THE QUADRATIC FORMULA

~~SOLVE the following quadratic equation by factoring: $x^2 + 7x - 14 = 0$~~

$y = ax^2 + bx + c$

Quadratic equations are not always factorable so we need another way to find solutions – THE QUADRATIC FORMULA!

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

What are some other words for SOLUTIONS of quadratics?

zeros, roots, x-intercepts, values of x, solutions

Now let's try to solve the above equation using the formula: $x^2 + 7x - 14 = 0$

EXAMPLES:

$x^2 - 5x - 24 = 0$ $\quad x = \{-3, 8\}$

$a=1 \quad b=-5 \quad c=-24$

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a} = \frac{-(-5) \pm \sqrt{(-5)^2-4(1)(-24)}}{2(1)} = \frac{5 \pm \sqrt{25+96}}{2}$

$x = \frac{5 \pm \sqrt{121}}{2}$

$x = \frac{5+\sqrt{121}}{2} = 8$ $\quad x = \frac{5-\sqrt{121}}{2} = -3$

$x^2 + 8x + 7 = 0$

$a=1 \quad b=8 \quad c=7$

$x = \frac{-8 \pm \sqrt{(8)^2-4(1)(7)}}{2(1)} = \frac{-8 \pm \sqrt{36}}{2}$

$x = \frac{-8+6}{2} = -1$ $\quad x = \frac{-8-6}{2} = -7$

$x = \{-7, -1\}$

$-x^2 - 8x - 16 = 0$

$2x^2 - 11x - 6 = 0$

REMEMBER: In order to SOLVE quadratic equations, the equation must be equal to ZERO.

$3m^2 + 5m - 38 = 4$

$7x^2 - 11 = -2$

SPECIAL CASES:

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

$5x^2 - 8x - 20 = 0$ $a=5$ $b=-8$ $c=-20$

$$x = \frac{-(-8) \pm \sqrt{(-8)^2-4(5)(-20)}}{2(5)} = \frac{8 \pm \sqrt{464}}{10}$$

$$x = \left\{\frac{8+\sqrt{464}}{10}, \frac{4-\sqrt{464}}{10}\right\}$$

$4x^2 - x - 2 = -5$

$+5 \quad +5$

$4x^2 - x + 3 = 0$

$a=4$ $b=-1$ $c=3$

$9x^2 - 6x + 1 = 0$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2-4(4)(3)}}{2(4)} = \frac{1 \pm \sqrt{-47}}{8}$$

No Solution

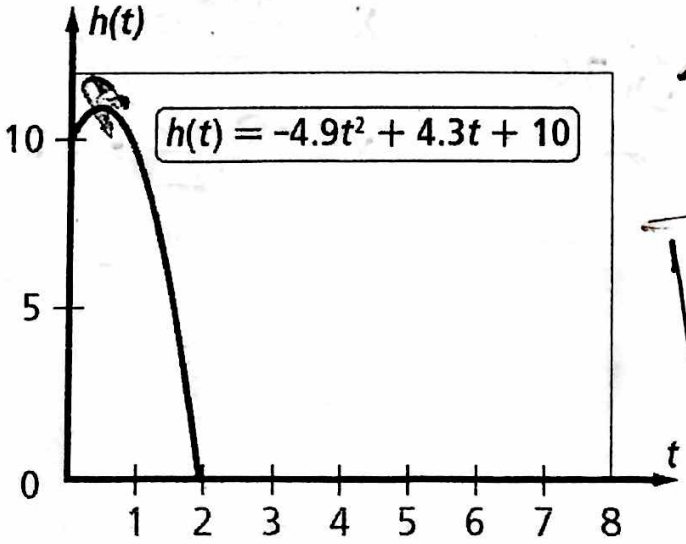
$b^2 - 4ac$ is called the DISCRIMINANT.

The discriminant determines how many solutions the quadratic equation will have.

- If the discriminant is:
  - ZERO: there is ONE SOLUTION
  - POSITIVE: there is TWO SOLUTIONS
  - NEGATIVE: there is NO SOLUTIONS

APPLICATION:

In 10-meter platform diving, the function $h(t) = -4.9t^2 + 4.3t + 10$ gives the approximate height h(t) above the water in meters a diver is at t seconds after launching into the dive if he jumps upward at an initial velocity of 4.3 meters per second. When the diver hits the water, h(t) is zero. To the nearest tenth, how many seconds elapse from the time the diver leaves the 10-meter platform until the diver hits the water?



$-4.9t^2 + 4.3t + 10 = 0$

$a=-4.9$ $b=4.3$ $c=10$

$t = 1.93$ sec