Warmup:

Simplify the following radicals

$\sqrt{20}$

$\sqrt{4 \cdot 5}$

$2\sqrt{5}$

$3\sqrt{60}$

$3\sqrt{4 \cdot 15}$

$3 \cdot 2\sqrt{15}$

$\boxed{6\sqrt{15}}$

$\sqrt{x^{21}}$

$\sqrt{x^1 \cdot x^{20}}$

$\boxed{x^{10}\sqrt{x}}$

$\cancel{10\sqrt{x}}$

$\cancel{10x\sqrt{x}}$

$2x\sqrt{8x^4}$

$2x\sqrt{4 \cdot 2 \cdot x^4}$

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

$\boxed{4x^3\sqrt{2}}$

Algebra 1 Name Key

HW #6 Simplifying Radicals

Period____

Simplify.

1) $\sqrt{12}$ $= \sqrt{4 \cdot 3} = 2\sqrt{3}$

2) $\sqrt{72}$ $= \sqrt{36 \cdot 2} = 6\sqrt{2}$

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

3) $\sqrt{75}$ $= \sqrt{25 \cdot 3} = 5\sqrt{3}$

4) $\sqrt{18}$ $= \sqrt{9 \cdot 2} = 3\sqrt{2}$

5) $\sqrt{42}$ $= \sqrt{42}$

6) $\sqrt{200}$ $= \sqrt{100 \cdot 2} = 10\sqrt{2}$

7) $\sqrt{128n^4} = \sqrt{64 \cdot 2 \cdot n^4}$

$= 8n^2\sqrt{2}$

8) $\sqrt{24m^2} = \sqrt{4 \cdot 6 \cdot m^2}$

$= 2m\sqrt{6}$

9) $\sqrt{72x} = \sqrt{36 \cdot 2 \cdot x}$

$= 6\sqrt{2x}$

10) $\sqrt{8x^4} = \sqrt{4 \cdot 2 \cdot x^4}$

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

11) $\sqrt{245k^2} = \sqrt{49 \cdot 5 \cdot k^2}$

$7k\sqrt{5}$

12) $\sqrt{12x^2} = \sqrt{4 \cdot 3 \cdot x^2}$

$= 2x\sqrt{3}$

13) $\sqrt{448xy^4} = \sqrt{64 \cdot 7 \cdot x \cdot y^4}$

$= 8y^2\sqrt{7x}$

14) $\sqrt{320x^3y^2} = \sqrt{64 \cdot 5 \cdot x \cdot x^2 \cdot y^2}$

$= 8xy\sqrt{5x}$

15) $\sqrt{448u^4v}$ $= \sqrt{64 \cdot 7 \cdot u^4 \cdot v}$

$= 8u^2\sqrt{7v}$

16) $\sqrt{125a^3b^4}$ $= \sqrt{25 \cdot 5 \cdot a \cdot a^2 \cdot b^4}$

$= 5ab^2\sqrt{5a}$

17) $-4\sqrt{28xy^2}$ $= -4\sqrt{4 \cdot 7 \cdot x \cdot y^2}$

$= -4 \cdot 2y\sqrt{7x}$

$= -8y\sqrt{7x}$

18) $2\sqrt{125x^2y^2}$ $= 2\sqrt{25 \cdot 5 \cdot x^2 \cdot y^2}$

$= 2 \cdot 5xy\sqrt{5}$

$= 10xy\sqrt{5}$

19) $-7\sqrt{147m^2n^3}$ $= -7\sqrt{49 \cdot 3 \cdot m^2 \cdot n \cdot n^2}$

$= -7 \cdot 7mn\sqrt{3n}$

$= -49mn\sqrt{3n}$

20) $2\sqrt{80m^2n}$ $= 2\sqrt{16 \cdot 5 \cdot m^2 \cdot n}$

$= 2 \cdot 4m\sqrt{5n}$

$= 8m\sqrt{5n}$

Add or subtract Radical Expressions

To be considered **like radicals** they have to be the same root and have the same number inside the house (called the radicand). For example,

$2\sqrt{3}$ and $5\sqrt{3}$ are like radicals

$\sqrt{2}$ and $\sqrt{5}$ are not like radicals – they have different radicands

$2x$ & $5x$

$2x + 5x$

$7x$

$2\sqrt{3}$ & $5\sqrt{3}$

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

$7\sqrt{3}$

To add or subtract radical expressions, the radicands must be alike in the same way that monomial terms must be alike to add or subtract.

Monomials	Radicals
$4x + 2x = \underline{6x}$	$4\sqrt{5} + 2\sqrt{5} = (\underline{4} + \underline{2})\sqrt{5} = \underline{6}\sqrt{5}$
$9y - 7y = \underline{2y}$	$9\sqrt{3} - 7\sqrt{3} = (\underline{9} - \underline{7})\sqrt{3} = \underline{2}\sqrt{3}$

You try!!

a. $2\sqrt{5} + 7\sqrt{5} = 9\sqrt{5}$

b. $9\sqrt{7} - 1\sqrt{7} = 8\sqrt{7}$

$10x + 4x - 5y$

$14x - 5y$

c. $\underbrace{5\sqrt{3} - 2\sqrt{3}} + \sqrt{3}$

$3\sqrt{3} + 1\sqrt{3}$

$4\sqrt{3}$

d. $\underbrace{10\sqrt{6} + 4\sqrt{6}} - 5\sqrt{2}$

$14\sqrt{6} - 5\sqrt{2}$

If a sum or difference involves terms that are not like radicals, we may be able to combine terms after simplifying the radicals according to our earlier methods.

Simplify each expression

$3\sqrt{2} + \underbrace{\sqrt{8}}$ we don't have like radicals, **but** we can simplify $\sqrt{8}$. Remember ... $\sqrt{8}$ = $2\sqrt{2}$

$3\sqrt{2} + 2\sqrt{2}$ $= 5\sqrt{2}$

$5\sqrt{3} - \sqrt{12}$ we don't have like radicals, **but** we can simplify $\sqrt{12}$. Remember ... $\sqrt{12}$= $2\sqrt{3}$

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

a. $\sqrt{2} + \sqrt{18}$

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

$4\sqrt{2}$

b. $5\sqrt{3} - \sqrt{27}$

$5\sqrt{3} - 3\sqrt{3}$

$2\sqrt{3}$

simplifying expressions involving variables

$$5\sqrt{3x} - 2\sqrt{3x} \quad = \quad (5-2)\sqrt{3x} \quad = \quad 3\sqrt{3x}$$

$$2\sqrt{3a^3} + 5a\sqrt{3a} = \underline{\ 2a\ }\sqrt{\underline{3a}} + 5a\sqrt{3a} = (\underline{\ 2a\ } + 5a)\sqrt{3a} = \underline{\ 7a\ }\sqrt{3a}$$

$2\sqrt{3 \cdot a \cdot a^2}$

$2a\sqrt{3a}$

a. $2\sqrt{7y} + 3\sqrt{7y}$

$5\sqrt{7y}$

b. $\sqrt{20a^2} - a\sqrt{45}$

$\sqrt{4 \cdot 5 \cdot a^2} - a\sqrt{9 \cdot 5}$

$2a\sqrt{5} - 3a\sqrt{5}$

$-a\sqrt{5}$

Multiplying Radicals

$$\sqrt{a} \cdot \sqrt{b} = \sqrt{a \cdot b} = \sqrt{ab}$$

The product of square roots is equal to the square root of the product of the radicands

EXAMPLE: $\sqrt{3} \cdot \sqrt{5} = \sqrt{3 \cdot 5} = \sqrt{15}$

After we multiply, it's possible that we will have to simplify the radicand.

a. $\sqrt{5} \cdot \sqrt{10}$ $= \sqrt{50}$

$\sqrt{5 \cdot 10}$

$\sqrt{5 \cdot 5 \cdot 2}$

$5\sqrt{2}$

$\sqrt{5 \cdot 10}$

$\sqrt{5 \cdot 5 \cdot 2}$

b. $\sqrt{12} \cdot \sqrt{6}$

$\sqrt{12 \cdot 6}$

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

$6\sqrt{2}$

c. $\sqrt{10x} \cdot \sqrt{2x}$

c) $\sqrt{10 \cdot 2 \cdot x \cdot x}$

$\sqrt{5 \cdot 2 \cdot 2 \cdot x \cdot x}$

$2x\sqrt{5}$

a. $\sqrt{3} \cdot \sqrt{6}$

$\sqrt{3 \cdot 6}$

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

$3\sqrt{2}$ ✓

b. $\sqrt{3} \cdot \sqrt{18}$

$\sqrt{3 \cdot 18}$

$\sqrt{3 \cdot 3 \cdot 6}$

$3\sqrt{6}$ ✓

c. $\sqrt{8a} \cdot \sqrt{3a}$

$\sqrt{8a \cdot 3a}$

$\sqrt{2 \cdot 4 \cdot 3 \cdot a \cdot a}$

$2a\sqrt{6}$

$3\sqrt{3} \cdot 5\sqrt{7}$

a. $(3\sqrt{3})(5\sqrt{7})$

$15\sqrt{3 \cdot 7}$

$\boxed{15\sqrt{21}}$ ✓

$3x \cdot 5x^2$

$15x^3$

b. $(5\sqrt{7})(2\sqrt{14})$

$10\sqrt{7 \cdot 14}$

$10\sqrt{7 \cdot 7 \cdot 2}$

$10 \cdot 7\sqrt{2}$

$70\sqrt{2}$

c. $(\sqrt{5x})(3\sqrt{15x})$

$3\sqrt{5 \cdot 15 \cdot x \cdot x}$

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

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

$15x\sqrt{3}$

HW #7: Operations with Radicals