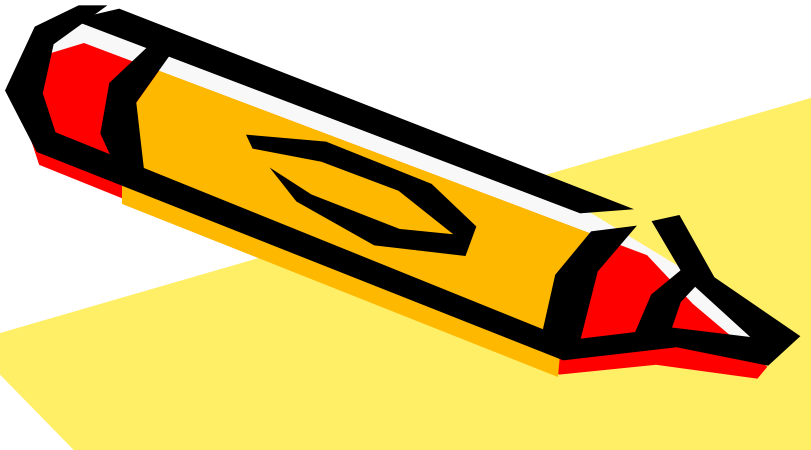
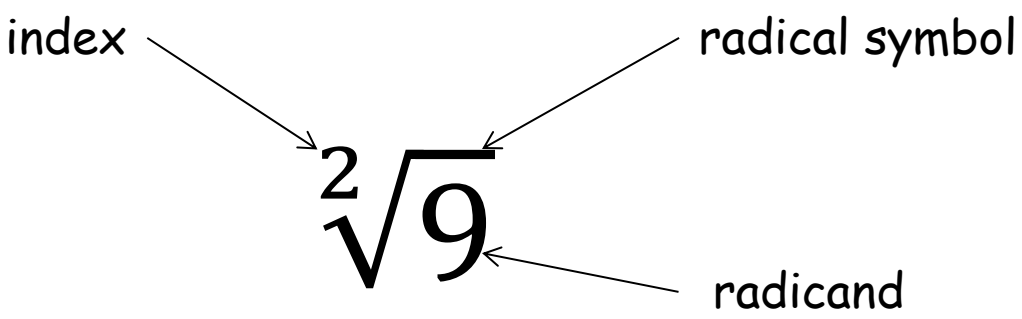


Geometry

Simplifying Radicals

Radicals



When the index is blank, it is the same as an index of 2, meaning square root

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

Simplifying Radicals

Rules for simplifying radicals:

1. No perfect squares may remain in the radicand
2. No fractions may remain in the radicand
3. No radicals may remain in the denominator

Simplifying Radicals

Square root is essentially asking us…what number was squared (multiplied by itself) to get here?

Start with some perfect squares…

1^2	=	1	and	$\sqrt{1}$	=	1
2^2	=	4	and	$\sqrt{4}$	=	2
3^2	=	9	and	$\sqrt{9}$	=	3
4^2	=	16	and	$\sqrt{16}$	=	4
5^2	=	25	and	$\sqrt{25}$	=	5
6^2	=	36	and	$\sqrt{36}$	=	6
7^2	=	49	and	$\sqrt{49}$	=	7
8^2	=	64	and	$\sqrt{64}$	=	8
9^2	=	81	and	$\sqrt{81}$	=	9

Simplifying Radicals

Usually the radicand is not a perfect square…

Simplify $\sqrt{18}$

One method is to factor the radicand into a perfect square factor and another factor:

$$\sqrt{18} = \sqrt{9} * \sqrt{2}$$

Then simplify the perfect square factor:

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

$$3\sqrt{2}$$

Simplifying Radicals

A few more examples…

$\sqrt{27}$

$\sqrt{9} * \sqrt{3}$

$3\sqrt{3}$

$\sqrt{48}$

$\sqrt{16} * \sqrt{3}$

$4\sqrt{3}$

$\sqrt{24}$

$\sqrt{4} * \sqrt{6}$

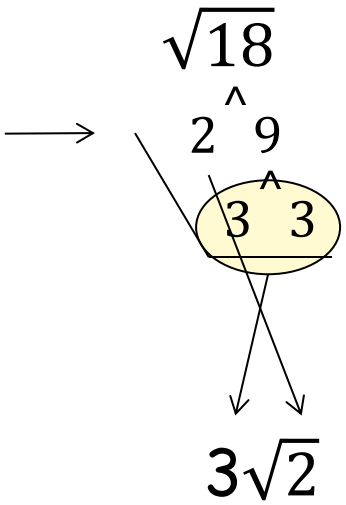
$2\sqrt{6}$

Simplifying Radicals

Usually the radicand is not a perfect square…

Another method is to complete a factor tree. Once we have the prime factors, we group them in sets based on the index number. Each group comes out as 1 factor, any left overs remain under the radical symbol. Finally all factors (inside and outside the radical symbol) get multiplied back together.

By starting with the lowest prime number, all the factors are already in order and grouped.

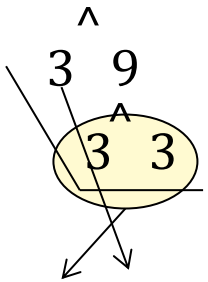


Since the index is 2, we're looking for pairs. The pair of 3's comes out as one 3. The 2 stays in the radical.

Simplifying Radicals

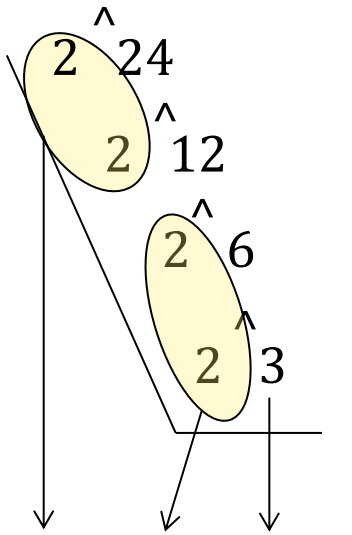
A few more examples…

$\sqrt{27}$



$3\sqrt{3}$

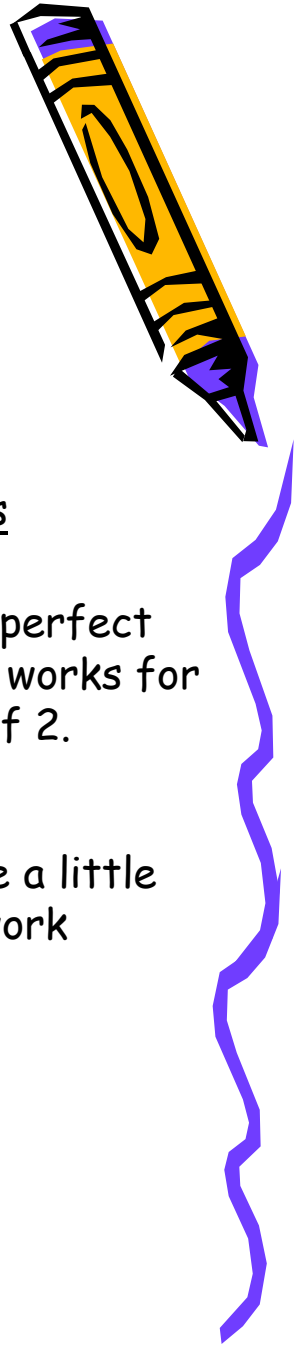
$\sqrt{48}$



$2 * 2 * \sqrt{3}$

$4\sqrt{3}$

Simplifying Radicals



Two methods…

method	pros	cons
Factoring the perfect square	Quick simple method. Most common method taught through algebra 2.	Must know perfect squares. Only works for index of 2.
Factor tree	Works for any index value. Does not require knowing perfect squares very well.	May require a little more work

Simplifying Radicals

When a number is provided in front of the radical…

$2\sqrt{45}$

$2 * \sqrt{45}$

$2 * 3\sqrt{5}$

$6\sqrt{5}$

$-8\sqrt{54}$

$-8 * \sqrt{54}$

$-8 * 3\sqrt{6}$

$-24\sqrt{6}$

Simplifying Radicals

Simplify each radical:

1) $\sqrt{12}$

2) $\sqrt{125}$

3) $\sqrt{486}$

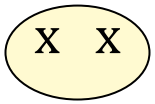
4) $3\sqrt{108}$

5) $-6\sqrt{200}$

Simplifying Radicals

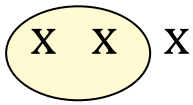
When it comes to variables and exponents, the concept is the same, but the work can be simplified…

$\sqrt{x^2}$



x

$\sqrt{x^3}$



$x\sqrt{x}$

Since we're looking for pairs, divide the exponent by 2. The integer part of the answer becomes the exponent on the outside, the remainder becomes the exponent on the inside.

$\sqrt{x^{12}} = x^6$

$\sqrt{x^{27}} = x^{13}\sqrt{x}$

Simplifying Radicals

Simplify each radical:

1) $\sqrt{x^{17}}$

2) $\sqrt{x^{85}}$

3) $\sqrt{x^8 y^7}$

Simplifying Radicals

Simplify each radical:

1) $\sqrt{50x^5}$

2) $3\sqrt{44x^8}$

3) $-7\sqrt{128x^7y^{14}}$