Aim: How Do We Simplify Radicals?

Do Now:

$$\sqrt{4}$$

$$\sqrt{16}$$

$$\sqrt{25}$$

$$\sqrt{100}$$

$$\sqrt{144}$$

Definitions

Finding the square root of a given number is the reverse process of squaring a number.

$\sqrt{x}$ is read the "square root of x."

The $\sqrt{\ }$ is called the radical sign.

$\sqrt{x}$

The expression inside the radical sign is called the radicand.

The entire expression, including the radical sign and radicand, is called the radical expression.

Definitions

The index tells the "root" of the expression. Since square roots have an index of 2, the index is generally not written in a square root.

$\sqrt{x}$ means $\sqrt[2]{x}$

Example:

$\sqrt{25} = 5 \ (\text{since } 5^2 = 5 \cdot 5 = 25)$

$\sqrt{\frac{9}{16}} = \frac{3}{4} \left(\text{since} \left(\frac{3}{4}\right)^2 = \left(\frac{3}{4}\right)\left(\frac{3}{4}\right) = \frac{9}{16}\right)$

Definitions

Square roots of negative numbers are not real numbers. Square roots of negative numbers are called imaginary numbers.

$\sqrt{-25} = ?$ There is no number multiplied by itself that will give you –25.

(Imaginary numbers will be studied later)

Definitions

A perfect square is the square of a natural number. 1, 4, 9, 16, 25, and 36 are the first six perfect squares.

A rational number is one that can be written in the form, $\frac{a}{b}$ where a and b are integers, and $b \neq 0$.

Real numbers that are not rational numbers are called irrational numbers. As decimals, irrational numbers are nonrepeating, nonterminating decimals.

Perfect Squares

- 1
- 4
- 9
- 16
- 25
- 36
- 49
- 64
- 81
- 100
- 121
- 144
- 169
- 196
- 225
- 256
- 289
- 324
- 400
- 625

Simplify

Perfect Square Factor * Other Factor

LEAVE IN RADICAL FORM

$$\sqrt{8} = \sqrt{4*2} = 2\sqrt{2}$$

$$\sqrt{20} = \sqrt{4*5} = 2\sqrt{5}$$

$$\sqrt{32} = \sqrt{16*2} = 4\sqrt{2}$$

$$\sqrt{75} = \sqrt{25*3} = 5\sqrt{3}$$

$$\sqrt{40} = \sqrt{4*10} = 2\sqrt{10}$$

Simplify

Perfect Square Factor * Other Factor

LEAVE IN RADICAL FORM

$$\sqrt{48} = \sqrt{16*3} = 4\sqrt{3}$$

$$\sqrt{80} = \sqrt{16*5} = 4\sqrt{5}$$

$$\sqrt{50} = \sqrt{25*2} = 5\sqrt{2}$$

$$\sqrt{125} = \sqrt{25*5} = 5\sqrt{5}$$

$$\sqrt{450} = \sqrt{225*2} = 15\sqrt{2}$$

Simplify

Perfect Square Factor * Other Factor

LEAVE IN RADICAL FORM

$\sqrt{18} = \quad =$

$\sqrt{288} = \quad =$

$\sqrt{75} = \quad =$

$\sqrt{24} = \quad =$

$\sqrt{72} = \quad =$

$$\left(\sqrt{5}\right)^2 = \sqrt{5} * \sqrt{5} = \sqrt{25} = 5$$

$$\left(\sqrt{7}\right)^2 = \sqrt{7} * \sqrt{7} = \sqrt{49} = 7$$

$$\left(\sqrt{8}\right)^2 = \sqrt{8} * \sqrt{8} = \sqrt{64} = 8$$

$$\left(\sqrt{x}\right)^2 = \sqrt{x} * \sqrt{x} = \sqrt{x^2} = x$$

Cube and Fourth Roots

$\sqrt[3]{a}$ is read "the cube root of a."

$\sqrt[4]{a}$ is read "the fourth root of a."

$\sqrt[3]{a} = b$ if $b^3 = a$ $\qquad$ $\sqrt[4]{a} = b$ if $b^4 = a$

$\sqrt[3]{8} = 2$ since $2 \cdot 2 \cdot 2 = 8$

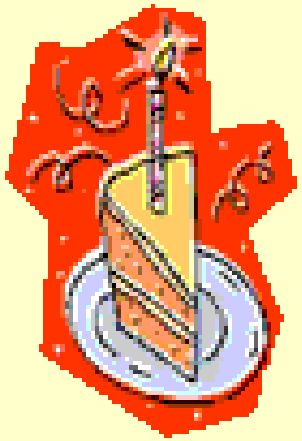
$\sqrt[3]{-8} = -2$ since $(-2)(-2)(-2) = -8$

$\sqrt[4]{81} = 3$ since $3^4 = 3 \cdot 3 \cdot 3 \cdot 3 = 81$

Simplify

$\sqrt{X^2}$ = X

$\sqrt{Y^6}$ = Y^3



$\sqrt{P^4X^6Y^2}$ = P^2X^3Y

$\sqrt{4X^4Y^2}$ = $2X^2Y$

$\sqrt{25C^8D^{10}}$ = $5C^4D^5$

Simplify

$$\sqrt{X^3} = \sqrt{X^2 * X}$$

$$= X\sqrt{X}$$

$$\sqrt{Y^5} = \sqrt{Y^4\ Y}$$

$$= Y^2\sqrt{\ Y}$$

$$\sqrt{PX^3Y^3} = \sqrt{X^2Y^2 * PXY}$$

$$= XY\sqrt{PXY}$$

$$\sqrt{12X^7Y^2} =$$

$$\sqrt{25C^8D^9} =$$