GRADE 8

ALIGNED TO THE CORE LESSON

Evaluate Square Roots OF PERFECT SQUARES

By DataWORKS Educational Research

Learning Objective

We will evaluate square roots of perfect squares.

CFU

What are we going to do?

Activate Prior Knowledge

A **squared expression** has a **base** with an exponent of **2**.

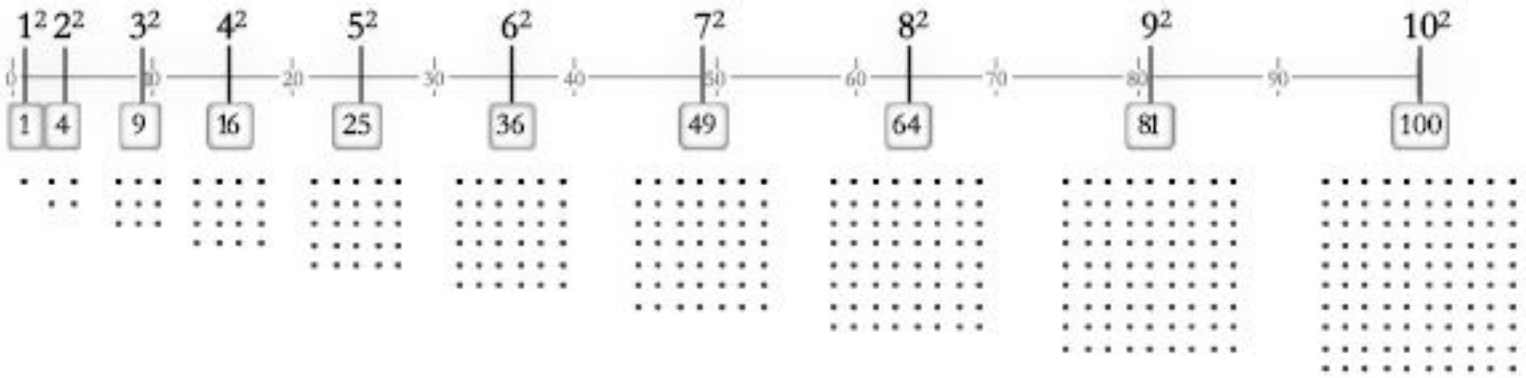
Evaluate the squared expressions to complete the number line.

Make Connection

Students, you already know that an exponent of two means we are multiplying a number by itself, e.g. $6^2 = 6 \cdot 6$. The numbers on the number line are called perfect numbers. Now, we will evaluate square roots of perfect squares.

A **perfect square** is a number that can be arranged into square arrays.

- Perfect squares can be written as a **squared expression**.
- To **evaluate square roots** $\sqrt{\ }$ means to **extract[1] the base of a squared expression**.



Evaluate square roots

$$\sqrt{64}$$

$$\sqrt{8^2}$$

$$8$$

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Use the definition of a perfect square number to explain why the number 7 is NOT a perfect square.

In your own words, what does it mean to evaluate a square root?

"To evaluate square roots means to _____."

Vocabulary

[1] take out

A **perfect square** is a number that can be arranged into square arrays.

- Perfect squares can be written as a **squared expression**.

Evaluate square roots of perfect squares.

1. Rewrite the perfect square as a squared expression. Hint: Guess and check if needed.
2. Extract the base of the squared expression.

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1. How did I/you rewrite the perfect square as a squared expression?
2. How did I/you extract the base of the squared expression?

1. $\sqrt{49}$

$\sqrt{7^2}$

7

2. $\sqrt{25}$

$\sqrt{5^2}$

5

3. $\sqrt{256}$

$\sqrt{16^2}$

16

16×16

$96 + 160$

256

4. $\sqrt{196}$

$\sqrt{14^2}$

14

14×14

$56 + 140$

196

5. $\sqrt{\frac{9}{16}}$

$\sqrt{\left(\frac{3}{4}\right)^2}$

$\frac{3}{4}$

6. $\sqrt{\frac{4}{25}}$

$\sqrt{\left(\frac{2}{5}\right)^2}$

$\frac{2}{5}$

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Solving Math Problems

1. Determine what the question is asking.
2. Determine the math concept required.
3. Determine relevant information.
4. Solve the problem, then interpret the answer.
5. Check the reasonableness of your answer.

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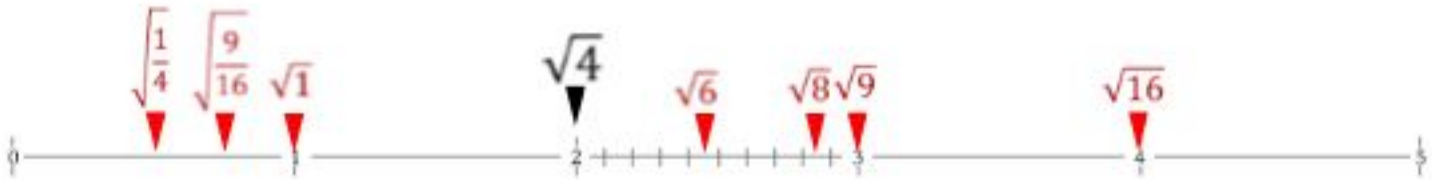
1. How did I/you determine what the question is asking?
2. How did I/you determine the math concept required?
3. How did I/you determine the relevant information?
4. How did I/you solve and interpret the problem?
5. How did I/you check the reasonableness of the answer?

Place each number on the number line.

$\sqrt{\frac{1}{4}}$ $\sqrt{\frac{9}{16}}$ $\sqrt{1}$ $\sqrt{6}$ $\sqrt{8}$ $\sqrt{9}$ $\sqrt{16}$



$2^2 = 4$
$2.1^2 = 4.41$
$2.2^2 = 4.84$
$2.3^2 = 5.29$
$2.4^2 = 5.76$
$2.5^2 = 6.25$
$2.6^2 = 6.76$
$2.7^2 = 7.29$
$2.8^2 = 7.84$
$2.9^2 = 8.41$

Relevance

A **perfect square** is a number that can be arranged into square arrays.

- Perfect squares can be written as a **squared expression**.

1 *Evaluating square roots of perfect squares will help you solve other math problems.*

Find the distance between points A to B.

- B: (3, 5)
- A: (-1, 2)

$$\sqrt{(-1-3)^2+(2-5)^2}$$

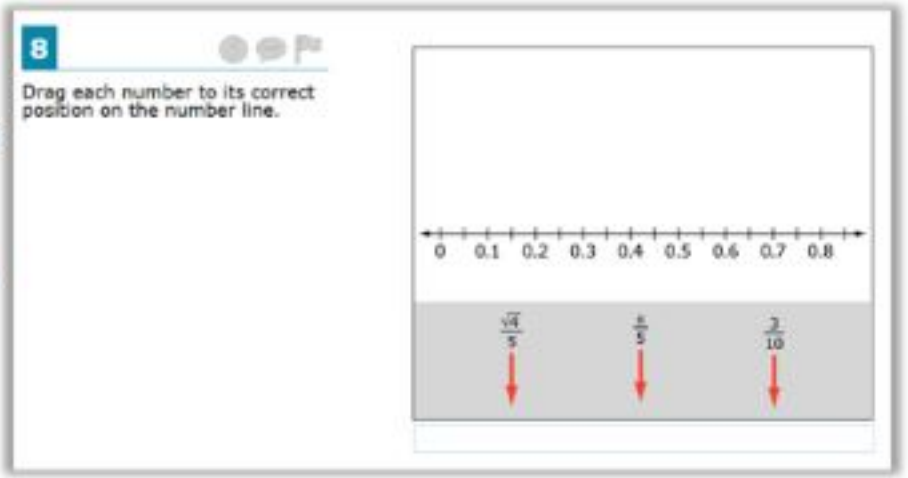
$$\sqrt{(-4)^2+(-3)^2}$$

$$\sqrt{16+9}$$

$$\sqrt{25}$$

5 units between points A to B.

2 *Evaluating square roots of perfect squares will help you do well on tests.*



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Does anyone else have another reason why it is relevant to evaluate square roots of perfect squares? (Pair-Share) Why is it relevant to evaluate square roots of perfect squares? You may give me one of my reasons or one of your own. Which reason is more relevant to you? Why?

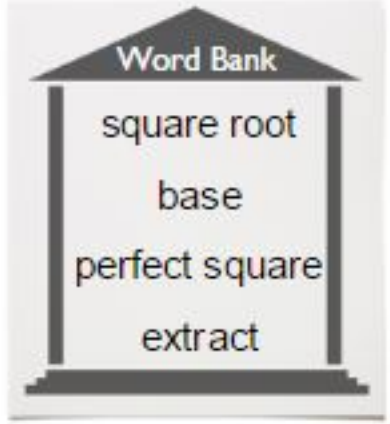
A **perfect square** is a number that can be arranged into square arrays.

- Perfect squares can be written as a **squared expression**.

Skill Closure

Evaluate square roots of perfect squares.

1. Rewrite the perfect square as a squared expression. Hint: Guess and check if needed.
2. Extract the base of the squared expression.



1. $\sqrt{81}$

$\sqrt{9^2}$

9

2. $\sqrt{169}$

$\sqrt{13^2}$

13

$$\begin{array}{r} 13 \\ \times\ 13 \\ \hline 39 \\ +\ 130 \\ \hline 169 \end{array}$$

Access Common Core

Earlier in the lesson we learned that 256 is a perfect square and that the square root is 16. The number 400 is also a perfect square and its square root is 20.

The number 324 is a perfect square. Using the information above to compare, which values may be the square root of 324? Which values cannot be the square root of 324. How do you know?

~~15~~ 17 18 19 ~~21~~ ~~22~~

Since 324 is between 256 and 400, the square root of 324 will be between the square root of 256, 16, and the square root of 400, 20. All the other options are outside of the range between 16 and 20.

Note: Students may argue that 17 and 19 are too far from the middle to be possible options.

Summary Closure

What did you learn today about evaluating square roots of perfect squares? (Pair-Share) Use words from the word bank.

Independent Practice

A **perfect square** is a number that can be arranged into square arrays.

- Perfect squares can be written as a **squared expression**.

Evaluate square roots of perfect squares.

1. Rewrite the perfect square as a squared expression. Hint: Guess and check if needed.
2. Extract the base of the squared expression.

1. $\sqrt{9}$

$\sqrt{3^2}$

3

2. $\sqrt{36}$

$\sqrt{6^2}$

6

3. $\sqrt{324}$

$\sqrt{18^2}$

18

$$\begin{array}{r} 18 \\ \times\ 18 \\ \hline 144 \\ +\ 180 \\ \hline 324 \end{array}$$

4. $\sqrt{400}$

$\sqrt{20^2}$

20

$$\begin{array}{r} 20 \\ \times\ 20 \\ \hline 00 \\ +\ 400 \\ \hline 400 \end{array}$$

5. $\sqrt{\frac{1}{9}}$

$\sqrt{\left(\frac{1}{3}\right)^2}$

$\frac{1}{3}$

6. $\sqrt{\frac{4}{9}}$

$\sqrt{\left(\frac{2}{3}\right)^2}$

$\frac{2}{3}$

Periodic Review 1

1. $\sqrt{4}$

   $\sqrt{2^2}$

   2

2. $\sqrt{289}$

   $\sqrt{17^2}$

   17

   $\begin{array}{r} 17 \\ \times\ 17 \\ \hline 119 \\ +\ 170 \\ \hline 289 \end{array}$

3. $\sqrt{\frac{81}{100}}$

   $\sqrt{\left(\frac{9}{10}\right)^2}$

   $\frac{9}{10}$

Access Common Core

What perfect square number has a square root of 10?

100 $\quad \sqrt{100} = \sqrt{10^2} = 10$

What perfect square number has a square root of 23?

$\begin{array}{r} 23 \\ \times\ 23 \\ \hline 69 \\ +\ 460 \\ \hline 529 \end{array}$

529 $\quad \sqrt{529} = \sqrt{23^2} = 23$

What perfect square number has a square root of 25?

$\begin{array}{r} 25 \\ \times\ 25 \\ \hline 125 \\ +\ 500 \\ \hline 625 \end{array}$

625 $\quad \sqrt{625} = \sqrt{25^2} = 25$

Periodic Review 2

1. $\sqrt{64}$

   $\sqrt{8^2}$

   8

2. $\sqrt{484}$

   $\sqrt{22^2}$

   22

   $\begin{array}{r} 22 \\ \times\ 22 \\ \hline 44 \\ +\ 440 \\ \hline 484 \end{array}$

3. $\sqrt{\frac{36}{4}}$

   $\sqrt{\left(\frac{6}{2}\right)^2}$

   3

Access Common Core

To **evaluate square roots** $\sqrt{\ }$ means to **extract the base of a squared expression.**

1. $\sqrt{x^2}$

   x

2. $\sqrt{n^2}$

   n

These equations represent the area of two squares with an unknown length.
Finish solving these equations to find the length, in units, of each square.

3. $x^2 = 144$

   $\sqrt{x^2} = \sqrt{144}$

   x = 12 units

4. $x^2 = 256$

   $\sqrt{x^2} = \sqrt{256}$

   x = 16 units

Periodic Review 3

1. $\sqrt{121}$

   $\sqrt{11^2}$

   11

2. $\sqrt{144}$

   $\sqrt{12^2}$

   12

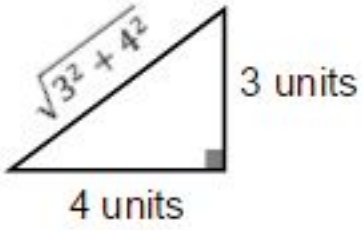
3. $\sqrt{\frac{25}{100}}$

   $\sqrt{\left(\frac{5}{10}\right)^2}$

   $\frac{1}{2}$

Access Common Core

Using the Pythagorean Theorem formula, Jeffrey found an expression to represent the unknown side length for each right triangle. Evaluate the square root to find the unknown length in units.

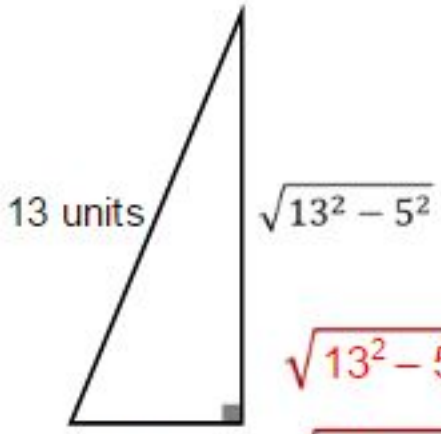
1. 

   $\sqrt{3^2 + 4^2}$

   $\sqrt{9 + 16}$

   $\sqrt{25}$

   5 units

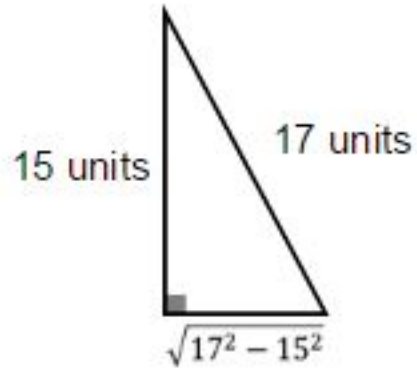
2. 

   $\sqrt{13^2 - 5^2}$

   $\sqrt{169 - 25}$

   $\sqrt{144}$

   12 units

3. 

   $\sqrt{289 - 225}$

   $\sqrt{64}$

   8 units

8th Grade Math

Learning Objective: We will evaluate square roots of perfect squares.

Focus Standard:	8.EE.2 Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of small perfect squares and cube roots of small perfect cubes. Know that $\sqrt{2}$ is irrational.
Support Standard:	SMP 1, SMP 3, SMP 6
Prerequisite(s):	
Manipulative(s):	
Special Instructions:	
Vocabulary	
Academic:	extract
Content:	squared expression, perfect square, evaluate square roots
Support:	

Standards for Mathematical Practice (SMPs)	
SMP1	Make sense of problems
SMP2	Reason abstractly and quantitatively
SMP3	Construct arguments and critique the reasoning of others
SMP4	Model with math
SMP5	Use appropriate tools
SMP6	Attend to precision
SMP7	Make use of structure
SMP8	Look for regularity in repeated reasoning

Common Core Shifts in Mathematics	
Shift 1	Focus
Shift 2	Coherence
Shift 3	Fluency
Shift 4	Deep Understanding
Shift 5	Application
Shift 6	Dual Intensity