9/8/17

Squares and Square Roots

Warm Up

Simplify.

1. 5^2 25

2. 8^2 64

3. 12^2 144

4. 15^2 225

5. 20^2 400

3-8 Squares and Square Roots

Learning Target:

I will be able

to find square roots

to estimate square roots to a given number of decimal places and

solve problems using square roots.

Vocabulary

principal square root
perfect square

3-8 Squares and Square Roots

Think about the relationship between the area of a square and the length of one of its sides.

area = 36 square units
side length = $\sqrt{36}$ = 6 units

Taking the square root of a number is the inverse of squaring the number.

$6^2 = 36$ $\qquad$ $\sqrt{36} = 6$

Every positive number has two square roots, one positive and one negative. One square root of 16 is 4, since $4 \cdot 4 = 16$. The other square root of 16 is –4, since $(-4) \cdot (-4)$ is also 16. You can write the square root of 16 as ± 4, meaning "plus or minus" 4.

When you press the $\sqrt{\ }$ key on a calculator, only the nonnegative square root appears. This is called the **principal square root** of the number.

$$+\sqrt{16} = 4 \qquad -\sqrt{16} = -4$$

The numbers 16, 36, and 49 are examples of perfect squares. A **perfect square** is a number that has integers as its square roots. Other perfect squares include 1, 4, 9, 25, 64, and 81.

Helpful Hint

$\sqrt{-49}$ is not the same as $-\sqrt{49}$. A negative number has no real square root.

Additional Example: 1 Finding the Positive and Negative Square Roots of a Number

Find the two square roots of each number.

A. 49

$\sqrt{49} = 7$ *7 is a square root, since 7 • 7 = 49.*

$-\sqrt{49} = -7$ *–7 is also a square root, since –7 • –7 = 49.*

B. 100

$\sqrt{100} = 10$ *10 is a square root, since 10 • 10 = 100.*

$-\sqrt{100} = -10$ *–10 is also a square root, since –10 • –10 = 100.*

C. 225

$\sqrt{225} = 15$ *15 is a square root, since 15 • 15 = 225.*

$-\sqrt{225} = -15$ *–15 is also a square root, since –15 • –15 = 225.*

Try This: Example 1

Find the two square roots of each number.

A. 25

$\sqrt{25} = 5$ *5 is a square root, since 5 • 5 = 25.*

$-\sqrt{25} = -5$ *–5 is also a square root, since –5 • –5 = 25.*

B. 144

$\sqrt{144} = 12$ *12 is a square root, since 12 • 12 = 144.*

$-\sqrt{144} = -12$ *–12 is also a square root, since –12 • –12 = 144.*

C. 289

$\sqrt{289} = 17$ *17 is a square root, since 17 • 17 = 289.*

$-\sqrt{289} = -17$ *–17 is also a square root, since –17 • –17 = 289.*

Additional Example 2: *Application*

A square window has an area of 169 square inches. How wide is the window?

Find the square root of 169 to find the width of the window. Use the positive square root; a negative length has no meaning.

$13^2 = 169$

So $\sqrt{169} = 13$.

The window is 13 inches wide.

Try This: Example 2

A square shaped kitchen table has an area of 16 square feet. Will it fit through a van door that has a 5 foot wide opening?

Find the square root of 16 to find the width of the table. Use the positive square root; a negative length has no meaning.

$\sqrt{16} = 4$

So the table is 4 feet wide, which is less than 5 feet.

The table will fit through the door.

Switch to lesson about finding square roots after this slide

Additional Example 3: Evaluating Expressions Involving Square Roots and Cube Roots

Evaluate the expression.

A. $x^2 = 169$

Solve the equations using inverse operations.

The inverse of squaring is square rooting!

B. $x^3 = 1000$

The inverse of cubing is cube rooting!

Try This: Example 3

Evaluate the expression.

A. $\sqrt{25}$ =

Solve the equations using inverse operations.

The inverse of square rooting is squaring!

B. $\sqrt[3]{729}$ =

The inverse of cube rooting is cubing!

Lesson Quiz

Find the two square roots of each number.

1. 81 ±9

2. 2500 ±50

Evaluate each expression.

3. $x^2 = 289$

4. $\sqrt[3]{216} =$

5. Ms. Estefan wants to put a fence around 3 sides of a square garden that has an area of 225 ft^2. How much fencing does she need? 45 ft