8-1 Radicals

- I can simplify radical expressions

8-1 Radicals

Definition
nth root

$$\sqrt[n]{b} = a \quad \text{means} \quad b = a^n$$

- if $n \geq 2$ and even then a and b must be greater than or equal to 0. (positive)
- if $n > 3$ and odd, then a and b can be any real number.

In $\sqrt[n]{b}$:

The symbol $\sqrt{}$ is called the radical

n is called the index - groups of n

b is called the radicand

if there is no written index, an index of 2 is implied

Know your powers and roots

Perfect Squares:	Square Roots:	Perfect Cubes:	Cube Roots:
$1^2 = 1$	$\sqrt{1} = 1$	$1^3 = 1$	$\sqrt[3]{1} = 1$
$2^2 = 4$	$\sqrt{4} = 2$	$2^3 = 8$	$\sqrt[3]{8} = 2$
$3^2 = 9$	$\sqrt{9} = 3$	$3^3 = 27$	$\sqrt[3]{27} = 3$
$4^2 = 16$	$\sqrt{16} = 4$	$4^3 = 64$	$\sqrt[3]{64} = 4$
$5^2 = 25$	$\sqrt{25} = 5$	$5^3 = 125$	$\sqrt[3]{125} = 5$

Evaluate

$\sqrt[2]{9} = 3$

$3 \quad 3$

$\sqrt[4]{16} = 2$

$4 \quad 4$

$2 \quad 2 \quad 2 \quad 2$

$\sqrt[3]{64} = 4$

$8 \quad 8$

$4 \quad 2 \quad 4 \quad 2$

$2 \quad 2 \quad 2 \quad 2$

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

$4 \quad 2$

$2 \quad 2$

You try

$\sqrt{121} = 11$

11 11

$\sqrt[3]{125} = 5$

5 25

5 5

$\sqrt[3]{-216} = -6$

6 36

6 6

$\sqrt[5]{32} = 2$

8 4

4 2 2 2

2 2

Simplify

$\sqrt{18} = 3\sqrt{2}$

9 2

3 3

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

6 8

3 2 4 2

2 2

2. $5\sqrt[3]{24} = 10\sqrt[3]{3}$

6 4

3 2 2 2

$\cancel{10\sqrt[3]{2}}$

$\sqrt[4]{32} = 2\sqrt[4]{2}$

16 2

4 4

2 2 2 2

Simplifying

If n≥2 is a positive integer and a is a real number, then

$$\sqrt[n]{a^n} = a \quad \text{if } n \geq 3 \text{ is odd}$$

$$\sqrt[n]{a^n} = |a| \quad \text{if } n \geq 2 \text{ is even}$$

For example

$$\sqrt{x^2} = |x| \qquad \sqrt[3]{x^3} = x \qquad \sqrt[4]{x^4} = |x|$$

and so on

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But to make our life easier some instructions will say "Assume all variables are greater than or equal to zero." In which case:

$$\sqrt{x^2} = x \qquad \sqrt[3]{x^3} = x \qquad \sqrt[4]{x^4} = x$$

and so on

SO READ YOUR INSTRUCTIONS!!!

Reduce. Assume all variables are greater than or equal to zero.

$\sqrt{x^2} = x$

x x

$\sqrt[5]{x^5} = x$

x x x x x

$\sqrt[3]{x^3} = x^1$

x x x

$\sqrt[6]{z^6} = z^1$

Reduce Assuming all variables are greater than or equal to zero.

(You can either do these using rational exponents or not.)

$\sqrt[2]{x^6} = x^3$

x x x x x x

$\sqrt[3]{x^{12}} = x^4$

$\sqrt[3]{x^{10}} = x^3\sqrt[3]{x}$

3R1

$\sqrt[4]{x^{14}} = x^3\sqrt[4]{x^2}$

3 R 2

You try (remember $\sqrt{x^2} = |x|$)

$\sqrt[2]{100a^2} = 10a$

$\sqrt[3]{64x^3} = 4x$

$\sqrt{12p^2q}$

$2p\sqrt{3q}$

$\sqrt{128x^2}$

$8x\sqrt{2}$

Reduce Assuming all variables are greater than or equal to zero.

$$\sqrt[2]{20x^{10\div 2}} = 2x^5\sqrt{5}$$

20
5 4
2 2

$$\sqrt[2]{75a^{6\div 2}} = 5a^3\sqrt{3}$$

75
25 3
5 5

Simplify Assuming all variables are greater than or equal to zero.

$\sqrt{80a^3} = 4a\sqrt{5a}$

80: 40, 2; 40: 20, 2; 20: 5, 4; 4: 2, 2

$\sqrt[3]{27m^4n^{14}}$ = $3mn^4\sqrt[3]{mn^2}$

27: 9, 3; 9: 3, 3

$\sqrt[3]{128x^6y^{10}}$

$\sqrt[4]{16a^5b^{11}}$