

Warm-up

CST/CAHSEE 7NS 2.4

35

Between which two integers is the value of $\sqrt{61}$?

- A 6 and 7
- B 7 and 8
- C 8 and 9
- D 9 and 10

Review 5NS1.4

What is the Prime Factorization of

48

Current

Other 7NS1.2

Fill in the chart

n	$n \cdot n$	n^2
1	1•1	1
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Simplifying Radicals Day 1

Standard: 2.0 Students understand and use such operations as taking the opposite, finding the reciprocal, taking a root, and raising to a fractional power. They understand and use the rules of exponents.

Objective: Students can simplify radical expressions

Debrief warm-up.

Discuss order of operations

Discuss inverse operations. The inverse of root extraction is exponentiation

Ex 1) Simplify $\sqrt{16}$

$$\begin{array}{l|l}
 \sqrt{16} & \sqrt{16} \\
 = \sqrt{2 \cdot 2 \cdot 2 \cdot 2} & = \sqrt{4 \cdot 4} \\
 = 2 \cdot 2 & = \sqrt{(4)^2} \\
 = 4 & = 4
 \end{array}$$

“One way to simplify is to prime factor the radicand. When a value does not appear in the index, then a square root is implied. If the index is 2, we are looking for groups of 2/pairs of numbers”

A $\sqrt{\quad}$ is in simplest form if

-there are no perfect squares factors other than 1 in the radicand

-No fractions are in the radicand

-No radicals in the denominator

You try!

Simplify using 2 different ways. $\sqrt{81}$

$$\begin{array}{l|l}
 \sqrt{81} & \sqrt{81} \\
 = \sqrt{3 \cdot 3 \cdot 3 \cdot 3} & = \sqrt{9 \cdot 9} \\
 = 3 \cdot 3 & = \sqrt{(9)^2} \\
 = 9 & = 9
 \end{array}$$

Ex 2) Simplify $\sqrt{48}$

$$\begin{array}{l|l}
 \sqrt{48} & \sqrt{48} \\
 = \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 3} & = \sqrt{16 \cdot 3} \\
 = 2 \cdot 2\sqrt{3} & = \sqrt{16} \cdot \sqrt{3}^* \\
 = 4\sqrt{3} & = 4\sqrt{3}
 \end{array}$$

* Talk about product property of roots $\sqrt{a \cdot b} = \sqrt{a} \cdot \sqrt{b}$

“Square root of the product is equal to the product of the square roots”

Ask students to show another way to simplify $\sqrt{48}$

Possible answers

$$\begin{array}{l|l}
 \sqrt{48} & \sqrt{48} \\
 = \sqrt{4 \cdot 12} & = \sqrt{4 \cdot 12} \\
 = 2\sqrt{12} & = 2\sqrt{12}
 \end{array}$$

Discuss why these are not completely simplified and how to continue

You Try!

Simplify $\sqrt{45}$

$\sqrt{45}$	$\sqrt{45}$
$= \sqrt{3 \cdot 3 \cdot 5}$	$= \sqrt{9 \cdot 5}$
$= 3\sqrt{5}$	$= \sqrt{9} \cdot \sqrt{5}$
	$= 3\sqrt{5}$

Product Property of Roots

$$\sqrt{a \cdot b} = \sqrt{a} \cdot \sqrt{b} \text{ where } a \geq 0 \text{ and } b \geq 0$$

Simplify $\sqrt{32m^5}$

$\sqrt{32m^5}$	$\sqrt{32m^5}$	$\sqrt{32m^5}$
$= \sqrt{2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 \cdot m \cdot m \cdot m \cdot m \cdot m}$	$= \sqrt{4 \cdot 4 \cdot 2 \cdot m^2 \cdot m^2 \cdot m}$	$= \sqrt{16 \cdot 2 \cdot (m^2)^2 \cdot m}$
$= 2 \cdot 2 \cdot m \cdot m \sqrt{2m}$	$= 4m^2 \sqrt{2m}$	$= \sqrt{16} \cdot \sqrt{m^4} \cdot \sqrt{2m}$
$= 4m^2 \sqrt{2m}$		$= 4m^2 \sqrt{2m}$

Have students do “You try”! as a partner activity. Possible activities.

- One student can do a) and the other do b) then they can check each other's work
- One student tells the other the steps to workout problem a) while the other student writes down the work, then they switch roles for b)
- Each student works out each problem and together they must have 2 different ways to simplify each problem.

You Try!

Simplify

a) $\sqrt{9x^3}$

$\sqrt{9x^3}$	$\sqrt{9x^3}$
$= \sqrt{9} \cdot \sqrt{x^2} \cdot \sqrt{x}$	$= \sqrt{3 \cdot 3 \cdot x \cdot x \cdot x}$
$= 3x\sqrt{x}$	$= 3x\sqrt{x}$

b) $\sqrt{8x^2}$

$\sqrt{8x^2}$	$\sqrt{8x^2}$
$= \sqrt{2 \cdot 2 \cdot 2 \cdot x \cdot x}$	$= \sqrt{4} \cdot \sqrt{x^2} \cdot \sqrt{2}$
$= 2x\sqrt{2}$	$= 2x\sqrt{2}$

Ex 4) Simplify

a) $\sqrt{50} \cdot \sqrt{18}$

$\sqrt{50} \cdot \sqrt{18}$	$\sqrt{50} \cdot \sqrt{18}$	$\sqrt{50} \cdot \sqrt{18}$	$\sqrt{50} \cdot \sqrt{18}$
$= \sqrt{50 \cdot 18}$	$= \sqrt{5 \cdot 5 \cdot 2 \cdot 2 \cdot 3 \cdot 3}$	$= \sqrt{50 \cdot 2 \cdot 9}$	$= \sqrt{25 \cdot 2 \cdot 9 \cdot 2}$
$= \sqrt{2 \cdot 25 \cdot 2 \cdot 9}$	$= \sqrt{2 \cdot 2 \cdot 5 \cdot 5 \cdot 3 \cdot 3}$	$= \sqrt{100 \cdot 9}$	$= 5\sqrt{2} \cdot 3\sqrt{2}$
$= \sqrt{(2 \cdot 2) \cdot 25 \cdot 9}$	$= 2 \cdot 5 \cdot 3$	$= 10 \cdot 3$	$= 15(\sqrt{2})^2$
$= 2 \cdot 5 \cdot 3$	$= 30$	$= 30$	$= 15 \cdot 2$
$= 30$			$= 30$

b) $\sqrt{75xy} \cdot \sqrt{2x^3}$

$\sqrt{75xy} \cdot \sqrt{2x^3}$	$\sqrt{75xy} \cdot \sqrt{2x^3}$
$= \sqrt{75 \cdot 2 \cdot x \cdot x^3 \cdot y}$	$= \sqrt{25 \cdot 3xy} \cdot \sqrt{2x^2 \cdot x}$
$= \sqrt{25 \cdot 3 \cdot 2 \cdot x \cdot x \cdot x \cdot x \cdot y}$	$= 5\sqrt{3xy} \cdot x\sqrt{2x}$
$= 5xx\sqrt{6y}$	$= 5x\sqrt{2 \cdot 3 \cdot x \cdot x \cdot y}$
$= 5x^2\sqrt{6y}$	$= 5x^2\sqrt{6y}$

You Try!
Simplify

a) $\sqrt{6x} \cdot \sqrt{8x^2}$

$$\begin{aligned} & \sqrt{6x} \cdot \sqrt{8x^2} \\ &= \sqrt{2 \cdot 3 \cdot 2 \cdot 4 \cdot x^2 \cdot x} \\ &= 2 \cdot 2 \cdot x \sqrt{3x} \\ &= 4x\sqrt{3x} \end{aligned}$$

b) $\sqrt{18y} \cdot \sqrt{6y^5}$

$$\begin{aligned} & \sqrt{18y} \cdot \sqrt{6y^5} \\ &= \sqrt{9 \cdot 2 \cdot y} \cdot \sqrt{2 \cdot 3 \cdot y^4 \cdot y} \\ &= 3\sqrt{2y} \cdot y^2\sqrt{2 \cdot 3y} \\ &= 3y^2\sqrt{2 \cdot y \cdot 2 \cdot 3 \cdot y} \\ &= 3y^2 \cdot 2y \sqrt{3} \\ &= 6y^3 \sqrt{3} \end{aligned}$$

You Try! can be done as a partner activity or used as an exit ticket.

$$\begin{aligned} & \sqrt{18y} \cdot \sqrt{6y^5} \\ &= \sqrt{9 \cdot 2 \cdot y \cdot 2 \cdot 3 \cdot y^2 \cdot y^2 \cdot y} \\ &= 3 \cdot 2 \cdot y \cdot y \cdot y \sqrt{3} \\ &= 6y^3 \sqrt{3} \end{aligned}$$