

radical  
radicand

Name \_\_\_\_\_

Date \_\_\_\_\_

What does it mean to say  $\sqrt{4}$ ? 2 is the number that can be squared to get 4

So, in general  $\sqrt{x}$  means: what number could be squared to get x?

Square Root is the inverse of Squared.

$3^2 = 9$      $\sqrt{9} = 3$      $\sqrt{3} \cdot \sqrt{3} = \sqrt{3 \cdot 3} = \sqrt{9} = 3$      $\sqrt{x \cdot x} = x$

Memorize the following square roots. These are the most common!

$\sqrt{1} = 1$

$\sqrt{4} = 2$

$\sqrt{9} = 3$

$\sqrt{16} = 4$

$\sqrt{25} = 5$

$\sqrt{36} = 6$

$\sqrt{49} = 7$

$\sqrt{64} = 8$

$\sqrt{81} = 9$

$\sqrt{100} = 10$

$\sqrt{121} = 11$

$\sqrt{144} = 12$

Simplify each radical expression: Rewrite each radical as a product of two factors (one being the largest perfect square each number is divisible by).

1.  $\sqrt{12} = \sqrt{4} \sqrt{3}$   
 $4 \hat{=} 3 = 2\sqrt{3}$

2.  $\sqrt{72} = \sqrt{36} \sqrt{2}$   
 $36 \hat{=} 2 = 6\sqrt{2}$

3.  $\sqrt{28} = \sqrt{4} \sqrt{7}$   
 $4 \hat{=} 7 = 2\sqrt{7}$

When simplifying radicals with a coefficient, remember: "outsides with outsides" and "insides with insides."

1.  $3\sqrt{8}$   
 $4 \hat{=} 2$   
=  $3\sqrt{4} \sqrt{2}$   
=  $3 \cdot 2\sqrt{2}$   
=  $6\sqrt{2}$

2.  $10\sqrt{36} = 10 \cdot 6$   
=  $60$

3.  $-20\sqrt{125} = -20\sqrt{25} \sqrt{5}$   
 $25 \hat{=} 5$   
=  $-20 \cdot 5\sqrt{5}$   
=  $-100\sqrt{5}$

Simplify each radical expression with variables.

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

1.  $\sqrt{a^8 b^{11} c}$

$a^4 b^5 \sqrt{bc}$

2.  $\sqrt{30a^2 b^9}$

$ab^4 \sqrt{30b}$

3.  $\sqrt{80x^{100}y^{49}}$

$16 \hat{=} 5$   
 $\sqrt{16} \sqrt{5} \times 50 y^{24} \sqrt{y}$   
 $4 \times 50 y^{24} \sqrt{5y}$

**Multiplying Radicals.** (Remember to simplify completely.) "outsides with outsides" and "insides with insides."

$$1. \sqrt{7} \cdot \sqrt{3} = \sqrt{7 \cdot 3} = \sqrt{21}$$

$$2. \sqrt{10} \cdot \sqrt{5} = \sqrt{10 \cdot 5} = \sqrt{50} = \sqrt{25 \cdot 2} = 5\sqrt{2}$$

$$3. -5\sqrt{12}(3\sqrt{6}) = -15\sqrt{72} = -15\sqrt{36 \cdot 2} = -15 \cdot 6\sqrt{2} = -90\sqrt{2}$$

$$4. -\sqrt{18}(-9\sqrt{2}) = 9\sqrt{36} = 9 \cdot 6 = 54$$

$$5. \sqrt{a^2b} \cdot \sqrt{ab^2} = \sqrt{a^3b^3} = ab\sqrt{ab}$$

$$6. \sqrt{2a^3} \cdot \sqrt{8a^5b^2} = \sqrt{16a^8b^2} = 4a^4b$$

**Dividing Radicals.** (Remember to simplify completely.)

$$1. \frac{\sqrt{30}}{\sqrt{15}} = \sqrt{\frac{30}{15}} = \sqrt{2}$$

$$2. \frac{6\sqrt{200}}{\sqrt{20}} = 6\sqrt{10}$$

$$3. \frac{\sqrt{40}}{\sqrt{8}} = \sqrt{5}$$

**IMPORTANT:** \* When simplifying, never leave a radical in the denominator of a fraction. \*

Always rationalize the denominator.

When the denominator is a monomial, multiply both the numerator and the denominator by whatever makes the denominator an expression that can be simplified so that it is no longer a radical.

Example 1: Simplify  $\frac{2}{\sqrt{7}} \cdot \frac{\sqrt{7}}{\sqrt{7}} = \frac{2\sqrt{7}}{7}$

Example 2: Simplify  $\frac{10}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{10\sqrt{6}}{6} = \frac{5\sqrt{6}}{3}$

Sometimes you need to multiply by whatever makes the denominator a perfect square.

Example 3: Simplify  $\frac{5}{\sqrt{8}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{5\sqrt{2}}{\sqrt{16}} = \frac{5\sqrt{2}}{4}$

Example 4: Simplify  $\frac{2}{\sqrt{18}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{2\sqrt{2}}{\sqrt{36}} = \frac{2\sqrt{2}}{6} = \frac{\sqrt{2}}{3}$

If the radicand is a fraction, rewrite the numerator and denominator as two separate radicals.

Example 5: Simplify  $\sqrt{\frac{1}{5}} = \frac{\sqrt{1}}{\sqrt{5}} = \frac{\sqrt{5}}{5}$

Example 6: Simplify  $\sqrt{\frac{9}{11}} = \frac{\sqrt{9}}{\sqrt{11}} = \frac{3}{\sqrt{11}} = \frac{3\sqrt{11}}{11}$

Example 7: Simplify  $\frac{\sqrt{45}}{\sqrt{5}} = \sqrt{\frac{45}{5}} = \sqrt{9} = 3$

Example 8: Simplify  $\frac{\sqrt{12}}{\sqrt{24}} = \sqrt{\frac{12}{24}} = \sqrt{\frac{1}{2}} = \frac{1}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{2}}{2}$

2 ways Example 9: Simplify  $\frac{\sqrt{21}}{\sqrt{18}}$

①  $\frac{\sqrt{21}}{\sqrt{18}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{\sqrt{42}}{\sqrt{36}} = \frac{\sqrt{42}}{6}$

②  $\frac{\sqrt{21}}{\sqrt{18}} = \frac{\sqrt{7}}{\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{\sqrt{42}}{6}$

Example 10: Simplify  $\frac{12}{5\sqrt{6}} \cdot \frac{\sqrt{6}}{\sqrt{6}} = \frac{12\sqrt{6}}{5 \cdot 6} = \frac{2\sqrt{6}}{5}$

### Dividing Radicals Practice

1.  $\frac{8}{\sqrt{5}} \cdot \frac{\sqrt{5}}{\sqrt{5}} = \frac{8\sqrt{5}}{5}$

2.  $\frac{10}{3\sqrt{20}} \cdot \frac{\sqrt{5}}{\sqrt{5}}$   
 $\frac{10\sqrt{5}}{3\sqrt{100}} = \frac{10\sqrt{5}}{3 \cdot 10}$   
 $= \frac{\sqrt{5}}{3}$

3.  $\frac{\sqrt{90}}{\sqrt{5}} = \sqrt{18}$   
 $= \sqrt{9 \cdot 2}$   
 $= 3\sqrt{2}$

4.  $\sqrt{\frac{4}{3}} = \frac{\sqrt{4}}{\sqrt{3}} = \frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$   
 $\frac{2\sqrt{3}}{3}$

5.  $\frac{6}{\sqrt{2}} \cdot \frac{\sqrt{2}}{\sqrt{2}} = \frac{6\sqrt{2}}{2} = 3\sqrt{2}$

6.  $\sqrt{\frac{125}{5}} = \sqrt{25} = 5$

7.  $\frac{3\sqrt{6}^2}{2\sqrt{3}} = \frac{3\sqrt{2}}{2}$



DAY 5.1 Practice - Radicals

Simplify.

$$1) \sqrt{150} \quad \sqrt{25} \cdot \sqrt{6} = 5\sqrt{6}$$

$\begin{matrix} \wedge \\ 25 \end{matrix}$

$$2) \sqrt{50} \quad \sqrt{25} \sqrt{2} = 5\sqrt{2}$$

$\begin{matrix} \wedge \\ 25 \end{matrix}$

$$3) -8\sqrt{175} \quad -8\sqrt{25}\sqrt{7}$$

$$-8 \cdot 5\sqrt{7}$$

$$-40\sqrt{7}$$

$$4) 2\sqrt{72} \quad 2\sqrt{36}\sqrt{2} = 2 \cdot 6\sqrt{2} = 12\sqrt{2}$$

$$5) \sqrt{100m} \quad 10\sqrt{m}$$

$$6) 5\sqrt{150p^4} \quad 5\sqrt{25}\sqrt{6} \cdot p^2$$

$$= 5 \cdot 5p^2\sqrt{6} = 25p^2\sqrt{6}$$

$$7) \sqrt{72x^2y^4} \quad \sqrt{36}\sqrt{2} \cdot xy^2$$

$$6xy^2\sqrt{2}$$

$$8) -6\sqrt{16x^3y^2} \quad -6 \cdot 4x^2y\sqrt{x}$$

$$-24x^2y\sqrt{x}$$

$$9) \sqrt{6} \cdot \sqrt{15} \quad \sqrt{90} = \sqrt{9}\sqrt{10}$$

$$3\sqrt{10}$$

$$10) \sqrt{15} \cdot \sqrt{15} \quad 15$$

$$11) -3\sqrt{8} \cdot 4\sqrt{6} \quad -12\sqrt{48} = -12\sqrt{16}\sqrt{3}$$

$$= -12 \cdot 4\sqrt{3} = -48\sqrt{3}$$

$$12) 5\sqrt{10} \cdot -3\sqrt{5} \quad -15\sqrt{50} = -15\sqrt{25}\sqrt{2}$$

$$-15 \cdot 5\sqrt{2} = -75\sqrt{2}$$

$$13) \frac{\sqrt{20}}{\sqrt{4}} \quad \sqrt{5}$$

$$14) \frac{\sqrt{5}}{\sqrt{9}} \quad \frac{\sqrt{5}}{3}$$

$$15) \frac{\sqrt{5}}{\sqrt{80}} \quad \frac{\sqrt{1}}{\sqrt{16}} = \frac{1}{4}$$

$$16) \frac{\sqrt{20}}{\sqrt{64}} \quad \frac{\sqrt{5}}{\sqrt{16}} = \frac{\sqrt{5}}{4}$$

$$17) \frac{4\sqrt{12}}{2\sqrt{4}} \quad 2\sqrt{3}$$

$$18) \frac{2\sqrt{12}}{2\sqrt{25}} \quad \frac{\sqrt{12}}{5} = \frac{\sqrt{4}\sqrt{3}}{5} = \frac{2\sqrt{3}}{5}$$