13 Solve by Quadratic Formula

September 20, 2020 3:45 PM

To solve a quadratic equation, we can use:

1. graphing
2. factoring
3. square root principle
4. quadratic formula

$x^2 = \#$ → $(x-\square)^2 = \#$

The quadratic formula can be used to solve quadratics that are in the form $ax^2+bx+c=0$.

Quadratic Formula Assignment

Recite, from memory, the quadratic formula to one teacher, one family member, and one additional person of your choice.

In Math:

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

$\sqrt{\text{negative \#}}$ = No solution

$\{\}$

$\emptyset$

(+)(+) = (+) (+)(−) = (−)

(−)(−) = (+) (−)(+) = (−)

If b is negative, use brackets!

Ex. $b = -3$

$(-3)^2$ vs -3^2

9 vs -9

In English:

X equals negative b plus or minus the square root of b squared minus 4ac all over 2a.

I hereby testify that I recited the quadratic formula from memory with zero mistakes to three people.

Signature: _____

Date: _____

Pay attention to your signs!

Quadratic Formula

Before substituting values for a, b, and c, rearrange your equation into the form $ax^2+bx+c=0$.

$$\square x^2 + \bigcirc x + \heartsuit = 0$$

$$x = -\frac{\bigcirc \pm \sqrt{\bigcirc^2 - 4 \square \heartsuit}}{2 \square}$$

Example 1: Solve each equation:

a) $x^2 - 2x = 5$ Make 1 side = 0.

$-5 \quad -5$

$1x^2 - 2x - 5 = 0$

$a = 1, b = -2, c = -5$

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

$$= \frac{-(-2) \pm \sqrt{(-2)^2 - 4(1)(-5)}}{2(1)}$$

$$= \frac{2 \pm \sqrt{4 + 20}}{2}$$

$$= \frac{2 \pm \sqrt{24}}{2}$$

24 = 4 · 6 = (2·2)(2·3)

$$= \frac{2 \pm \sqrt{2 \cdot 2 \cdot 2 \cdot 3}}{2}$$

$$= \frac{2 \pm 2\sqrt{6}}{2}$$

$$= \frac{2}{2} \pm \frac{2\sqrt{6}}{2}$$

$$= \boxed{1 \pm \sqrt{6}}$$

b) $6x^2 - 3 = 7x$

$-7x \quad -7x$

$6x^2 - 7x - 3 = 0$

$a = 6 \quad b = -7 \quad c = -3$

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

$$= \frac{-(-7) \pm \sqrt{(-7)^2 - 4(6)(-3)}}{2(6)}$$

$$= \frac{7 \pm \sqrt{49 + 72}}{12}$$

$$= \frac{7 \pm \sqrt{121}}{12}$$

121 = 11 · 11

$$= \frac{7 \pm 11}{12}$$

$$= \frac{7 + 11}{12} \quad \frac{7 - 11}{12}$$

$$= \frac{18 \div 6}{12 \div 6} \quad \frac{-4 \div 4}{12 \div 4}$$

$$= \boxed{\frac{3}{2}} \quad \boxed{-\frac{1}{3}}$$

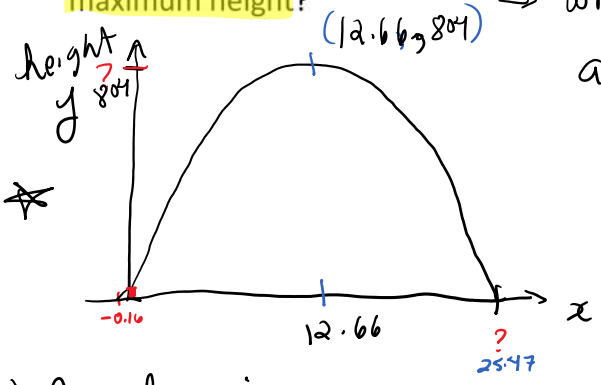
Example 2 - Revenue: A store rents an average of 750 video games each month at the current rate of $4.50. The store's owners want to raise the rental rate to increase the revenue to $6500 per month. However, for every $1 increase, they know they will rent 30 fewer games each month. The following function relates the price increase, *p*, to the revenue, *r*.

$$(4.5 + p)(750 - 30p) = r$$

By how much should the owners increase the rental rate to generate revenue of $6500 per month? What would the new price be?

Example 3 – Trajectory Problem: A rocket is shot up into the air. Its trajectory follows the equation $h(t) = -4.9t^2 + 124t + 20$, where t is the time it seconds it takes to reach height, h. What is a) the total airtime (i.e., time in flight)? and b) What is the maximum height?

↳ when does it hit ground?



a) $h = 0$?

$0 = -4.9x^2 + 124x + 20$

$a = -4.9$

$b = 124$

$c = 20$

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

$= \frac{-124 \pm \sqrt{124^2 - 4(-4.9)(20)}}{2(-4.9)}$

$= \frac{-124 \pm \sqrt{15768}}{-9.8}$

15768 → √ → ANS → $6\sqrt{438}$

$= \frac{-124 \pm 6\sqrt{438}}{-9.8}$

$\frac{-124 + 6\sqrt{438}}{-9.8}$ $\qquad$ $\frac{-124 - 6\sqrt{438}}{-9.8}$

Calc: $-124 + 6 \sqrt{} 438 = \div -9.8 =$ $\qquad$ $= \frac{-249.57}{-9.8}$

$= \frac{1.57}{-9.8}$ $\qquad$ $= 25.47$ sec

$= -0.16$ Reject! Can't have negative time!

The rocket was in the air for 25.47 sec

b) Axis of sym:

Take avg: $\frac{-0.16 + 25.47}{2}$

$= 12.66$ sec

For word problems, use calculator!

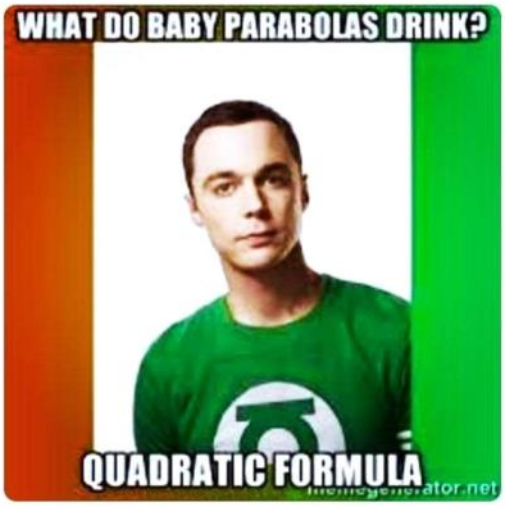
Max height: Plug $x = 12.66$ into

$y = -4.9x^2 + 124x + 20$

$= -4.9(12.66)^2 + 124(12.66) + 20$

$\approx 804.$ m

The max height is 804 m.



Assignment: Sec 7.7, p. 428, #4abd, 6ab, 7, 10.