

Warmup:

Simplify the following radicals

$$\sqrt{20}$$

$$\sqrt{4 \cdot 5}$$

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

$$2\sqrt{5}$$

$$3\sqrt{60}$$

$$3\sqrt{4 \cdot 15}$$

$$3 \cdot 2 \sqrt{15}$$

$$6\sqrt{15}$$

$$\sqrt{x^{21}}$$

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

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

~~$$10\sqrt{x}$$~~

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

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

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

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

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

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

Algebra 1

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

$$\begin{aligned} 7) \sqrt{128n^4} &= \sqrt{64 \cdot 2 \cdot n^4} \\ &= 8n^2\sqrt{2} \end{aligned}$$

$$\begin{aligned} 8) \sqrt{24m^2} &= \sqrt{4 \cdot 6 \cdot m^2} \\ &= 2m\sqrt{6} \end{aligned}$$

$$\begin{aligned} 9) \sqrt{72x} &= \sqrt{36 \cdot 2 \cdot x} \\ &= 6\sqrt{2x} \end{aligned}$$

$$\begin{aligned} 10) \sqrt{8x^4} &= \sqrt{4 \cdot 2 \cdot x^4} \\ &= 2x^2\sqrt{2} \end{aligned}$$

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

$$7k\sqrt{5}$$

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

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

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

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

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

$$= 8xy\sqrt{5x}$$

$$\begin{aligned} 15) \sqrt{448u^4v} &= \sqrt{64 \cdot 7 \cdot u^4 \cdot v} \\ &= 8u^2\sqrt{7v} \end{aligned}$$

$$\begin{aligned} 16) \sqrt{125a^3b^4} &= \sqrt{25 \cdot 5 \cdot a \cdot a^2 \cdot b^4} \\ &= 5ab^2\sqrt{5a} \end{aligned}$$

$$\begin{aligned} 17) -4\sqrt{28xy^2} &= -4\sqrt{4 \cdot 7 \cdot x \cdot y^2} \\ &= -4 \cdot 2y\sqrt{7x} \\ &= -8y\sqrt{7x} \end{aligned}$$

$$\begin{aligned} 18) 2\sqrt{125x^2y^2} &= 2\sqrt{25 \cdot 5 \cdot x^2 \cdot y^2} \\ &= 2 \cdot 5xy\sqrt{5} \\ &= 10xy\sqrt{5} \end{aligned}$$

$$\begin{aligned} 19) -7\sqrt{147m^2n^3} &= -7\sqrt{49 \cdot 3 \cdot m^2 \cdot n \cdot n^2} & 20) 2\sqrt{80m^2n} &= 2\sqrt{16 \cdot 5 \cdot m^2 \cdot n} \\ &= -7 \cdot 7mn\sqrt{3n} & &= 2 \cdot 4m\sqrt{5n} \\ &= -49mn\sqrt{3n} & &= 8m\sqrt{5n} \end{aligned}$$

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

$$\underline{2}x \neq \underline{5}x$$

$$7(x)$$

$$\begin{array}{c} 2\sqrt{3} \\ \uparrow \end{array} + \begin{array}{c} 5\sqrt{3} \\ \uparrow \end{array}$$

$$7\sqrt{3}$$

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

$$4x + 2x = \underline{6x}$$

$$9y - 7y = \underline{2y}$$

Radicals

$$4\sqrt{5} + 2\sqrt{5} = (\underline{4} + \underline{2})\sqrt{5} = \underline{6}\sqrt{5}$$

$$9\sqrt{3} - 7\sqrt{3} = (\underline{9} - \underline{7})\sqrt{3} = \underline{2}\sqrt{3}$$

You try!!

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

$$9\sqrt{5}$$

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

$$8\sqrt{7}$$

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

$$4\sqrt{3}$$

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

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

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

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

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

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

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

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

↓

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

$$4\sqrt{2}$$

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

↓

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

$$2\sqrt{3}$$

simplifying EXPRESSIONS involving variables

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

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

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

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

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

$\sqrt{12 \cdot 6}$

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

$6\sqrt{2}$

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

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

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

$2x\sqrt{5}$

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

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

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

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

$$2a\sqrt{6}$$

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

$$15\sqrt{3 \cdot 7}$$

$$15\sqrt{21}$$

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