# 9.3: Solving Quadratic Equations Using Square Roots

## Essential Question

How can you determine the number of solutions of a quadratic equation of the form $ax^2 + c = 0$?

Essential Question

Solve each equation by graphing. Explain how the number of solutions of $ax^2 + c = 0$ relates to the graph of $y = ax^2 + c$.

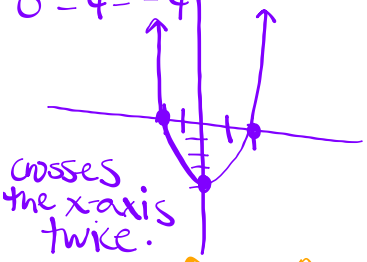
a. $x^2 - 4 = 0$

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

$x+2=0$ $\quad x-2=0$

$x=-2$ $\quad x=2$

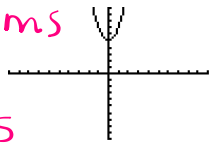
$0^2-4=-4$



crosses the x-axis twice.

b. $2x^2 + 5 = 0$

no real solutions because doesn't cross the x-axis.



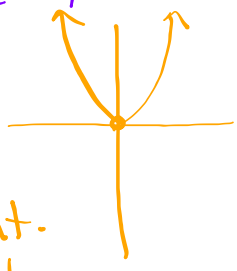
c. $x^2 = 0$

(0,0)

$x=0$

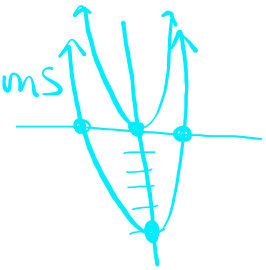
1 x-int.

& 1 sol.



d. $x^2 - 5 = 0$

2 solutions w/ 2 x-int.



Exploration 1

**9.3 Soving Quadratics Using Square Roots with work**

Complete each table. Use the completed tables to estimate the solutions of $x^2 - 5 = 0$. Explain your reasoning.

a.

| $x$ | $x^2 - 5$ |
|---|---|
| 2.21 | -0.01159 |
| 2.22 | -0.0716 |
| 2.23 | -0.0271 |
| 2.24 | 0.0176 |
| 2.25 | 0.0625 |
| 2.26 | 0.10 |

$(2.26)^2 - 5$

b.

| $x$ | $x^2 - 5$ |
|---|---|
| −2.21 | -0.01159 |
| −2.22 | -0.0716 |
| −2.23 | -0.0271 |
| −2.24 | 0.0176 |
| −2.25 | 0.0625 |
| −2.26 | 0.10 |

$(-2.26)^2 - 5$

Exploration 2

Two equations are equivalent when they have the same solutions.

a. Are the equations $x^2 - 5 = 0$ and $x^2 = 5$ equivalent? Explain your reasoning.

Yes, because it is ±5.

$(-2)(-2) = 4$
$(2)(2) = 4$

b. Use the square root key on a calculator to estimate the solutions of $x^2 - 5 = 0$. Describe the accuracy of your estimates.

~~If you~~ $\sqrt{\ }$ ~~⇒~~ you ±. ~~✗~~

$x^2 - 5 = 0$
$+5 \quad +5$
$\sqrt{x^2} = \sqrt{5}$
$x = \pm\sqrt{5}$

$\sqrt{\ }^2$

$\sqrt{2} \cdot \sqrt{2} = \sqrt{4} = 2$

$(\sqrt{3})^2 = 3$

c. Write the exact solutions of $x^2 - 5 = 0$.

Exploration 3

## Core Concept

### Solutions of $x^2 = d$

- When $d > 0$, $x^2 = d$ has two real solutions, $x = \pm\sqrt{d}$.
- When $d = 0$, $x^2 = d$ has one real solution, $x = 0$.
- When $d < 0$, $x^2 = d$ has no real solutions.

Core Concept

a. Solve $2x^2 - 32 = 0$ using square roots.

$+32 \quad +32$

$\frac{2x^2}{2} = \frac{32}{2}$

$\sqrt{x^2} = \sqrt{16}$ $\quad x = \pm 4$

$d = 16$

$d > 0$ 2 real sol.

b. Solve $x^2 - 8 = -8$ using square roots.

$+8 \quad +8$

$\sqrt{x^2} = \sqrt{0}$

$x = 0$

$d = 0$ 1 sol.

c. Solve $-2x^2 + 3 = 27$ using square roots.

$-3 \quad -3$

$\frac{-2x^2}{-2} = \frac{24}{-2}$

$x^2 = -12$

no real solutions

Example 1

**9.3 Soving Quadratics Using Square Roots with work**

Solve $\sqrt{(x-3)^2} = \sqrt{16}$ using square roots.

$x - 3 = \pm 4$

$+3 \quad +3$

$x = 3 \pm 4$

$3 + 4 = 7$

$3 - 4 = -1$

$x = -1, 7$

Example 2

Solve $2x^2 + 10 = 32$ using square roots. Round the solutions to the nearest hundredth.

$2x^2 + 10 = 32$

$-10 \quad -10$

$\frac{2x^2}{2} = \frac{22}{2}$

$\sqrt{x^2} = \sqrt{11}$

$x = \pm\sqrt{11} \approx \pm 3.32$

$3.316$

Example 3

**9.3 Soving Quadratics Using Square Roots with work**

Solve the equation using square roots. Round your solutions to the nearest hundredth.

7. $x^2 + 8 = 19$

$-8 \quad -8$

$\sqrt{x^2} = \sqrt{11}$

$x = \pm\sqrt{11}$

$\approx \pm 3.32$

8. $5x^2 - 2 = 0$

$+2 \quad +2$

$\frac{5x^2}{5} = \frac{2}{5}$

$\sqrt{x^2} = \sqrt{\frac{2}{5}}$

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

$\approx \pm 0.63$

9. $3x^2 - 30 = 4$

$+30 \quad +30$

$\frac{3x^2}{3} = \frac{34}{3}$

$\sqrt{x^2} = \sqrt{\frac{34}{3}}$

$x = \pm\sqrt{\frac{34}{3}}$

$\approx \pm 3.37$

Monitoring Progress 7-9

A touch tank has a height of 3 feet. Its length is three times its width. The volume of the tank is 270 cubic feet. Find the length and width of the tank.

$V = lwh$

$270 = (3w)(w)(3)$

$\frac{270}{9} = \frac{9w^2}{9}$

$\sqrt{30} = \sqrt{w^2}$


$w = \sqrt{30} \approx 5.477$ ft

$l = 3\sqrt{30} \approx 16.432$ ft

Example 4

**9.3 Soving Quadratics Using Square Roots with work**

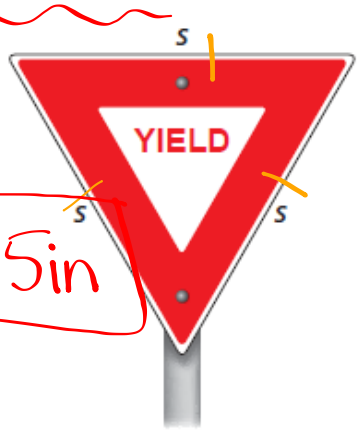
The area A of an equilateral triangle with side length s is given by the formula $A = \frac{\sqrt{3}}{4}s^2$. Solve the formula for s. Then approximate the side length of the traffic sign that has an area of 390 square inches.

$\frac{4}{\sqrt{3}} \cdot A = \frac{\sqrt{3}}{4} S^2 \cdot \frac{4}{\sqrt{3}}$

$\sqrt{\frac{4A}{\sqrt{3}}} = \sqrt{S^2}$

$S = \sqrt{\frac{4A}{\sqrt{3}}} = \sqrt{\frac{4(390)}{\sqrt{3}}}$

$S \approx 30.05 in$




√(4*391)/(√3)
30.04955609

Example 5

Exit Ticket : State the number of solutions for each equation.

a. $2x^2 + 8 = 40$

$-8 \quad -8$

$\frac{2x^2}{2} = \frac{32}{2}$

$x^2 = 16$

$x = \pm 4$

b. $2x^2 - 8 = -40$

$+8 \quad +8$

$\frac{2x^2}{2} = \frac{-32}{2}$

$x^2 = -16$

no real Solution

c. $2x^2 = 0$

$\frac{2x^2}{2} = \frac{0}{2}$

$\sqrt{x^2} = \sqrt{0}$

$x = 0$

Closure

HW Assignment:

9.3 DAY ONE WS's

WS from the WB: 4 - 6, 10 - 12, 16 - 18, 22 - 26

WS A: 1 - 3, 16 - 19

21 problems total!