

## Multiplying and Dividing Radicals

### NOTE:

*You can only multiply or divide radicals IF they have the same INDEX.*

### Property #1: Multiplicative Property

*The product of two square roots is equal to the square root of the product.*

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

NOTE: Be Careful!

1.a)  $\sqrt{5} \cdot \sqrt{2} =$

b)  $\sqrt[3]{6} \cdot \sqrt[3]{3} =$

$$\sqrt{5} \cdot 2 \neq \sqrt{10}$$

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

**Property #2: Product Rule**

*The product of two mixed radicals is equal to the product of the coefficients times the product of the radicals.*

$$c\sqrt[n]{a} \cdot d\sqrt[n]{b} = cd\sqrt[n]{ab}$$

2.a)  $3\sqrt{2} \cdot 4\sqrt{5}$

b)  $\sqrt{12} \cdot \sqrt{18}$

NOTE: Can multiply then simplify

OR can simplify then multiply!

***Multiplying/Dividing:***

What are the restrictions on each variable above?

c)  $(5\sqrt{x})(-4\sqrt{x^3})$

d)  $(-3\sqrt{2x})(4\sqrt{6})$



**Property #3:**

*You can use the same properties you use with rational numbers to multiply and divide radical numbers.*

*ie, distributive property and FOIL*

$$3.a) 4\sqrt{2}(7\sqrt{5} + \sqrt{3})$$

Note the  
similarity!

$$4x(7x + 3)$$

$$b) -2\sqrt[3]{11}(4\sqrt[3]{2} - 3\sqrt[3]{3})$$

$$c)(3 + \sqrt{14})(4\sqrt{7} - 5\sqrt{2})$$

***Multiplying/Dividing:***

What are the restrictions on each variable?

$$d) 9\sqrt[3]{2w}(\sqrt[3]{4w} + 7\sqrt[3]{28})$$

$$e)(2\sqrt{x} + 1)(3 - 6\sqrt{x})$$

Assign: p. 289 - 293, #1, 2, 3, 4 bcd

Worksheet

**Property #4:**

The quotient of two  $n$ th roots is equal to the  $n$ th root of the quotient.

$$\frac{\sqrt[n]{a}}{\sqrt[n]{b}} = \sqrt[n]{\frac{a}{b}}$$

$$4.a) \sqrt{\frac{25}{4}} =$$

$$b) \frac{\sqrt{56}}{\sqrt{7}} =$$

**Property #5:**

When two radicals are divided and the numbers under the radical signs cannot be divided evenly, we must use a process called...

*Rationalizing the Denominator*

...which converts the denominator to a rational number.

$$5. a) \frac{7\sqrt{10}}{5\sqrt{3}}$$

$$b) \frac{14\sqrt[3]{2}}{10\sqrt[3]{5}}$$

TIP:

Reduce radicals first before rationalizing!



What are the restrictions on each variable?

NOTE: Combine into a single radical if possible, and then simplify, or rationalize the denominator as necessary.

c)  $\frac{\sqrt{10x^9}}{\sqrt{5x^3}}$

d)  $\frac{\sqrt{2}}{\sqrt{5x}}$

Radicals may be added/subtracted in the numerator of a fraction that also requires Rationalizing of the Denominator.

e)  $\frac{2\sqrt{3} + 4\sqrt{5}}{\sqrt{6}}$

f)  $\frac{-5\sqrt{8} + \sqrt{11}}{7\sqrt{3}}$



$$g) \frac{4 + 2\sqrt{x}}{\sqrt{x}}$$

*Radicals containing a binomial denominator will also have to be rationalized.*

$$h) \frac{5\sqrt{3}}{4 - \sqrt{6}}$$

What must you multiply the denominator by to make it a rational number?

This time we multiply by the **conjugate**.

The conjugate of  $(a + b)$  is  $(a - b)$

The product of a pair of conjugates is a difference of squares.

$$(a + b)(a - b) = a^2 - b^2$$

Ex:  $(4 - \sqrt{6})(4 + \sqrt{6})$

i)  $\frac{5\sqrt{3}}{4 - \sqrt{6}}$

j)  $\frac{4\sqrt{2} - 6}{2\sqrt{5} + \sqrt{3}}$

k)  $\frac{x + 3\sqrt{y}}{\sqrt{y} - x}$

Key Ideas p. 289

Assign: p. 289 - 293 questions #6(bd), 7, 8(bcd), 9(ab), 10(bd), 11(bc), 13, 17, 20, 21, 29