

Quadratic Equation

Definition:

A quadratic equation is a polynomial equation of the second degree.

General Form:

The general form is,

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

Where x represents a variable or unknown, and a, b, c are real numbers, with $a \neq 0$

a = Quadratic Coefficient.

b = linear coefficient.

c = Constant term.

The form $ax^2 + bx + c = 0$ is the standard form of a quadratic equation. For example.

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

2) $y^2 + 6y = -8$

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

All are quadratic equations but only $x^2 + 5x + 6 = 0$ is in standard form.

Quadratic or not Quadratic?

1) $x^2 + 5x + 10 = 0$

2) $12 - 4x = 0$

3) $3m + 8 = 15$

4) $25 - n^2 = 4n$

Quadratic

Not Quadratic

Not Quadratic

$n^2 - 4n + 25 = 0$ Quadratic

Quadratic Equations	Standard Form ax^2+bx+c	a	b	c
1) $5 - 2x^2 = 6x$	$-2x^2 - 6x + 5 = 0$ or $2x^2 + 6x - 5 = 0$	-2 2	-6 6	5 -5
2) $3x - 2x^2 = 7$	$-2x^2 + 3x - 7 = 0$ $2x^2 - 3x + 7 = 0$	-2 2	3 -3	-7 7
3) $(x+3)(x+4)$	$x^2 + 7x + 12 = 0$	1	7	12

$$\begin{aligned}
 x \cdot x &= x^2 \\
 1 \cdot 4 &= 4x \\
 3 \cdot x &= 3x \\
 3 \cdot 4 &= 12
 \end{aligned}$$

$$x^2 + 4x + 3x + 12 = 0 \Rightarrow x^2 + 7x + 12 = 0$$

Examples:

$$1) 3x^2 + 3x + 6 = 0$$

$$2) j^2 + j + 6 = 0$$

$$3) s^2 - s + 6 = 0$$

$$4) 2s^2 + 5s + 3 = 0$$

$$5) 2u^2 + 5u + 3 = 0$$

$$6) (x+1)^2 = (2x+3)^2$$

$$x^2 + 2x + 1 = 4x^2 + 12x + 9$$

$$x^2 + 2x + 1 - 4x^2 - 12x - 9 = 0$$

$$-3x^2 - 10x - 8 = 0$$

$$-(3x^2 + 10x + 8) = 0$$

$$3x^2 + 10x + 8 = 0$$

Solution of Quadratic Equation: by factorisation method

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

$acx^2 \begin{cases} + \\ - \end{cases}$

Example:

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

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

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

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

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

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

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

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

$$* 2 \times 3 = 6$$

$$* \begin{array}{l} 2 \times 3 \checkmark \\ 3 \times 2 \checkmark \\ 6 \times 1 \times \end{array}$$

Example:

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

$$6x^2 - (4-3)x - 2 = 0$$

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

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

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

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

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

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

$$+6x - 2 = -12$$

$$\begin{array}{l} 6 \times 2 \times \\ 4 \times 3 \checkmark \\ 12 \times 1 \times \end{array}$$

Question #1

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

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

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

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

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

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

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

Q#2: $2x^2 + x - 6 = 0$

$$2x^2 + (4-3)x - 6 = 0$$

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

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

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

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

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

Q#3

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

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

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

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

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

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

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

Q#4

$$2x^2 - x + \frac{1}{8} = 0$$

$$\frac{16x^2 - 8x + 1}{8} = 0$$

$$16x^2 - 8x + 1 = 0$$

$$16x^2 - (4+4)x + 1 = 0$$

$$16x^2 - 4x - 4x + 1 = 0$$

$$4x(4x-1) - 1(4x-1) = 0$$

$$(4x-1)(4x-1) = 0$$

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

$$x = 1/4 \quad \text{or} \quad x = 1/4$$

Q#5: $100x^2 - 20x + 1 = 0$

$$100x^2 - 10x - 10x + 1 = 0$$

$$10x(10x-1) - 1(10x-1) = 0$$

$$(10x-1)(10x-1) = 0$$

$$10x-1 = 0 \quad \text{or} \quad 10x-1 = 0$$

$$x = 1/10 \quad \text{or} \quad x = 1/10$$