

# The Quadratic Formula

The solutions of a quadratic equation of the form  $ax^2 + bx + c = 0$  are given by the following formula:

The Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**The Discriminant:** determines the number and type of roots

Value of Discriminant $b^2 - 4ac$	$b^2 - 4ac$ is positive and a perfect square	$b^2 - 4ac$ is positive and is NOT a perfect square	$b^2 - 4ac = 0$	$b^2 - 4ac < 0$ (a negative number)
	answer will be a # 2 real sol.	answer will have a radical 2 real sol.	1 real sol.	2 imag. sol.
Example of Graph of Related Function				

\*always set equal to zero  
 Example 1: Find the value of the discriminant, and then state the number and type of solutions.

a)  $9x^2 - 3x - 8 = -10$   
 $9x^2 - 3x + 2 = 0$   
 $a=9, b=-3, c=2$   
 $(-3)^2 - 4(9)(2) = -63$   
 2 imag. sol.

b)  $-2x^2 - 8x - 14 = -6$   
 $-2x^2 - 8x - 8 = 0$   
 $a=-2, b=-8, c=-8$   
 $(-8)^2 - 4(-2)(-8) = 0$   
 1 real sol.

c)  $-6x^2 - 9 = -7x - 9$   
 $0 = 6x^2 - 7x - 3$   
 $a=6, b=-7, c=-3$   
 $(-7)^2 - 4(6)(-3) = 121$   
 2 real sol.

d)  $4x^2 + 5x + 4 = -3x$   
 $4x^2 + 8x + 4 = 0$   
 $a=4, b=8, c=4$   
 $(8)^2 - 4(4)(4) = 0$   
 1 real sol.

Example 2: Find the value of k, given the equation  $f(x) = x^2 + kx + 18$ , for each of the following.

a) Two imaginary solutions  
 $a=1, b=k, c=18$   
 $k^2 - 4(1)(18)$   
 $k^2 - 72 = \text{neg}$   
 $k \geq 8$

b) One real solution  
 $k^2 - 72 = \text{zero}$   
 $k = \sqrt{72}$   
 or  
 $\approx 8.485$

c) Two real solutions  
 $k^2 - 72 = \text{pos}$   
 $k \geq 9$