Solving by Finding Square Roots

Review: If possible, simplify the following radicals completely.

a. $\sqrt{25} = 5$ b. $\sqrt{49} = 7$ c. $\sqrt{64} = 8$

Explore: Solve the following equations for x:

a. $x^2 = 16$

$\sqrt{x^2} = \sqrt{16}$

$x = 4$

b. $x^2 = 4$

$\sqrt{x^2} = \sqrt{4}$

$x = 2$

c. $x^2 = 9$

$\sqrt{x^2} = \sqrt{9}$

$x = 3$

d. $x^2 = 1$

$\sqrt{x^2} = \sqrt{1}$

$x = 1$

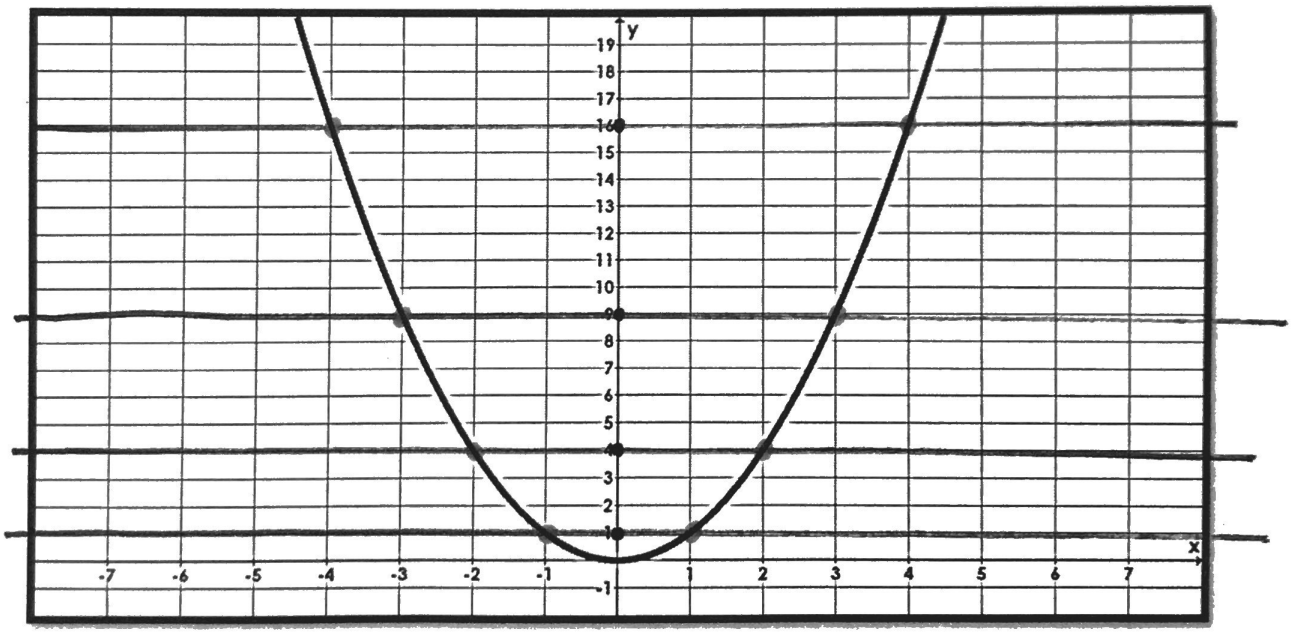
What operation did you perform to solve for x?

inverse operation → square root

How many of you only had one number as an answer for each equation?

✓

Well, let's take a look at the graph of this function.



After looking at the graph, what values of x produce a y value of 1, 4, 9, and 16? In other words, what are the values of x when y = 1, 4, 9 and 16?

y	1	4	9	16
x	-1, 1	-2, 2	-3, 3	-4, 4

What would be your new answers for the previous equations?

a. $x^2 = 16$

$x = +4, -4$

± 4

b. $x^2 = 4$

$x = +2, -2$

± 2

c. $x^2 = 9$

$x = +3, -3$

$x = \pm 3$

d. $x^2 = 1$

$x = +1, -1$

$x = \pm 1$

Solving by Taking Square Roots without Parentheses

Steps for Solving Quadratics by Finding Square Roots

1. Add or Subtract any constants that are on the same side of x^2.
2. Multiply or Divide any constants from x^2 terms. "Get x^2 by itself"
3. Take square root of both sides and set equal to positive and negative roots (±).

Ex: $x^2 = 25$

$\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

$x = +5$ and $x = -5$

REMEMBER WHEN SOLVING FOR X YOU GET A ___+___ **AND** ___−___ **ANSWER!** positive negative

Solve the following for x:

1) $x^2 = 49$

$\sqrt{x^2} = \sqrt{49}$

$x = \pm 7$

2) $x^2 = 36$

$\sqrt{x^2} = \sqrt{36}$

$x = \pm 6$

3) $x^2 = 0$

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

$x = \pm 0$

4) $2x^2 = 128$

$\frac{2}{2} \quad \frac{2}{2}$

$\sqrt{x^2} = \sqrt{64}$

$x = \pm 8$

5) $x^2 - 11 = 14$

$+11 \quad +11$

$\sqrt{x^2} = \sqrt{25}$

$x = \pm 5$

6) $3x^2 = 48$

$\frac{3}{3} \quad \frac{3}{3}$

$\sqrt{x^2} = \sqrt{16}$

$x = \pm 4$

7) $2x^2 + 8 = 170$

$-8 \quad -8$

$\frac{2x^2}{2} = \frac{162}{2}$

$\sqrt{x^2} = \sqrt{81}$

$x = \pm 9$

8) $7x^2 - 6 = 57$

$+6 \quad +6$

$\frac{7x^2}{7} = \frac{63}{7}$

$\sqrt{x^2} = \sqrt{9}$

$x = \pm 3$

9) $10x^2 + 9 = 499$

$-9 \quad -9$

$\frac{10x^2}{10} = \frac{490}{10}$

$\sqrt{x^2} = \sqrt{49}$

$x = \pm 7$

Solving by Finding Square Roots (More Complicated)

Steps for Solving Quadratics by Finding Square Roots with Parentheses

1. Add or Subtract any constants outside of any parenthesis.
2. Multiply or Divide any constants around parenthesis/squared term. "Get ( )^2 by itself"
3. Take square root of both sides and set your expression equal to BOTH the positive and negative root (±). Ex: $(x + 4)^2 = 25$

$\sqrt{(x + 4)^2} = \sqrt{25}$

$(x + 4) = \pm 5$

$x + 4 = +5$ and $x + 4 = -5$

$x = 1$ and $x = -9$

4. Add, subtract, multiply, or divide any remaining numbers to isolate x.

REMEMBER WHEN SOLVING FOR X YOU GET A POSITIVE AND NEGATIVE ANSWER!

Solve the following for x:

1) $\sqrt{(x-4)^2} = \sqrt{81}$

$x - 4 = \pm 9$

$x - 4 = +9 \quad x - 4 = -9$

2) $\sqrt{(p-4)^2} = \sqrt{16}$

$p - 4 = \pm 4$

$p - 4 = +4 \quad p - 4 = -4$

3) $\frac{2}{1} \cdot \frac{1}{2}(x+8)^2 = 14 \cdot \frac{2}{1}$

$\sqrt{(x+8)^2} = \sqrt{28}$

$x + 8 = \sqrt{7} \cdot \sqrt{4}$

$x + 8 = \pm 2\sqrt{7}$

$x + 8 = 2\sqrt{7} \quad x + 8 = -2\sqrt{7}$

$-8 \quad -8 \qquad -8 \quad -8$

$x = 2\sqrt{7} - 8 \qquad x = -2\sqrt{7} - 8$

5) $-2(x+3)^2 - 16 = -48$

$+16 \quad +16$

$\frac{-2(x+3)^2}{-2} = \frac{-32}{-2}$

$\sqrt{(x+3)^2} = \sqrt{16}$

$x + 3 = \pm 4$

$x + 3 = +4 \quad x + 3 = -4$

$-3 \quad -3 \qquad -3 \quad -3$

$x = 1 \qquad x = -7$

6) $3(x-4)^2 + 7 = 67$

$-7 \quad -7$

$\frac{3(x-4)^2}{3} = \frac{60}{3}$

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

$x - 4 = \sqrt{20}$

$x - 4 = \sqrt{4} \cdot \sqrt{5}$

$x - 4 = \pm 2\sqrt{5}$

$x - 4 = 2\sqrt{5} \quad x - 4 = -2\sqrt{5}$