3

Check whether the following equation is quadratic or not: $x^3 - 6x^2 + 2x - 1 = 0$.

Solution:

The degree of the equation is 3

$\therefore x^3 - 6x^2 + 2x - 1 = 0$ is not a quadratic equation.

Question-4

Check whether the following equation is quadratic or not: $7x = 2x^2$.

Solution:

The degree of the equation $2x^2 - 7x = 0$ is 2

$\therefore 7x = 2x^2$ is a quadratic equation.

Question-5

Check whether the following equation is quadratic or not: $x^2 + \frac{1}{x^2} = 2 (x \neq 0)$.

Solution:

The given equation also written as

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

\Rightarrow The degree of the equation is 4

$\therefore x^2 + \frac{1}{x^2} = 2 (x \neq 0)$ is not a quadratic equation.

Question-6

Check whether the following equation is quadratic or not: $3x^2 - 4 = 0$.

Solution:

The degree of the given equation is 2

$\therefore 3x^2 - 4 = 0$ is a quadratic equation.

Question-7

Check whether the following equation is quadratic or not: $(x + 1)(x + 3) = 0$.

Solution:

The degree of the given equation is 2

$\therefore (x + 1)(x + 3) = 0$ is a quadratic equation.

Question-8

Check whether the following equation is quadratic or not: $(2x + 1)(3x + 2) = 6(x - 1)(x - 2)$.

Solution:

By solving the given equation $(2x + 1)(3x + 2) = 6(x - 1)(x - 2)$ we get,

$$6x^2 + 7x + 2 = 6x^2 - 18x + 12$$

$$25x - 10 = 0$$

The degree of the given equation is 1

$\therefore (2x + 1)(3x + 2) = 6(x - 1)(x - 2)$ is not a quadratic equation.

Question-9

Check whether the following equation is quadratic or not: $x + \frac{1}{x} = x^2 (x \neq 0)$.

Solution:

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

The degree of the given equation is 4.

$\therefore x + \frac{1}{x} = x^2 (x \neq 0)$ is not a quadratic equation.

Question-10

Check whether the following equation is quadratic or not: $16x^2 - 3 = (2x + 5)(5x - 3)$.

Solution:

By solving the given equation we get,

$$6x^2 - 19x + 12 = 0$$

$\therefore 16x^2 - 3 = (2x + 5)(5x - 3)$ is a quadratic equation.

Question-11

Determine whether the given value of x is a solution of the given equation or not: $3x^2 - 2x - 1 = 0$; $x = 1$.

Solution:

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

$$\text{Let } x = 1, 3(1)^2 - 2(1) - 1 = 3 - 2 - 1 = 0.$$

Therefore the given value of x is a solution of the given equation.

Question-12

Determine whether the given value of x is a solution of the given equation or not: $2x^2 - 6x + 3 = 0$; $x = \frac{1}{2}$.

Solution:

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

$$\text{Let, } x = \frac{1}{2} \Rightarrow 2\left(\frac{1}{2}\right)^2 - 6\left(\frac{1}{2}\right) + 3 = \frac{1}{2} - 3 + 3 = \frac{1}{2}.$$

Therefore the given value of x is not a solution of the given equation.

Question-13

Determine whether the given value of x is a solution of the given equation or not: $(2x + 3)(3x - 2) = 0$; $x = \frac{2}{3}$.

Solution:

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

$$\begin{aligned}\text{Let } x = \frac{2}{3} &\Rightarrow (2 \times \frac{2}{3} + 3)(3 \times \frac{2}{3} - 2) = (\frac{4}{3} + 3)(2 - 2) \\ &= (\frac{4}{3} + 3) 0 = 0.\end{aligned}$$

Therefore the given value of x is a solution of the given equation.

Question-14

Determine whether the given value of x is a solution of the given equation or not: $x^2 + x + 1 = 0$; $x = -1$.

Solution:

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

$$\text{Let } x = -1 \Rightarrow (-1)^2 + (-1) + 1 = 1 - 1 + 1 = 1.$$

Therefore the given value of x is not a solution of the given equation.

Question-15

Determine whether the given values of x are solutions of the given equation or not:

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

Solution:

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

$$\text{Put } x = -1$$

$$\Rightarrow (-1)^2 + 6(-1) + 5 = 1 - 6 + 5 = 0$$

$$\text{Put } x = -5$$

$$\Rightarrow (-5)^2 + 6(-5) + 5 = 25 - 30 + 5 = 0$$

Therefore the given value of x is a solution of the given equation.

Question-16

Determine whether the given values of x are solutions of the given equation or not: $9x^2 - 3x - 2 = 0$; $x = -\frac{1}{3}$, $x = \frac{2}{3}$.

Solution:

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

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

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

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

$$9x^2 - 3x - 2 = 9(\frac{2}{3})^2 - 3(\frac{2}{3}) - 2 = 4 - 2 - 2 = 0$$

Therefore the given value of x is a solution of the given equation.

Question-17

Determine whether the given values of x are solutions of the given equation or not:

$$(x + 4)(x - 5) = 0; x = -4, x = 5.$$

Solution:

$$\text{Put } x = -4$$

$$(x + 4)(x - 5) = (-4 + 4)(-4 - 5) = 0(-9) = 0$$

$$\text{Put } x = 5$$

$$(x + 4)(x - 5) = (5 + 4)(5 - 5) = 9(0) = 0$$

Therefore the given value of x is a solution of the given equation.

Question-18

Determine whether the given values of x are solutions of the given equation or not:

$$(3x + 8)(2x + 5) = 0; x = 2\frac{2}{3}, x = 2\frac{1}{2}.$$

Solution:

$$\text{Put } x = 2\frac{2}{3} = \frac{8}{3}$$

$$(3x + 8)(2x + 5) = (3 \times \frac{8}{3} + 8)(2 \times \frac{8}{3} + 5) = (8 + 8)(\frac{16}{3} + 5) = 16 \times \frac{31}{3} = \frac{496}{3} \neq 0$$

$$\text{Put } x = 2\frac{1}{2} = \frac{5}{2}$$

$$(3x + 8)(2x + 5) = (3 \times \frac{5}{2} + 8)(2 \times \frac{5}{2} + 5) = (\frac{15}{2} + 8)(5 + 5) = \frac{31}{2} \times 10 = 155 \neq 0$$

Therefore the given value of x is not the solution of the given equation.

Question-19

Using factorization, find the roots of the quadratic equation: $9x^2 - 16 = 0$.

Solution:

$$9x^2 - 16 = 0$$

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

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

$$x = 4/3, -4/3.$$

Question-20

Using factorization, find the roots of the quadratic equation: $64x^2 - 9 = 0$.

Solution:

$$64x^2 - 9 = 0$$

$$(8x)^2 - 3^2 = 0$$

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

$$\therefore x = 3/8, -3/8.$$

Question-21

Using factorization, find the roots of the quadratic equation: $(x - 2)^2 - 25 = 0$.

Solution:

$$(x - 2)^2 - 25 = 0$$

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

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

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

$$x = 7, -3.$$

Question-22

Using factorization, find the roots of the quadratic equation: $(x + 5)^2 - 36 = 0$.

Solution:

$$(x + 5)^2 - 36 = 0$$

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

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

$$(x - 1)(x + 11) = 0$$

$$x = 1, -11$$

Question-23

Using factorization, find the roots of the quadratic equation: $(2x + 3)^2 = 81$.

Solution:

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

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

$$(2x + 3 - 9)(2x + 3 + 9) = 0$$

$$(2x - 6)(2x + 12) = 0$$

$$x = 3, -6.$$

Question-24

Using factorization, find the roots of the quadratic equation: $y^2 - 3 = 0$
[Hint: $3 = (\sqrt{3})^2$].

Solution:

$$y^2 - 3 = 0$$

$$y^2 - (\sqrt{3})^2 = 0$$

$$(y - \sqrt{3})(y + \sqrt{3}) = 0$$

$$y = \sqrt{3}, -\sqrt{3}.$$

Question-25

Using factorization, find the roots of the quadratic equation: $a^2z^2 - b^2 = 0$.

Solution:

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

$$(az)^2 - b^2 = 0$$

$$(az - b)(az + b) = 0$$

$$z = b/a, -b/a.$$

Question-26

Using factorization, find the roots of the quadratic equation: $3z - z^2 = 0$.

Solution:

$$3z - z^2 = 0$$

$$z(3 - z) = 0$$

$$z = 0 \text{ or } (3 - z) = 0$$

$$z = 0, z = 3.$$

Question-27

Using factorization, find the roots of the quadratic equation: $5z^2 - 30 = 0$.

Solution:

$$5z^2 - 30 = 0$$

$$5(z^2 - 6) = 0$$

$$z^2 - (\sqrt{6})^2 = 0$$

$$(z - \sqrt{6})(z + \sqrt{6}) = 0$$

$$z = \sqrt{6}, -\sqrt{6}.$$

Question-28

Using factorization, find the roots of the quadratic equation: $ax^2 - 2abx = 0$.

Solution:

$$ax^2 - 2abx = 0$$

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

$$ax = 0 \text{ or } (x - 2b) = 0$$

$$x = 0 \text{ or } x = 2b.$$

Question-29

Using factorization, find the roots of the quadratic equation: $4y^2 + 4y + 1 = 0$.

Solution:

$$4y^2 + 4y + 1 = 0$$

$$4y^2 + 2y + 2y + 1 = 0$$

$$2y(2y + 1) + (2y + 1) = 0$$

$$(2y + 1)(2y + 1) = 0$$

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

$$y = -1/2 \text{ or } y = -1/2.$$

Question-30

Using factorization, find the roots of the quadratic equation: $y^2 - 8y + 16 = 0$.

Solution:

$$y^2 - 8y + 16 = 0$$

$$y^2 - 4y - 4y + 16 = 0$$

$$y(y - 4) - 4(y - 4) = 0$$

$$(y - 4)(y - 4) = 0$$

$$y = 4 \text{ or } y = 4.$$

Question-31

Using factorization, find the roots of the quadratic equation: $z^2 - z + \frac{1}{4} = 0$.

Solution:

$$z^2 - z + \frac{1}{4} = 0$$

$$z^2 - \frac{1}{2}z - \frac{1}{2}z + \frac{1}{4} = 0$$

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

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

$$z = \frac{1}{2} \text{ or } z = \frac{1}{2}.$$

Question-32

Using factorization, find the roots of the quadratic equation: $\frac{1}{9}x^2 - \frac{2}{3}x + 1 = 0$.

Solution:

$$\frac{1}{9}x^2 - \frac{2}{3}x + 1 = 0$$

$$\frac{1}{9}x^2 - \frac{1}{3}x - \frac{1}{3}x + 1 = 0$$

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

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

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

Question-33

Using factorization, find the roots of the quadratic equation: $y^2 + 2\sqrt{3}y + 3 = 0$.

Solution:

$$y^2 + 2\sqrt{3}y + 3 = 0$$

$$y^2 + \sqrt{3}y + \sqrt{3}y + 3 = 0$$

$$y(y + \sqrt{3}) + \sqrt{3}(y + \sqrt{3}) = 0$$

$$(y + \sqrt{3})(y + \sqrt{3}) = 0$$

$$y = -\sqrt{3} \text{ or } y = -\sqrt{3}.$$

Question-34

Using factorization, find the roots of the quadratic equation: $x^2 - 4qx + 4q^2 = 0$.

Solution:

$$x^2 - 4qx + 4q^2 = 0$$

$$x^2 - 2qx - 2qx + 4q^2 = 0$$

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

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

$$x = 2q \text{ or } x = 2q.$$

Question-35

Using factorization, find the roots of the quadratic equation: $z^2 - 2z - 8 = 0$.

Solution:

$$z^2 - 2z - 8 = 0$$

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

$$z(z - 4) + 2(z - 4) = 0$$

$$(z - 4)(z + 2) = 0$$

$$z = 4 \text{ or } z = -2.$$

Question-36

Using factorization, find the roots of the quadratic equation: $6z^2 - 5z - 21 = 0$.

Solution:

$$6z^2 - 5z - 21 = 0$$

$$6z^2 - 14z + 9z - 21 = 0$$

$$2z(3z - 7) + 3(3z - 7) = 0$$

$$(2z + 3)(3z - 7) = 0$$

$$(2z + 3) = 0 \text{ or } (3z - 7) = 0$$

$$z = -3/2 \text{ or } z = 7/3.$$

Question-37

Using factorization, find the roots of the quadratic equation: $y^2 + 3y - 18 = 0$.

Solution:

$$y^2 + 3y - 18 = 0$$

$$y^2 + 6y - 3y - 18 = 0$$

$$y(y + 6) - 3(y + 6) = 0$$

$$(y - 3)(y + 6) = 0$$

$$y = 3 \text{ or } y = -6.$$

Question-38

Using factorization, find the roots of the quadratic equation: $y^2 - 3y - 10 = 0$.

Solution:

$$y^2 - 3y - 10 = 0$$

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

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

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

$$y = -2 \text{ or } y = 5.$$

Question-39

Using factorization, find the roots of the quadratic equation: $6y^2 - y - 2 = 0$.

Solution:

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

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

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

$$(2y + 1)(3y - 2) = 0$$

$$2y + 1 = 0 \text{ or } 3y - 2 = 0$$

$$y = -1/2 \text{ or } y = 2/3.$$

Question-40

Using factorization, find the roots of the quadratic equation: $9y^2 - 3y - 2 = 0$.

Solution:

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

$$9y^2 - 6y + 3y - 2 = 0$$

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

$$(3y + 1)(3y - 2) = 0$$

$$y = -1/3 \text{ or } y = 2/3.$$

Question-41

Using factorization, find the roots of the quadratic equation: $5z^2 - 3z - 2 = 0$.

Solution:

$$5z^2 - 3z - 2 = 0$$

$$5z^2 - 5z + 2z - 2 = 0$$

$$5z(z - 1) + 2(z - 1) = 0$$

$$(5z + 2)(z - 1) = 0$$

$$z = -2/5 \text{ or } z = 1.$$

Question-42

Using factorization, find the roots of the quadratic equation: $2z^2 + az - a^2 = 0$.

Solution:

$$2z^2 + az - a^2 = 0$$

$$2z^2 + 2az - az - a^2 = 0$$

$$2z(z + a) - a(z + a) = 0$$

$$(z + a)(2z - a) = 0$$

$$z = -a \text{ or } z = a/2.$$

Question-43

Using factorization, find the roots of the quadratic equation: $8x^2 - 22x - 21 = 0$.

Solution:

$$8x^2 - 22x - 21 = 0$$

$$8x^2 + 6x - 28x - 21 = 0$$

$$2x(4x + 3) - 7(4x + 3) = 0$$

$$(2x - 7)(4x + 3) = 0$$

$$x = 7/2 \text{ or } x = -3/4.$$