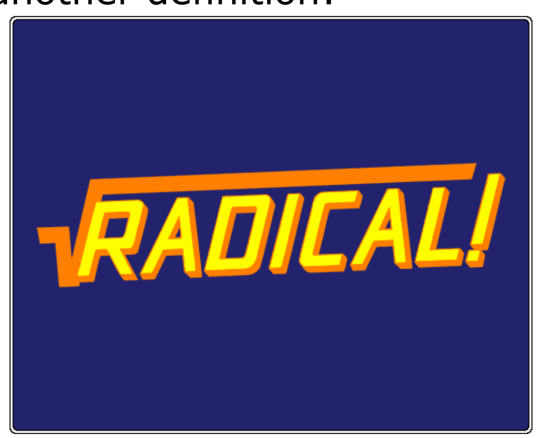
Working with Radicals

When I was a kid ‘radical’ meant something different:

In the news I often hear radical used differently:

And Math has yet another definition:



Any function with a root in it. The root is a radical. That’s pretty radical, right?

These are radicals:

$$\sqrt{4},\ \sqrt{2x},\ \sqrt{4x-7},\ \sqrt[3]{7}$$

Let's define the parts of a radical:

$2x^2$

$$a\sqrt[n]{x}$$

a=coefficient

n=index or root

x=radicand

We group like terms with radicals the same way we do with x, x^2.
Ie:

$$x + 2x + 3x^2 + 4x^2$$

$$3x + 7x^2$$

Radicals work the same way:

$$\sqrt{x} + 2\sqrt{x} + 3\sqrt[3]{x} + 4\sqrt[3]{x}$$

$$3\sqrt{x} + 7\sqrt[3]{x}$$

Simplifying Radicals:

In order to simplify a radical, you want to break down the radicand to its prime factors. Look for pieces that can come out. First let's look at how we can put a number into a radical:

Convert the following to an entire radical:

$4\sqrt{3}$	$5\sqrt{10}$
$\sqrt{16}\sqrt{3}$	$=\sqrt{25}\sqrt{10}$
$=\sqrt{16\cdot 3}$	$=\sqrt{25\cdot 10}$
$=\sqrt{48}$	$=\sqrt{250}$

$2\sqrt[3]{3}$	$x^2\sqrt[4]{x}$
$=\sqrt[3]{2^3}\ \sqrt[3]{3}$	$\sqrt[4]{(x^2)^4}\ \sqrt[4]{x}$
$=\sqrt[3]{2^3\cdot 3}$	$=\sqrt[4]{x^{2^4}\ x}$
$=\sqrt[3]{24}$	$=\sqrt[4]{x^8\ x}$
	$=\sqrt[4]{x^9}$

$x^2\ x^2\ x^2\ x^2$

$x\ x\ x\ x\ x\ x\ x\ x$

$1\ 1\ 1\ 1\ 1\ 1\ 1\ 1$

Now let's take a radical expression and simplify it. You will be expected to do this for every radical question you come across for the rest of your life. You cannot leave a fraction as $\frac{2}{4}$. Same thing here!

$\sqrt{75}$

$= \sqrt{25 \cdot 3}$

$= \sqrt{5 \cdot 5 \cdot 3}$

$= \sqrt{5^2} \cdot \sqrt{3}$

$= 5\sqrt{3}$

$2\sqrt{48}$

$= 2\sqrt{2 \cdot 24}$

$= 2\sqrt{2 \cdot 2 \cdot 12}$

$= 2\sqrt{2 \cdot 2 \cdot 6 \cdot 2}$

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

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

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

$= 8\sqrt{3}$

$\sqrt[3]{54}$

$= \sqrt[3]{9 \cdot 6}$

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

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

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

$\sqrt[3]{x^7}$

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

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

List the following from least to greatest. Hint: put everything under the radical so that you can easily compare numbers.

$$5,\ 2\sqrt{6},\ 3\sqrt{3},\ \sqrt{23}$$

$\sqrt{25},\ \sqrt{24},\ \sqrt{27},\ \sqrt{23}$

$\sqrt{23},\ \sqrt{24},\ \sqrt{25},\ \sqrt{27}$

Adding and subtracting:

We can do it, if the things are the same. Ie: $\sqrt{x} + 2\sqrt{x} = 3\sqrt{x}$

$$5\sqrt{3} - 2\sqrt{3} = \quad 3\sqrt{3}$$

$$7\sqrt{2} + 4\sqrt{3} - 5\sqrt{2} + 6\sqrt{3} =$$

$2\sqrt{2} + 10\sqrt{3}$

$2(\sqrt{2} + 5\sqrt{3})$

$$\sqrt{24} + \sqrt{54} =$$

$= \sqrt{2^2 \cdot 6} + \sqrt{3^2 \cdot 6}$

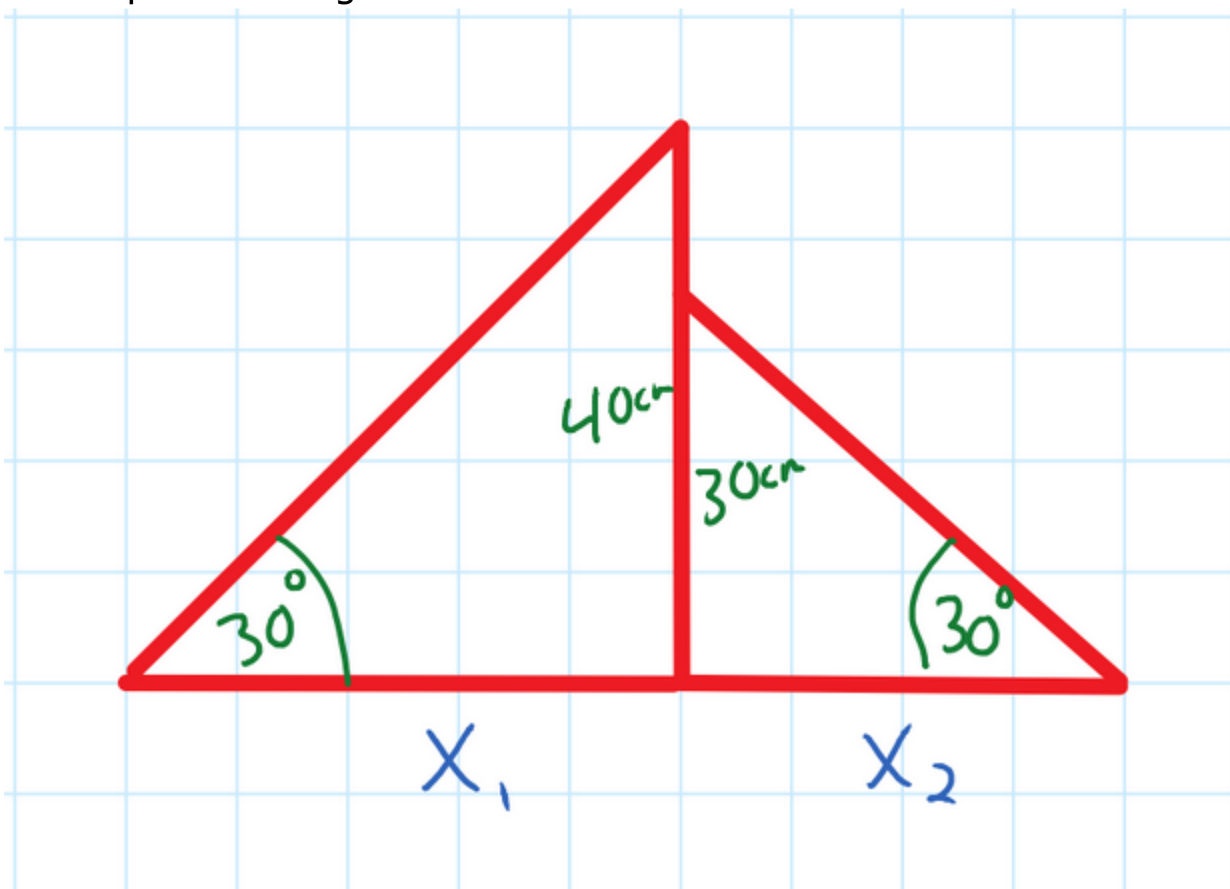
$= 2\sqrt{6} + 3\sqrt{6}$

$= 5\sqrt{6}$

$2\sqrt[3]{3} - \sqrt[3]{81} =$ $\quad 2\sqrt[3]{3} - 3\sqrt[3]{3}$

$\sqrt[3]{3^3 \cdot 3}$ $\quad = -\sqrt[3]{3}$

A skateboard ramp is shown. What is the total length? $X_1 + x_2$?
Hint: special triangles.



$$d = x_1 + x_2$$

$$= 40\sqrt{3} + 30\sqrt{3}$$

$$= 70\sqrt{3}$$

HW: 278 #1,2,3ab,
6,8,9,10ab,
11,12,25