Radical expressions can also be written equivalently as powers, with the exponent being a rational exponent (aka: fraction exponent).

SQUARE ROOT	CUBED ROOT			
$49^{1/2}$	$27^{1/3}$	$625^{1/4}$	$32^{1/5}$	
$\sqrt{49}$	$\sqrt[3]{27}$	$\sqrt[4]{625}$	$\sqrt[5]{32}$	$\sqrt[n]{a}$
$\boxed{\sqrt[2]{49} = 7}$ Since $7 \cdot 7$ or $7^2 = 49$	Since $3 \cdot 3 \cdot 3 = 27$, $3^3 = 27$, $\boxed{\sqrt[3]{27} = 3}$	"WHAT NUMBER TIMES ITSELF FOUR TIMES IS 625?" $(5)^4 = 625$ $\boxed{\sqrt[4]{625} = 5}$	$\sqrt[5]{32} = 2$ $(\underline{2})^5 = 32$	$\sqrt[n]{a} = \underline{\quad}$ $(\underline{\quad})^n = a$

RADICAL EXPRESSIONS: $\sqrt[5]{32}$

Index: how many times the number multiplies by itself

THE RADICAND THE PRODUCT = SIMPLIFIES TO BE THE FACTOR WHICH MULTIPLIED BY ITSELF (index) TIMES TO MAKE (the radicand)

Examples: Level one:

$$\sqrt[n]{a^1} = a^{1/n}$$

← BASE

radicand exponent / index

Fraction exponent means root!

Rewrite the power as a radical in simplified form. Evaluate.

a. $16^{1/2}$	b. $-64^{1/3}$	c. $81^{1/2} - 243^{1/5}$	d. $-8^{1/3} + 125^{1/3}$
$16^{1/2} \rightarrow \sqrt[2]{16^1}$ $\boxed{4}$	$\sqrt[3]{-64} = \boxed{-4}$ since $(\underline{-4})^3 = -64$	$\sqrt[2]{81} - \sqrt[5]{243}$ $9 - 3$ 6	$\sqrt[3]{-8} + \sqrt[3]{125}$ $-2 + 5$ 3

Examples:

Level two:

Use the power rules to simplify the expression.

- *Simplify any expressions in parentheses first.*
- *Distribute exponent to all parts of the base.*
- *Rewrite as a fractional exponent.*

e. $-125^{2/3}$

$\sqrt[3]{-125^2}$

$\sqrt[3]{-125 \cdot -125}$

$\sqrt[3]{-125} \cdot \sqrt[3]{-125}$

$-5 \cdot -5 = \boxed{25}$

f. $(a^{-9}b^6)^{2/3}$

$a^{-\frac{9}{1}\cdot\frac{2}{3}}\, b^{12/3}$

$a^{-\frac{18}{3}}\, b^4$

$a^{-6}\, b^4$

$\boxed{\dfrac{b^4}{a^6}}$

g. $\left(\dfrac{16x^4}{y^{10}}\right)^{1/2}$

$\dfrac{16^{1\cdot\frac{1}{2}}\, x^{4\cdot 1/2}}{y^{10\cdot\frac{1}{2}}}$

$\dfrac{\sqrt{16}\,x^2}{y^5} \rightarrow \boxed{\dfrac{4x^2}{y^5}}$

h.

Level three:

Rewrite the radical expression as a power with a rational exponent; simplify the power.

- *Simplify expression under the radical first.*
- *Use index to rewrite radical as a power with a rational exponent.*

NOTES

i. $\sqrt[6]{x} \cdot \sqrt[4]{x}$

$x^{1/6 \cdot 4} \cdot x^{1/4 \cdot 6}$

$x^{\frac{4}{24}} \cdot x^{6/24}$

$x^{\frac{4+6}{24}} \rightarrow x^{\frac{10}{24} \div 2}$

$\boxed{x^{5/12}}$

j. $\sqrt[3]{\dfrac{27x^9}{y^{12}}} \rightarrow \left(\dfrac{27x^9}{y^{12}}\right)^{1/3} \rightarrow \dfrac{27^{1/3}x^{9/3}}{y^{12/3}}$

$\sqrt[3]{27} \rightarrow \boxed{\dfrac{3x^3}{y^4}}$

k. $\sqrt[6]{\dfrac{x}{y^{18}}} \rightarrow \left(\dfrac{x}{y^{18}}\right)^{1/6} \quad \dfrac{x^{1/6}}{y^{18/6}}$

$\boxed{\dfrac{x^{1/6}}{y^3}}$

l. $\sqrt{ab} \cdot \sqrt{a^7 \cdot b^9} \rightarrow \sqrt{ab \cdot a^7 \cdot b^9}$

l.

$\sqrt{a^8\, b^{10}}$

$(a^8 b^{10})^{1/2}$

$a^{8/2}\, b^{10/2}$

$\boxed{a^4\, b^5}$