2.2 Simplifying Radicals

Index - the kind of root you take → $\sqrt[n]{146}$ ← **Radicand** - the expression inside the root

1) Identify the index and the radicand for each radical.

a. $\sqrt[3]{146}$
Index: 3
Radicand: 146

b. $\sqrt[5]{425x}$
Index: 5
Radicand: $425x$

c. $\sqrt{-144x^4}$
Index: 2
Radicand: $-144x^4$

* $\sqrt{}$ is $\sqrt[2]{}$

1) Simplify each radical.

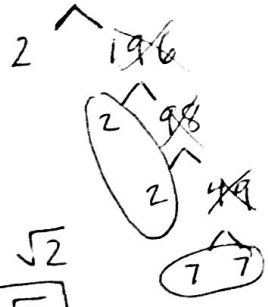
Steps to Simplifying Radicals

1) Make a prime factor tree
2) Circle groups of the index
   ex: $\sqrt[3]{}$ means groups of 3
3) Circled numbers come out, everything else stays in
   - multiply outside parts together & inside parts together

a) $\sqrt{63}$

$= 3\sqrt{7}$

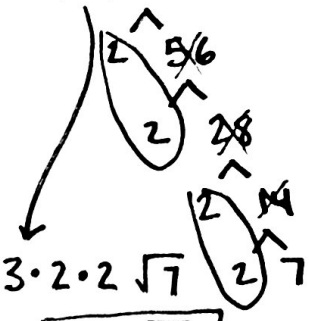
b) $\sqrt{392}$



$2 \cdot 7\sqrt{2}$

$14\sqrt{2}$

c) $3\sqrt{112}$



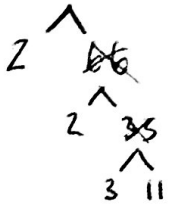
$3 \cdot 2 \cdot 2\sqrt{7}$

$12\sqrt{7}$

d) $\sqrt[3]{56}$

$2\sqrt[3]{7}$

f) $\sqrt[3]{-132}$



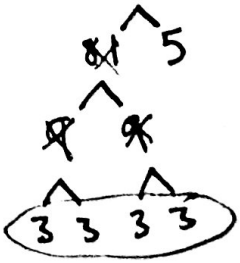
$-\sqrt[3]{132}$

* A negative radicand with an odd index will have a negative answer

Nothing came out, so everything stayed in, but the answer was negative

g) $4\sqrt[3]{500}$

h) $\sqrt[4]{405}$



$3\sqrt[4]{5}$

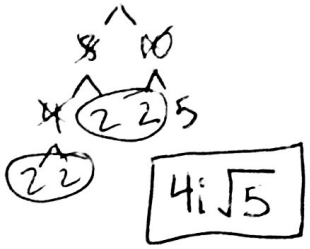
You will also be asked to simplify radicals with imaginary roots. To do this, simplify as if it were positive & slap an i on it.

2) Simplify each radical.

a) $\sqrt{-20}$

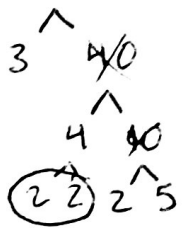
$2i\sqrt{5}$

b) $\sqrt{-80}$



$4i\sqrt{5}$

c) $\sqrt{-120}$



$2i\sqrt{30}$

$3 \cdot 2 \cdot 5$

d) $\sqrt{-16}$

e) $\sqrt{-1000}$

f) $\sqrt{-50}$

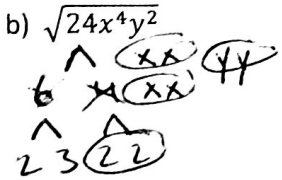
If you encounter radicals with variables, you will still break it down like normal; however, the variables that come out of the radical may need absolute value signs around them.

When you are asked to find a root, you are being asked for the **principal root**, meaning the positive outcome of the square root. Because the variable might be negative, we need absolute value signs to assure that we are answering with the positive root.

Variables outside the radical need absolute value when:

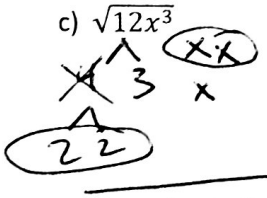
1) Positive radicand
2) Even index *
3) The variable on the outside has an odd index

b) $\sqrt{24x^4y^2}$



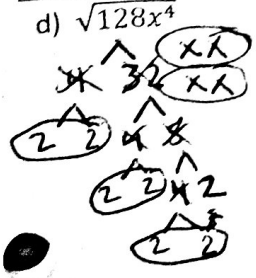
$2x^2|y|\sqrt{6}$

c) $\sqrt{12x^3}$



$2|x|\sqrt{3x}$

d) $\sqrt{128x^4}$



$2 \cdot 2 \cdot 2x^2\sqrt{2}$

$8x^2\sqrt{2}$

e) $2\sqrt{175x^3y^2}$

f) $\sqrt[3]{-72x^4}$

$-2x\sqrt[3]{9x}$

*All three conditions must be met in order to need absolute value