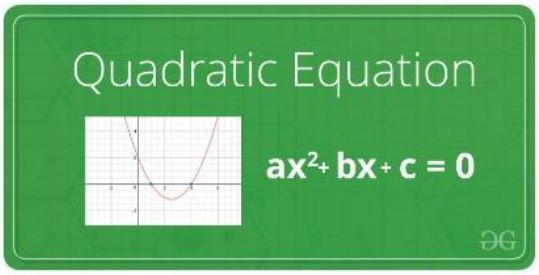
Quadratic equation



A **quadratic equation** is a second-order polynomial equation of a variable say **x**. The general form of a quadratic equation is given as:

```
a*x² + b*x + c = 0

Where a,b and c are real known values and,
a can't be zero.
```

Roots of an Equation: The roots of an equation are the values for which the equation satisfies the given condition. For Example, the roots of equation **x^2 - 7x - 12 = 0** are 3 and 4 respectively. If we replace the value of x by 3 and 4 individually in the equation, the equation will evaluate to zero.

A quadratic equation has two roots. The roots of a quadratic equation can be easily obtained using the quadratic formula:

```
roots = (-b ± √(b² - 4ac))/2a
```

Derivation:

```
ax2 + bx + c = 0

or, ax² + bx = -c

or, x² + (b/a)x = -(c/a)

or, x² + (b/a)x + (b²/4a²) - (b²/4a²) = -(c/a)

or, x² + (b/a)x + (b²/4a²) = -(c/a) + (b²/4a²)

or, (x + b/2a)²  = -(c/a) + (b²/4a²)

or, (x + b/2a)²  = (b²  - 4ac) /4a²

or, (x + b/2a) = ± √(b² - 4ac) /2a

or, x = (-b ± √(b² - 4ac))/2a
```

There arises **three cases** as described below while finding the roots of a quadratic equation:

```
If b² < 4ac, then roots are complex
(not real).
For example roots of x² + x + 1, roots are
-0.5 + i1.73205 and -0.5 - i1.73205

If b² = 4ac, then roots are real
and both roots are same.
For example, roots of x² - 2x + 1 are 1 and 1

If b² > 4ac, then roots are real
and different.
For example, roots of x² - 7x - 12 are 3 and 4
```