Algebra 1 **9.6 Notes – Quadratic Formula and the Discriminant**

Methods for Solving Quadratics:

- completing the square
- graphing
- with square roots
- factoring / zero product property

Quadratic Formula: gives solutions of quadratic equations in the form $ax^2+bx+c=0$ for real values of a, b and c. The quadratic formula is a useful method to find the solutions to any quadratic equations.

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

Ex. 1: Find the solutions to the equation: $x^2-7=4x$

$-4x \quad -4x$

$x^2-4x-7=0$

$a=1,\ b=-4,\ c=-7$

$$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(1)(-7)}}{2(1)}$$

$$x=\frac{4\pm\sqrt{16+28}}{2}$$

$$x=\frac{4\pm\sqrt{44}}{2}=\frac{4\pm 6.63}{2}$$

$\frac{10.63}{2}=5.32$

$\frac{-2.63}{2}=-1.32$

$x=5.32$ & -1.32

1) Bring all terms to one side of the equal sign.
2) Identify a, b, and c. **Be sure to include signs in front of value.**
3) Plug values into the quadratic formula.
4) Simplify and solve.

Ex. 2: Find the solutions to the equation: $21-4x=x^2$

$0=x^2+4x-21$

$a=1,\ b=4,\ c=-21$

$$x=\frac{-4\pm\sqrt{(4)^2-4(1)(-21)}}{2(1)}$$

$$x=\frac{-4\pm\sqrt{16+84}}{2}$$

$$x=\frac{-4\pm\sqrt{100}}{2}=\frac{-4\pm 10}{2}$$

$\frac{-4+10}{2}=3$

$\frac{-4-10}{2}=\frac{-14}{2}=-7$

$x=-7, 3$

You Try! Find the solutions to the equation: $x^2 - 2x = 24$

$x^2 - 2x - 24 = 0$

$a = 1 \quad b = -2 \quad c = -24$

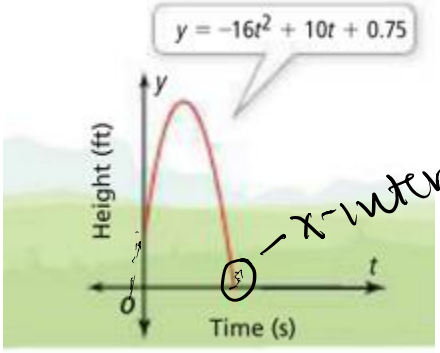
$x = \dfrac{2 \pm \sqrt{(-2)^2 - 4(1)(-24)}}{2(1)}$

$x = \dfrac{2 \pm \sqrt{4 + 96}}{2} = \dfrac{2 \pm \sqrt{100}}{2} = \dfrac{2 \pm 10}{2}$

$\dfrac{2+10}{2} = 6$ $\qquad$ $\dfrac{2-10}{2} = -4$

$x = 6, -4$

Ex. 3: The function shown represents the height of the frog x seconds after it jumps off a rock. How many seconds is the frog in the air before it lands on the ground?



x-intercept

$a = -16, \quad b = 10, \quad c = 0.75$

*ground is an x-intercept

$x = \dfrac{-10 \pm \sqrt{(10)^2 - 4(-16)(0.75)}}{2(-16)}$

$x = \dfrac{-10 \pm \sqrt{100 + 48}}{-32} = \dfrac{-10 \pm \sqrt{148}}{-32}$

$\dfrac{-10+12.166}{-32} = -.068$ $\qquad$ $\dfrac{-10-12.166}{-32} = 0.69$

$\dfrac{-10 \pm 12.166}{-32}$

0.69 sec

The Discriminant indicates the number of real solutions of the equation. The discriminant is the expression $b^2 - 4ac$.

If $b^2 - 4ac > 0$, there are two real solutions.
If $b^2 - 4ac = 0$, there is one real solution.
If $b^2 - 4ac < 0$, there are no real solutions.

Find the number of solutions for $x^2 - 4x + 3 = 0$

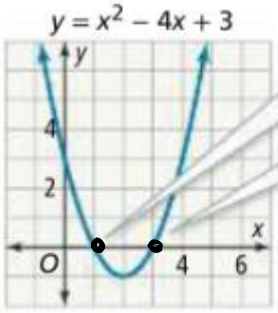
$b^2 - 4ac$

$(-4)^2 - 4(1)(3)$

$16 - 12 = 4$

$4 > 0$

so 2 solutions



The graph of the related function intersects the x-axis at two points.

Find the number of solutions for $-x^2-4x-4=0$

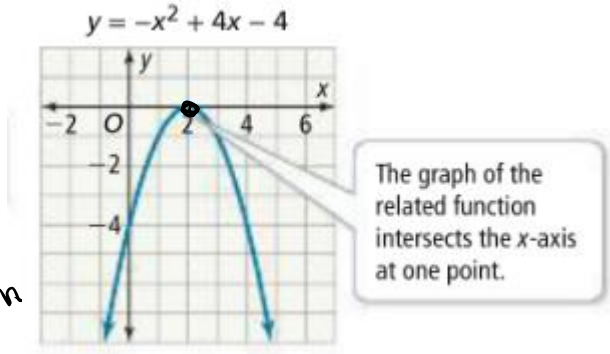
b^2-4ac

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

$16-16=0$

$0=0$

there is 1 solution



Find the number of solutions for $x^2-4x+5=0$

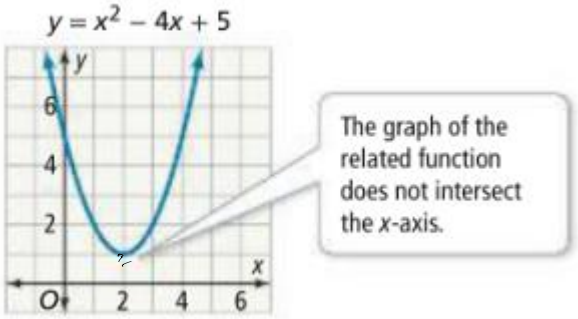
b^2-4ac

$(-4)^2-4(1)(5)$

$16-20=-4$

$-4<0$

there are no solutions



You Try! Use the discriminant to determine how many real solutions the quadratic has. $-x^2-6x-10=0$

$(-6)^2-4(-1)(-10)$

$36-40=-4$

$-4<0$

No solutions