

## Quadratic Equations

A quadratic equation is an equation that can be written in the form  $ax^2 + bx + c = 0$ .

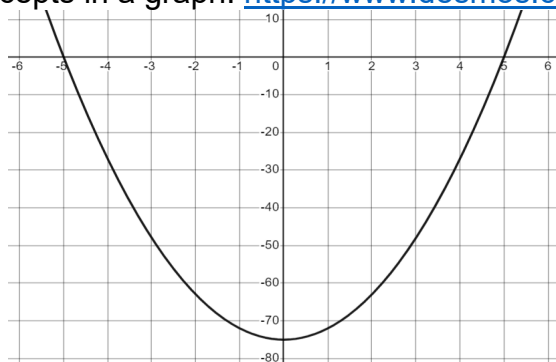
### The Square Root Property

If  $x^2 = k$ , then  $x = \pm\sqrt{k}$ . This allows us to solve quadratic equations with no  $bx$  term.

**Example:** Solve  $3x^2 - 75 = 0$ .

**Solution:**  $3x^2 = 75$ . Therefore  $x^2 = 25$ . Using the square root property,  $x = \pm\sqrt{25} = \pm 5$ .

The solutions are the  $x$ -intercepts in a graph. <https://www.desmos.com/calculator/5vz7f1aidd>



### The Zero Product Property

If  $(m)(n) = 0$ , then either  $(m) = 0$  or  $(n) = 0$  or both. This allows us to solve by factoring:

1. Write the equation with 0 on one side.
2. Factor the other side (the side with the variable) as much as possible.
3. Set each factor equal to zero, then solve each resulting equation.

**Example:** Solve  $2x^2 + 5x = 12$ .

**Solution:**  $2x^2 + 5x - 12 = 0$

$$2x^2 + 8x - 3x - 12 = 0$$

$$(2x - 3)(x + 4) = 0$$

- If  $2x - 3 = 0$ , then  $2x = 3$ , so  $x = \frac{3}{2}$ .
- If  $x + 4 = 0$ , then  $x = -4$ .

### The Quadratic Formula

In general, the equation  $ax^2 + bx + c = 0$  has solutions  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .

**Example:** Solve  $x^2 - 11x - 4 = 0$ .

**Solution:**  $a = 1$ ,  $b = -11$ ,  $c = -4$ .

$$x = \frac{+11 \pm \sqrt{+121 - 4(1)(-4)}}{2(1)} = \frac{11 \pm \sqrt{137}}{2}$$