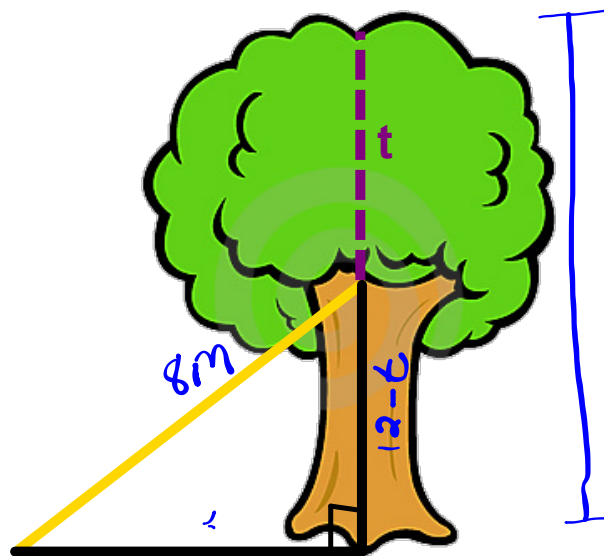


Warm Up

To support the tree, a guy wire 8 m long is attached to the trunk and then secured in the ground 5 m from the base of the tree. The tree is 12 m in height. Find "t" to the nearest tenth of a metre.



Similar \triangle ques.

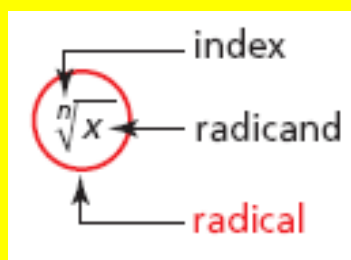
$$\frac{(12-t)}{5} = \frac{12}{5}$$



What do you know???

$$\sqrt{36} = \sqrt{6^2} = 6$$

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



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

$$x \sqrt{y}$$

$$\sqrt{x} y$$

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

$$y^{\frac{1}{x}}$$

G-calculator \rightarrow Radicals
 $16^{2^{nd}}$ y^x 2^{index}
 C-calculator index 2^{nd} $\sqrt[y]{x}$ rd

$$\sqrt{16} = 4$$

List Perfect Squares

$$1^2 = 1$$

$$2^2 = 4$$

$$3^2 = 9$$

$$4^2 = 16$$

$$5^2 = 25$$

$$6^2 = 36$$

.

.

.

.

$$20^2$$

Perfect Cubes

$$1^3 = 1$$

$$2^3 = 8$$

$$3^3 = 27$$

$$4^3 = 64$$

$$5^3 = 125$$

$$6^3 =$$

.

.

.

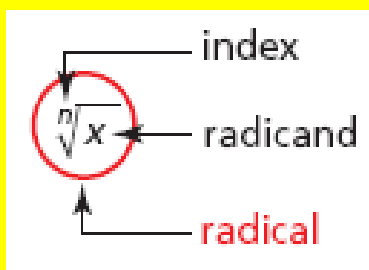
$$20^3$$



What do you know???

$$\sqrt[2]{\frac{144}{196}} = \frac{\sqrt[2]{144}}{\sqrt[2]{196}} = \frac{\sqrt[2]{12^2}}{\sqrt[2]{14^2}} = \frac{12}{14} \underset{\text{Reduce}}{=} \frac{6}{7}$$

$$\sqrt[3]{\frac{125}{1000}} = \frac{\sqrt[3]{125}}{\sqrt[3]{1000}} = \frac{\sqrt[3]{5^3}}{\sqrt[3]{10^3}} = \frac{5}{10} = \frac{1}{2}$$



$$\sqrt{144}$$

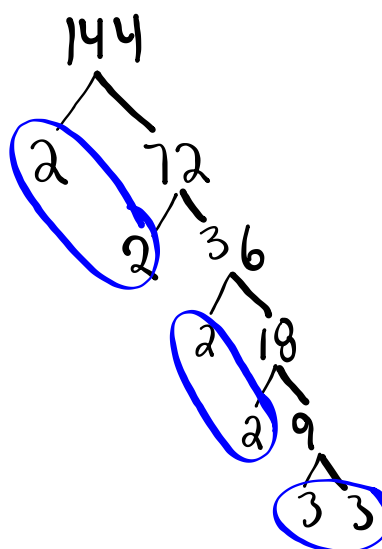
$$= \sqrt{(2 \times 2) \times (2 \times 2) \times (3 \times 3)}$$

$$= \sqrt{2 \times 2} \times \sqrt{2 \times 2} \times \sqrt{3 \times 3}$$
$$\sqrt{2^2} \times \sqrt{2^2} \times \sqrt{3^2}$$

$$= 2 \times 2 \times 3$$

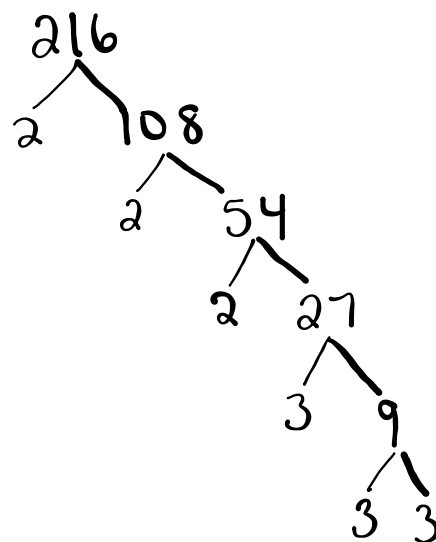
$$= 12$$

Prime 2, 3, 5, 7, 11, ...



$$\begin{aligned} & \sqrt[3]{216} \\ &= \sqrt[3]{(2 \times 2 \times 2) \times (3 \times 3 \times 3)} \\ & \sqrt[3]{(2)^3} \times \sqrt[3]{3^3} \\ & 2 \times 3 \\ &= \boxed{6} \end{aligned}$$

2, 3, 5, 7, 11, 13, ...

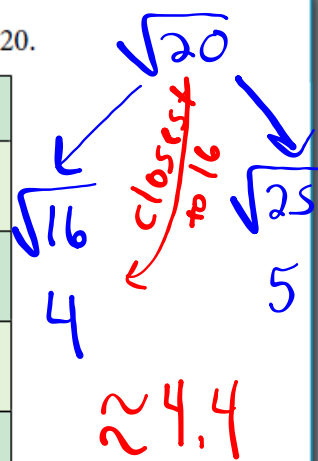


TRY THIS

Write the two consecutive perfect squares closest to 20.

Fill in the table until the square of the estimate is within 1 decimal place of 20.

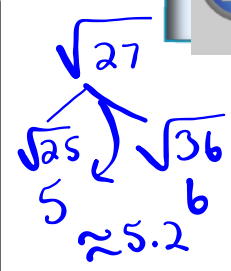
Estimated value of $\sqrt{20}$	Square of estimate



TRY THIS

Determine the value of each radical.

Radical	Value	Is the Value Exact or Approximate?
$\sqrt{16}$	4	Exact
$\sqrt{27}$	5.1962	Approximate
$\sqrt{\frac{16}{18}}$	[Redacted]	[Redacted]
$\sqrt{0.64}$	$\frac{\sqrt{64}}{\sqrt{100}} = \frac{8}{10} = 0.8$	Exact Rational
$\sqrt[3]{16}$	2.519842097	No pattern Irrational
$\sqrt[3]{27}$	3	Exact Rational
$\sqrt[3]{\frac{16}{18}}$	$\frac{\sqrt[3]{16}}{\sqrt[3]{18}}$	$\frac{Irr}{Irr} = Irr$

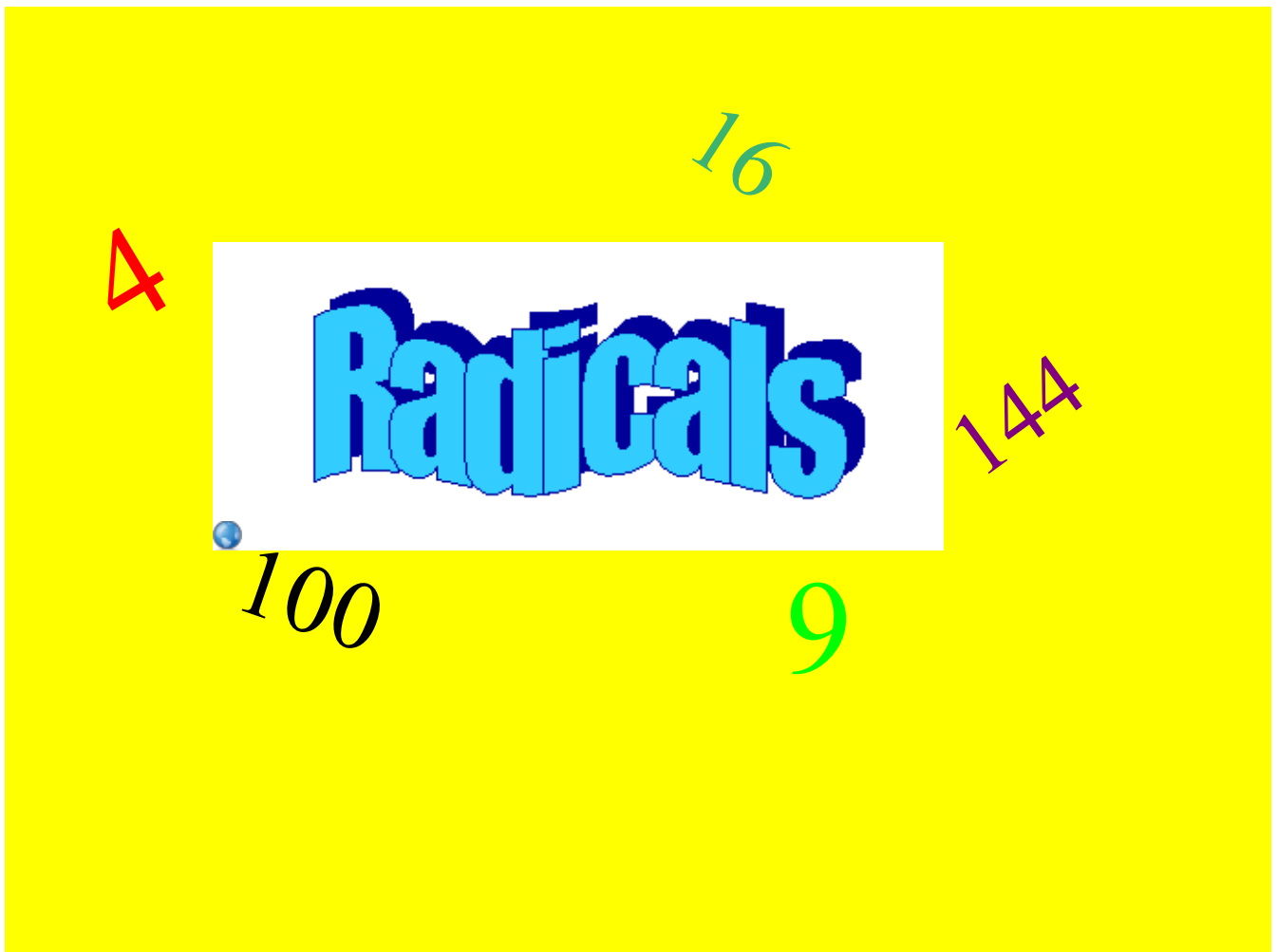


- Use fractions to help
- Use cube numbers list to help

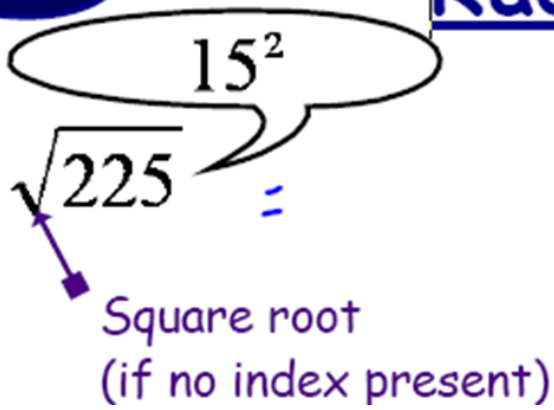
$\sqrt{\frac{16}{81}} = \frac{\sqrt{16}}{\sqrt{81}} = \frac{4}{9} = 0.\overline{4}$ Repeating

4.1 Math Lab: Estimating Roots

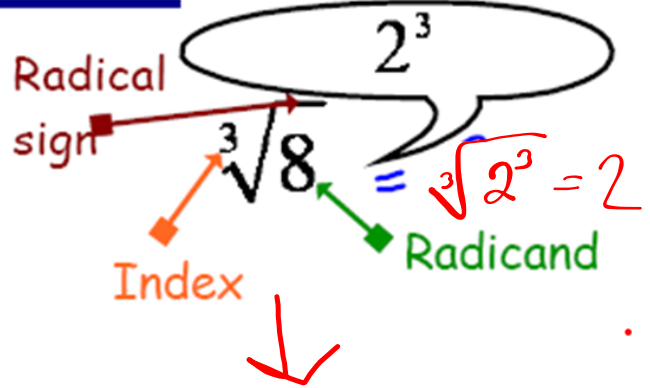
$\sqrt[3]{\frac{27}{125}} = \frac{\sqrt[3]{27}}{\sqrt[3]{125}} = \frac{\sqrt[3]{3^3}}{\sqrt[3]{5^3}} = \frac{3}{5} = 0.6$



Radicals



$1/4$



$8^{1/3}$

Radicals



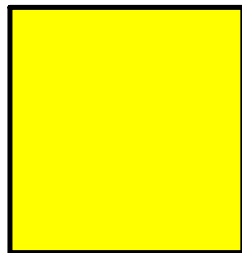
Write a fraction that is equivalent to:

$$\frac{3}{4} \stackrel{\times 2}{=} \frac{6}{8} = \frac{9}{12} = \frac{12}{16}$$

Just as with fractions, Radicals expressions have equivalent expressions:

$$\begin{aligned} \sqrt{16 \cdot 9} &= \sqrt{16} \cdot \sqrt{9} \\ &= 4 \cdot 3 \\ &= 12 \end{aligned} \quad \text{or}$$

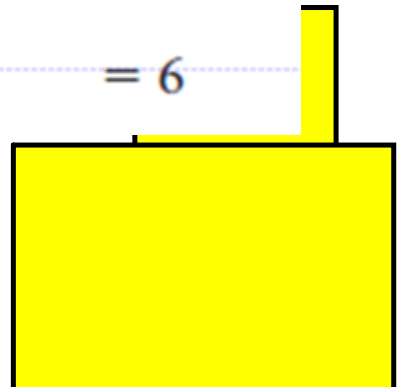
$$\begin{aligned} \sqrt{16 \cdot 9} &= \sqrt{144} \\ &= 12 \end{aligned}$$

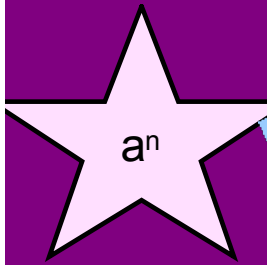


Same works if we change the "index":

$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \\ &= \\ &= \end{aligned} \quad \text{or}$$

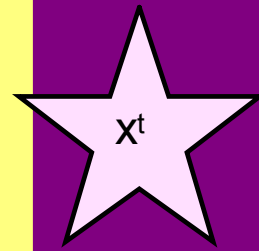
$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \sqrt[3]{216} \\ &= 6 \end{aligned}$$





POWERS

From last week



$$\begin{aligned} 1^0 &= 1 \\ 1^1 &= 1 \\ 1^2 &= 1 \\ 1^3 &= 1 \\ 1^4 &= 1 \\ 1^5 &= 1 \end{aligned}$$

$$\begin{aligned} 2^0 &= 1 \\ 2^1 &= 2 \\ 2^2 &= 4 \\ 2^3 &= 8 \\ 2^4 &= 16 \\ 2^5 &= 32 \end{aligned}$$

$$\begin{aligned} 3^0 &= 1 \\ 3^1 &= 3 \\ 3^2 &= 9 \\ 3^3 &= 27 \\ 3^4 &= 81 \\ 3^5 &= 243 \end{aligned}$$

$$\begin{aligned} 4^0 &= 1 \\ 4^1 &= 4 \\ 4^2 &= 16 \\ 4^3 &= 64 \\ 4^4 &= 256 \\ 4^5 &= 1024 \end{aligned}$$

$$\begin{aligned} 5^0 &= 1 \\ 5^1 &= 5 \\ 5^2 &= 25 \\ 5^3 &= 125 \\ 5^4 &= 625 \\ 5^5 &= 3125 \end{aligned}$$

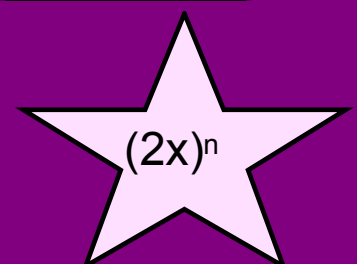
$$\begin{aligned} 6^0 &= 1 \\ 6^1 &= 6 \\ 6^2 &= 36 \\ 6^3 &= 216 \\ 6^4 &= 1296 \\ 6^5 &= 7776 \end{aligned}$$

$$\begin{aligned} 7^0 &= 1 \\ 7^1 &= 7 \\ 7^2 &= 49 \\ 7^3 &= 343 \\ 7^4 &= 2401 \\ 7^5 &= 16807 \end{aligned}$$

$$\begin{aligned} 8^0 &= 1 \\ 8^1 &= 8 \\ 8^2 &= 64 \\ 8^3 &= 512 \\ 8^4 &= 4096 \\ 8^5 &= 32\,768 \end{aligned}$$

$$\begin{aligned} 9^0 &= 1 \\ 9^1 &= 9 \\ 9^2 &= 81 \\ 9^3 &= 729 \\ 9^4 &= 6561 \\ 9^5 &= 59049 \end{aligned}$$

$$\begin{aligned} 10^0 &= 1 \\ 10^1 &= 10 \\ 10^2 &= 100 \\ 10^3 &= 1000 \\ 10^4 &= 10000 \\ 10^5 &= 100000 \end{aligned}$$



Reducing Radicals

* Multiplication Property of Radicals

* $\sqrt[n]{ab} = \sqrt[n]{a} \cdot \sqrt[n]{b}$,

where n is a natural number, and a and b are real numbers

Ex) $\sqrt{36} = \sqrt{9} \cdot \sqrt{4}$
 $\quad \quad \quad \uparrow \quad \quad \quad \uparrow$
 $\quad \quad \quad 3 \quad \times \quad 2$

Same works if we change the "index":

$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \sqrt[3]{8} \cdot \sqrt[3]{27} \\ &= 2 \cdot 3 \\ &= 6 \end{aligned}$$

or

$$\begin{aligned} \sqrt[3]{8 \cdot 27} &= \sqrt[3]{216} \\ &= 6 \end{aligned}$$

From last week purple slide. NEED in front of you

Evaluate each radical. Justify you answer

$$\begin{aligned} \text{a) } \sqrt{64} \\ = \sqrt{8^2} \\ = 8 \end{aligned}$$

$$\begin{aligned} \text{b) } \sqrt[4]{81} \\ = \sqrt[4]{3^4} \\ = 3 \end{aligned}$$

$$\begin{aligned} \text{c) } \sqrt[3]{27} \\ = \sqrt[3]{3^3} \\ = 3 \end{aligned}$$

Estimate to one decimal

$$\sqrt{9}$$

$$\text{b) } \sqrt[5]{1562}$$

Remember

Rational numbers are numbers that can be written as a fraction or is a decimal that repeats or terminates. Ex) $\sqrt[4]{\frac{1296}{10000}}$ Ex) $\sqrt[3]{\frac{8}{27}}$

Irrational numbers are numbers that cannot be written as a fraction and its decimal neither terminates or repeats. $\sqrt{28}$

Class Work/Homework

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STOP