



Quadratic Equation

Suppose we have two variables 'x' and 'y'.

The relationship between the variables can be any one of the following:

$$x > y$$

$$x < y$$

$x = y$ or relation can't be established between x & y

$$x \geq y$$

$$x \leq y$$

WHAT DOES THE SYMBOLS DENOTE?

Before getting deep into the quadratic equations, let us try to understand the meaning of the basic operations used in finding the relationship between the variables –

(1) '>' symbol: This symbol indicates that variable on the left side is definitely greater than the variable on the right side of the symbol.

For example: $x > y$ means x is definitely greater than y.

(2) '<' symbol: This symbol indicates that the variable on the left is definitely smaller than the variable on the right side of the symbol.

For example: $x < y$ means x is definitely smaller than y.

(3) '=' symbol: This symbol indicates that variable on the left side is equal to the variable on the right side of the symbol.

(4) '≥' symbol: This symbol indicates that variable on the left side is either greater than or equal to the variable on the right side of the symbol.

For example: $x \geq y$ means x is either greater than y or equal to y.

(5) '≤' symbol: This symbol indicates that variable on the left side is either smaller than or equal to the variable on the right side of the symbol.

For example: $x \leq y$ means x is either smaller than y or equal to y.



General form of a Quadratic Equation = $ax^2 + bx + c = 0$

Quadratic equation means that it will definitely have the maximum power of the variable as '2' which means we will always see ax^2 term in a quadratic equation.

Or we can say that b can be 0, c can be 0 but a will never be 0.

Whenever we solve a quadratic equation, we will get exactly 2 values of the equation. These 2 values are called roots of the equation. The roots of the equation always satisfy the equation. So in case of doubt, we can check the solution by putting the values back into the equation. If the equation turns out to be zero then our roots are correct.

First method:

The general quadratic equation is $ax^2 + bx + c = 0$

$$\text{or, } x^2 + (b/a)x + (c/a) = 0$$

Now let us compare these two highlighted equations, After comparison, we will get:

$$(\alpha + \beta) = -(b/a)$$

$$\alpha\beta = c/a$$

Example: $x^2 + 9x + 20 = 0$

$a=1, b=9, c=20$

$$\alpha\beta = 20/1 = 20$$

So, now we have to think which two numbers multiplication gives us 20 and their addition gives -9

The answer is -5 and -4.

So these two are the roots or solution for equation $x^2 + 9x + 20 = 0$.

Second method:

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

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

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

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

So $x = -4$ and $x = -5$



Third method:

Use of formula for finding the roots of a quadratic equation: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$x = \frac{-9 \pm \sqrt{9^2 - 4 \cdot 1 \cdot 20}}{2 \cdot 1}$$

$$x = \frac{-9 \pm \sqrt{81 - 80}}{2} \quad x = \frac{-9 \pm \sqrt{1}}{2}$$

$$x = \frac{-9 \pm 1}{2}$$

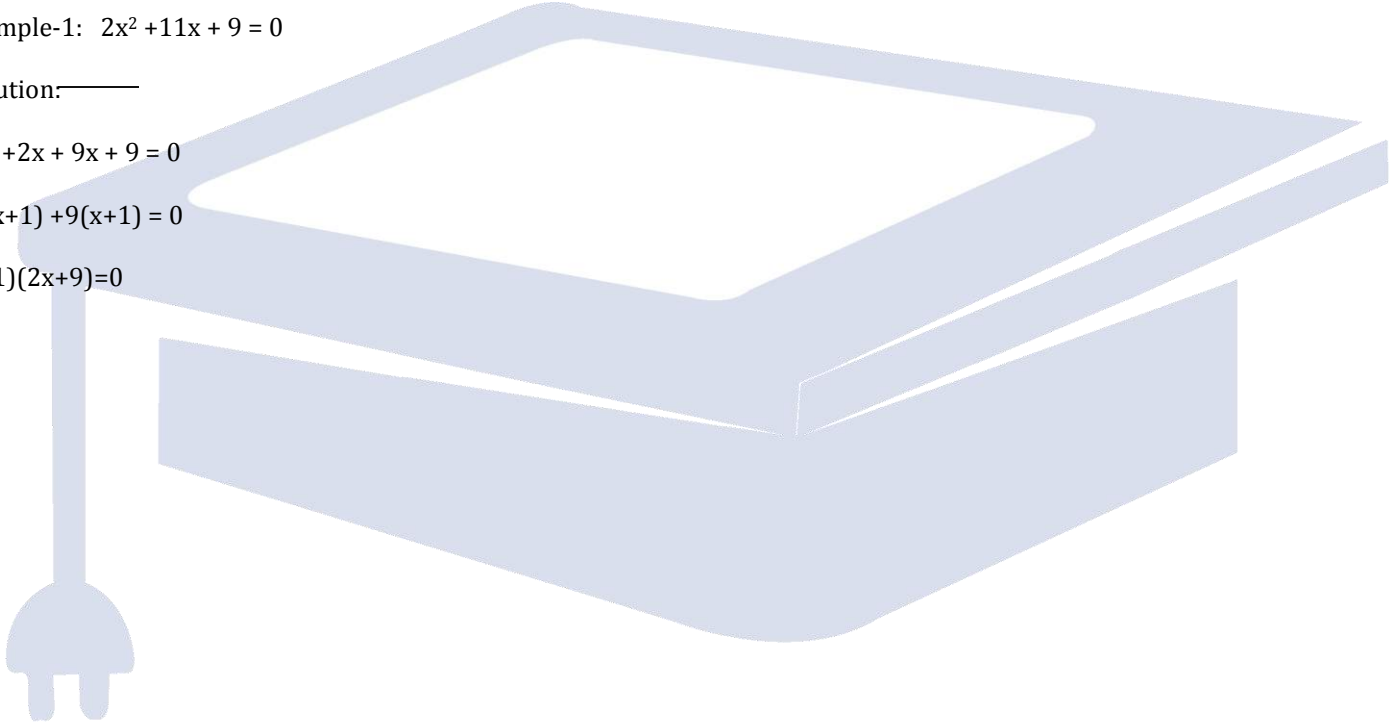
Example-1: $2x^2 + 11x + 9 = 0$

Solution: _____

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

$$2x(x+1) + 9(x+1) = 0$$

$$(x+1)(2x+9) = 0$$



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