

THE QUADRATIC FORMULA



LEARNING GOAL

- Understand the development of the quadratic formula, and use the quadratic formula to solve quadratic equations.



MINDS ON ...

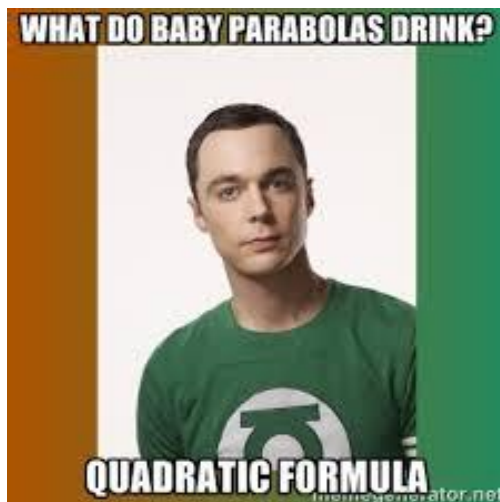
- Consider the quadratic relation the zeros?

$$y = x^2 - 4x - 7, \text{ what are}$$

- Can we factor this?

No

- Does it have zeros? It must have a vertex!



↑
Complete the
Square



BIG IDEAS

→ zeros

- The roots of a quadratic equation of the form $ax^2 + bx + c = 0$ can be determined using the quadratic formula:

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



$$y = ax^2 + bx + c$$

EXAMPLE

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

- Solve $6x^2 - x - 15 = 0$ using the quadratic formula.

$$a = 6, \quad b = -1, \quad c = -15$$

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

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(6)(-15)}}{2(6)}$$

$$= \frac{1 \pm \sqrt{1 - (-360)}}{12}$$

$$x = \frac{1 \pm \sqrt{1 + 360}}{12}$$

$$x = \frac{1 \pm \sqrt{361}}{12}$$



$$x = \frac{1 \oplus 19}{12}$$

$$x = \frac{1+19}{12}$$

$$x = \frac{1-19}{12}$$

$$x = \frac{20}{12}$$

$$x = \frac{-18}{12}$$

$$x = 1.67$$

$$x = -1.5$$

∴ The roots (zeros) are $x = 1.5$ and
 $x = 1.67$

ANOTHER EXAMPLE

- Solve $-2(x + 5)^2 + 2 = 0$.

First we have to put in standard form.

$$-2(x+5)^2 + 2 = 0 \quad \text{Expand \&}$$

$$-2(x+5)(x+5) + 2 = 0 \quad \text{Simplify}$$

$$-2(x^2 + 5x + 5x + 25) + 2 = 0$$

$$-2(x^2 + 10x + 25) + 2 = 0$$

$$-2x^2 - 20x - 50 + 2 = 0$$

$$-2x^2 - 20x - 48 = 0$$

$$a = -2 \quad b = -20 \quad c = -48$$



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

$$x = \frac{-(-20) \pm \sqrt{(-20)^2 - 4(-2)(-48)}}{2(-2)}$$

$$x = \frac{20 \pm \sqrt{400 - (384)}}{-4}$$

$$x = \frac{20 \pm \sqrt{16}}{-4}$$

$$x = \frac{20 \begin{matrix} + \\ - \end{matrix} 4}{-4}$$

$$x = \frac{20 + 4}{-4}$$

$$x = \frac{20 - 4}{-4}$$

$$x = \frac{24}{-4}$$

$$x = \frac{16}{-4}$$

$$x = -6$$

$$x = -4$$

\therefore The roots (zeros) are $x = -6$ and $x = -4$.

ONE LAST EXAMPLE

Expand
↓

- Solve $2x(x - 5) = x^2 + 1$.

$$2x^2 - 10x = x^2 + 1 \quad \leftarrow \text{Put in}$$

$$2x^2 - x^2 - 10x - 1 = 0 \quad \text{standard form.}$$

$$x^2 - 10x - 1 = 0$$

$$a = 1 \quad b = -10 \quad c = -1$$

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

$$x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(1)(-1)}}{2(1)}$$

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



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

$$x = \frac{10 \pm \sqrt{104}}{2}$$

$$x = \frac{10 \pm 10,2}{2}$$

$$x = \frac{10 + 10,2}{2}$$

$$x = \frac{10 - 10,2}{2}$$

$$x = \frac{20,2}{2}$$

$$x = \frac{-0,2}{2}$$

$$x = 10,1$$

$$x = -0,1$$

∴ The zeros are $x = 10,1$
and $x = -0,1$

REINFORCEMENT

- Page 343 – 344
 - #8acf, 9ac, 12, 13, 14

Don't forget Test,
Monday,

Ch. 5 + Completing
Square
-
-
-
Quadratic
Formula.

