

**Simplifying Radicals: Finding hidden perfect squares and taking their root.**

Simplify each expression by factoring to find perfect squares and then taking their root.

1)  $\sqrt{75}$

2)  $\sqrt{16}$

3)  $\sqrt{36}$

4)  $\sqrt{64}$

5)  $\sqrt{80}$

6)  $\sqrt{30}$

7)  $\sqrt{8}$

8)  $\sqrt{18}$

9)  $\sqrt{32}$

10)  $\sqrt{12}$

11)  $\sqrt{8}$

12)  $\sqrt{108}$

13)  $\sqrt{125}$

14)  $\sqrt{50}$

15)  $\sqrt{175}$

16)  $\sqrt{28}$

17)  $\sqrt{45}$

18)  $\sqrt{72}$

19)  $\sqrt{20}$

20)  $\sqrt{150}$

### Simplifying Radical Expressions: Adding and Subtracting

Add or subtract radicals by simplifying each term and then combining like terms.

a.  $2\sqrt{2} + \sqrt{5} - 6\sqrt{2} = -4\sqrt{2} + \sqrt{5}$       **Subtract like radicals.**

b.  $4\sqrt{3} - \sqrt{27} = 4\sqrt{3} - \sqrt{9 \cdot 3}$       **Perfect square factor**

$= 4\sqrt{3} - \sqrt{9} \cdot \sqrt{3}$       **Use product property.**

$= 4\sqrt{3} - 3\sqrt{3}$       **Simplify.**

$= \sqrt{3}$       **Subtract like radicals.**

1)  $3\sqrt{6} - 4\sqrt{6}$

2)  $-3\sqrt{7} + 4\sqrt{7}$

3)  $-11\sqrt{21} - 11\sqrt{21}$

4)  $-9\sqrt{15} + 10\sqrt{15}$

5)  $-10\sqrt{7} + 12\sqrt{7}$

6)  $-3\sqrt{17} - 4\sqrt{17}$

7)  $-10\sqrt{11} - 11\sqrt{11}$

8)  $-2\sqrt{3} + 3\sqrt{27}$

9)  $2\sqrt{6} - 2\sqrt{24}$

10)  $2\sqrt{6} + 3\sqrt{54}$

11)  $-\sqrt{12} + 3\sqrt{3}$

12)  $3\sqrt{3} - \sqrt{27}$

13)  $3\sqrt{8} + 3\sqrt{2}$

14)  $-3\sqrt{6} + 3\sqrt{6}$

### Simplifying Radical Expressions: Multiplying

- (a) Multiply numbers that are BOTH OUTSIDE the radical.  
Multiply numbers that are BOTH INSIDE the radical.  
Simplify the expression

$2 \cdot 5 = \underline{\hspace{2cm}}$

$2 \cdot \sqrt{5} = \underline{\hspace{2cm}}$

$\sqrt{2} \cdot 5 = \underline{\hspace{2cm}}$

$2\sqrt{3} \cdot 5 = \underline{\hspace{2cm}}$

$2\sqrt{3} \cdot \sqrt{5} = \underline{\hspace{2cm}}$

$2\sqrt{3} \cdot 4\sqrt{5} = \underline{\hspace{2cm}}$

1)  $\sqrt{6} \cdot 4\sqrt{6}$

2)  $-\sqrt{5} \cdot \sqrt{20}$

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

4)  $4\sqrt{8} \cdot \sqrt{2}$

5)  $\sqrt{12} \cdot \sqrt{15}$

6)  $\sqrt{5} \cdot -2\sqrt{5}$

7)  $-3\sqrt{5} \cdot \sqrt{20}$

8)  $\sqrt{15} \cdot 3\sqrt{5}$

9)  $\sqrt{9} \cdot \sqrt{3}$

10)  $-4\sqrt{8} \cdot \sqrt{10}$

### Simplifying Radical Expressions: Dividing and rationalizing the Denominator

$$\frac{6}{3} = \underline{\hspace{2cm}}$$

$$\frac{\sqrt{6}}{\sqrt{2}} = \underline{\hspace{2cm}}$$

$$\frac{\sqrt{6}}{2} = \underline{\hspace{2cm}}$$

$$\frac{12\sqrt{6}}{2} = \underline{\hspace{2cm}}$$

$$\frac{12\sqrt{6}}{\sqrt{2}} = \underline{\hspace{2cm}}$$

#### Simplest form for fractions with $\sqrt{\hspace{1cm}}$

1. No perfect square factor under  $\sqrt{\hspace{1cm}}$       ex.  $\sqrt{75} = \sqrt{25}\sqrt{3} = 5\sqrt{3}$

2. No fractions under a  $\sqrt{\hspace{1cm}}$       ex.  $\sqrt{\frac{3}{4}} = \frac{\sqrt{3}}{\sqrt{4}} = \frac{\sqrt{3}}{2}$

3. No  $\sqrt{\hspace{1cm}}$  in a denominator      ex.  $\frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{\sqrt{9}} = \frac{2\sqrt{3}}{3}$

4. Must be reduced      ex.  $\frac{8\sqrt{5}}{2} = 4\sqrt{5}$

11)  $\frac{\sqrt{8}}{\sqrt{7}}$

12)  $\frac{7}{8\sqrt{7}}$

13)  $\frac{\sqrt{2}}{\sqrt{6}}$

14)  $\frac{\sqrt{21}}{\sqrt{15}}$

15)  $\frac{\sqrt{3}}{6\sqrt{7}}$

16)  $\frac{\sqrt{5}}{\sqrt{3}}$

17)  $\frac{\sqrt{15}}{3\sqrt{6}}$

18)  $\frac{\sqrt{8}}{2\sqrt{7}}$

Simplify each radical expression. ODD PROBLEMS REQUIRED

1.  $\sqrt{5} \sqrt{15}$

2.  $\sqrt{14} \sqrt{35}$

3.  $\sqrt{2}(\sqrt{3} - \sqrt{5})$

4.  $\sqrt{3}(\sqrt{27} - \sqrt{3})$

5.  $\sqrt{2}(\sqrt{6} + \sqrt{10})$

6.  $\sqrt{7}(3 - \sqrt{7})$

7.  $\sqrt{5}(3\sqrt{5} - 4\sqrt{3})$

8.  $\sqrt{y}(\sqrt{y} - \sqrt{5})$

Simplify each radical expression. ODD PROBLEMS REQUIRED

21.  $\sqrt{\frac{27}{16}}$

22.  $\sqrt{\frac{14}{y^2}}$

23.  $\sqrt{\quad}$

24.  $\sqrt{\frac{7}{5}}$

25.  $\sqrt{\frac{10}{7}}$

26.  $\frac{2}{\sqrt{3}}$

27.  $\frac{5}{\sqrt{10}}$

28.  $\frac{6}{\sqrt{3}}$

29.  $\frac{2}{\sqrt{6}}$

15)  $-3\sqrt{20} - \sqrt{5}$

16)  $2\sqrt{45} - 2\sqrt{5}$

17)  $3\sqrt{18} - 2\sqrt{2}$

18)  $-3\sqrt{18} + 3\sqrt{8} - \sqrt{24}$

19)  $3\sqrt{18} + 3\sqrt{12} + 2\sqrt{27}$

20)  $-3\sqrt{5} - \sqrt{6} - \sqrt{5}$

Simplify each expression completely.

2.  $\sqrt{14} \sqrt{35}$

4.  $\sqrt{3}(\sqrt{27} - \sqrt{3})$

24.  $\sqrt{\frac{7}{5}}$

26.  $\frac{2}{\sqrt{3}}$

16)  $2\sqrt{45} - 2\sqrt{5}$

18)  $-3\sqrt{18} + 3\sqrt{8} - \sqrt{24}$

A perfect square is a number whose square root is an integer. Half of the first 300 perfect squares are listed for you. Fill in the other 15 perfect squares.

$$\sqrt{1} = 1 \quad \text{because} \quad 1^2 = 1$$

$$\sqrt{256} = 16 \quad \text{because} \quad 16^2 = 256$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{361} = 19 \quad \text{because} \quad 19^2 = 361$$

$$\sqrt{25} = 5 \quad \text{because} \quad 5^2 = 25$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{441} = 21 \quad \text{because} \quad 21^2 = 441$$

$$\sqrt{49} = 7 \quad \text{because} \quad 7^2 = 49$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{576} = 24 \quad \text{because} \quad 24^2 = 576$$

$$\sqrt{100} = 10 \quad \text{because} \quad 10^2 = 100$$

$$\sqrt{625} = 25 \quad \text{because} \quad 25^2 = 625$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{144} = 12 \quad \text{because} \quad 12^2 = 144$$

$$\sqrt{729} = 27 \quad \text{because} \quad 27^2 = 729$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{784} = 28 \quad \text{because} \quad 28^2 = 784$$

$$\sqrt{196} = 14 \quad \text{because} \quad 14^2 = 196$$

$$\sqrt{\quad} = \quad \text{because} \quad \quad^2 = \quad$$

$$\sqrt{225} = 15 \quad \text{because} \quad 15^2 = 225$$

$$\sqrt{900} = 30 \quad \text{because} \quad 30^2 = 900$$