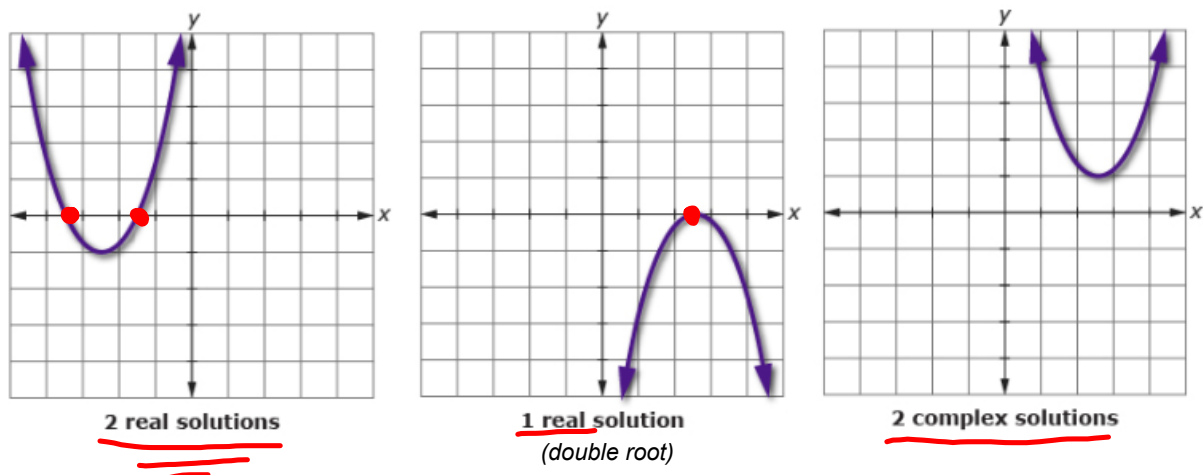


## Predicting Solution Types Graphically

First, the graph of a quadratic function is a parabola. The parabola can exist in different locations relative to the axes on the graph. The  $x$ -intercepts are the solutions of the equation. If there are no  $x$ -intercepts, then the solutions are complex. If there is one  $x$ -intercept, then there is one solution, called a **double root**.



## Predicting Solution Types Using the Discriminant

The discriminant, part of the quadratic formula, can also be used to predict the number and type of solutions.

The **discriminant** is the part of the quadratic formula under the radical,  $b^2 - 4ac$  and can be used to find the number and type of solutions of a quadratic equation.

- ● If  $b^2 - 4ac < 0$ , then there are two complex solutions.
- ● If  $b^2 - 4ac = 0$ , then there is one real, double solution.
- ● If  $b^2 - 4ac > 0$ , then there are two real solutions.
  - If the **discriminant** is a perfect square, then real solutions are rational.
  - If the discriminant is not a perfect square, then real solutions are irrational.

**Ex5.)** Predict how many and what types of solutions each quadratic equation will have.

$$x^2 = 4x + 13$$

$$x^2 - 4x - 13 = 0$$

$$b^2 - 4ac$$

$$(-4)^2 - 4(1)(-13)$$

$$16 + 52$$

↑ 68  
positive

2 real solutions

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

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

$$b^2 - 4ac$$

$$(-12)^2 - 4(4)(9)$$

$$144 - 144$$

0  
zero, so 1 real solution

**Ex6.)** The quadratic equation below gives the height of a ball,  $h$ , in feet above the ground after  $t$  seconds of being thrown upward. Will the ball ever reach a height of 29 feet?

$$h = -16t^2 + 32t + 9$$

$$\underline{29} = -16t^2 + 32t + \underline{9}$$

$$\underline{-29}$$

$$0 = \underset{a}{-16}t^2 + \underset{b}{32}t - \underset{c}{20}$$

$$(32)^2 - 4(-16)(-20)$$

discriminant  
-256  
So, no real solutions, which means imaginary times, thus the ht. will not reach 29 ft.