

# 11-2 Study Guide and Intervention

## Operations with Radical Expressions

**Add and Subtract Radical Expressions** When adding or subtracting radical expressions, use the Associative and Distributive Properties to simplify the expressions. If radical expressions are not in simplest form, simplify them.

**Example 1** Simplify  $10\sqrt{6} - 5\sqrt{3} + 6\sqrt{3} - 4\sqrt{6}$ .

$$10\sqrt{6} - 5\sqrt{3} + 6\sqrt{3} - 4\sqrt{6} = (10 - 4)\sqrt{6} + (-5 + 6)\sqrt{3} \quad \text{Associative and Distributive Properties}$$

$$= 6\sqrt{6} + \sqrt{3} \quad \text{Simplify.}$$

**Example 2** Simplify  $3\sqrt{12} + 5\sqrt{75}$ .

$$3\sqrt{12} + 5\sqrt{75} = 3\sqrt{2^2 \cdot 3} + 5\sqrt{5^2 \cdot 3} \quad \text{Simplify.}$$

$$= 3 \cdot 2\sqrt{3} + 5 \cdot 5\sqrt{3} \quad \text{Simplify.}$$

$$= 6\sqrt{3} + 25\sqrt{3} \quad \text{Simplify.}$$

$$= 31\sqrt{3} \quad \text{Distributive Property}$$

### Exercises

Simplify each expression.

1.  $2\sqrt{5} + 4\sqrt{5} = 6\sqrt{5}$

3.  $\frac{\sqrt{8} - \sqrt{2}}{2\sqrt{2} - \sqrt{2}} = \sqrt{2}$

5.  $\frac{\sqrt{20} + 2\sqrt{5} - 3\sqrt{5}}{2\sqrt{3}} = \sqrt{5}$

7.  $\frac{\sqrt{12} + 2\sqrt{3} - 5\sqrt{3}}{2\sqrt{3}} = -\sqrt{3}$

9.  $\frac{\sqrt{8a} - \sqrt{2a} + 5\sqrt{2a}}{2\sqrt{2a}} = 6\sqrt{2a}$

11.  $\frac{3\sqrt{3}}{3} + \sqrt{\frac{1}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}}} = \frac{\sqrt{3}}{3} = \frac{4\sqrt{3}}{3}$

13.  $\frac{\sqrt{54}}{3\sqrt{6}} - \sqrt{\frac{1}{6} \cdot \frac{\sqrt{6}}{\sqrt{6}}} = \frac{\sqrt{6}}{6} = \frac{18\sqrt{6} - \sqrt{6}}{6} = \frac{17\sqrt{6}}{6}$

15.  $\frac{\sqrt{50} + \sqrt{18} - \sqrt{75} + \sqrt{27}}{5\sqrt{2} + 3\sqrt{2} - 5\sqrt{3} + 3\sqrt{3}} = \frac{8\sqrt{2} - 2\sqrt{3}}{8\sqrt{2} - 2\sqrt{3}}$

17.  $\frac{\sqrt{125} - 2\sqrt{\frac{1}{5}} + \sqrt{\frac{1}{3}}}{5\sqrt{5} - \frac{2\sqrt{3}}{5} + \frac{\sqrt{3}}{3}} = \frac{\frac{23\sqrt{5}}{5} + \frac{\sqrt{3}}{3}}{5\sqrt{5} - \frac{2\sqrt{3}}{5} + \frac{\sqrt{3}}{3}}$

2.  $\sqrt{6} - 4\sqrt{6} = -3\sqrt{6}$

4.  $\frac{3\sqrt{75} + 2\sqrt{5}}{3 \cdot 5\sqrt{3} - 15\sqrt{3}} = \frac{15\sqrt{3} + 2\sqrt{5}}{15\sqrt{3} - 15\sqrt{3}}$

6.  $2\sqrt{3} + \sqrt{6} - 5\sqrt{3} = -3\sqrt{3} + \sqrt{6}$

8.  $\frac{3\sqrt{6} + 3\sqrt{2} - \sqrt{50} + \sqrt{24}}{4\sqrt{5} - 2\sqrt{5} + 6\sqrt{3}} = \frac{5\sqrt{6} - 2\sqrt{2}}{-5\sqrt{2} + 2\sqrt{2}}$

10.  $\frac{\sqrt{54} + \sqrt{24}}{3\sqrt{6} - 2\sqrt{6}} = 5\sqrt{6}$

12.  $\frac{\sqrt{12}}{2\sqrt{3}} + \sqrt{\frac{1}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}}} = \frac{6\sqrt{3}}{3} + \frac{\sqrt{3}}{3} = \frac{7\sqrt{3}}{3}$

14.  $\frac{\sqrt{80} - \sqrt{20} + \sqrt{180}}{4\sqrt{5} - 2\sqrt{5} + 6\sqrt{3}} = 8\sqrt{5}$

16.  $\frac{2\sqrt{3} - 4\sqrt{45} + 2\sqrt{\frac{1}{3}}}{2\sqrt{3} - 12\sqrt{5} + \frac{2\sqrt{3}}{3}} = \frac{\frac{6\sqrt{3}}{3} - 12\sqrt{5} + \frac{2\sqrt{3}}{3}}{2\sqrt{3} - 12\sqrt{5} + \frac{2\sqrt{3}}{3}} = \frac{8\sqrt{3} - 2\sqrt{5}}{8\sqrt{3} - 2\sqrt{5}}$

18.  $\frac{\sqrt{\frac{2}{3}} + 3\sqrt{3} - 4\sqrt{\frac{1}{12}}}{\frac{\sqrt{6}}{3} + 3\sqrt{3} - \frac{4\sqrt{3}}{3}} = \frac{\frac{\sqrt{2}}{\sqrt{3}} + 3\sqrt{3} - \frac{4\sqrt{1}}{2\sqrt{3}}}{\frac{\sqrt{6}}{3} + 3\sqrt{3} - \frac{4\sqrt{3}}{3}} = \frac{\frac{2\sqrt{3}}{3} + \frac{\sqrt{3}}{3}}{\frac{\sqrt{6}}{3} + 3\sqrt{3} - \frac{4\sqrt{3}}{3}} = \frac{\sqrt{3}}{3}$

# Why Was the Pail Pale?



Simplify each expression. Find your answer below and notice the letter next to it. Write this letter in each box containing the number of that exercise.

S ①  $7\sqrt{2} + \sqrt{50} - 2\sqrt{18} = 6\sqrt{2}$

U ②  $\frac{\sqrt{7}}{2} + \frac{\sqrt{7}}{2} = \frac{3\sqrt{7}}{2}$

A ③  $3\sqrt{\frac{3}{3}} + \sqrt{\frac{3}{3}} = \frac{4\sqrt{3}}{3}$

C ④  $3\sqrt{\frac{1}{2}} + \sqrt{2} = \frac{3\sqrt{2}}{2} + \frac{2\sqrt{2}}{2} = \frac{5\sqrt{2}}{2}$

E ⑤  $\frac{2\sqrt{5}}{5} + 3\sqrt{\frac{1}{5}} = \frac{3\sqrt{5}}{5} = \frac{13\sqrt{5}}{5}$

N ⑥  $10\sqrt{\frac{3}{5}} - 24\sqrt{\frac{5}{3}}$   
 $\frac{10\sqrt{15}}{5} - \frac{24\sqrt{15}}{3}$   
 $2\sqrt{15} - 8\sqrt{15} = -6\sqrt{15}$

Answers:

Ⓒ  $\frac{5\sqrt{2}}{2}$

Ⓐ  $\frac{4\sqrt{3}}{3}$

Ⓓ  $\frac{7\sqrt{2}}{3}$

Ⓔ  $\frac{13\sqrt{5}}{5}$

Ⓘ  $6\sqrt{2}$

Ⓓ  $9\sqrt{5}$

Ⓝ  $-6\sqrt{15}$

Ⓤ  $\frac{3\sqrt{7}}{2}$

I ⑦  $\sqrt{\frac{3}{2}} + 3\sqrt{\frac{1}{6}} = \frac{\sqrt{6}}{2} + \frac{3\sqrt{6}}{6} = \frac{2\sqrt{6}}{2} = \sqrt{6}$

B ⑧  $5\sqrt{\frac{1}{2}} - 2\sqrt{\frac{1}{8}} = \frac{5\sqrt{2}}{2} - \frac{2\sqrt{2}}{8} = \frac{5\sqrt{2}}{2} - \frac{1\sqrt{2}}{4} = \frac{4\sqrt{2}}{2} = 2\sqrt{2}$

T ⑨  $\sqrt{\frac{3}{8}} + \sqrt{\frac{2}{3}} = \frac{\sqrt{3}}{2\sqrt{2}} + \frac{\sqrt{2}}{\sqrt{3}} = \frac{\sqrt{6}}{4} + \frac{\sqrt{6}}{3} = \frac{3\sqrt{6}}{12} + \frac{4\sqrt{6}}{12} = \frac{7\sqrt{6}}{12}$

K ⑩  $\sqrt{\frac{3}{4}} + \sqrt{12} = \frac{\sqrt{3}}{2} + 2\sqrt{3} = \frac{5\sqrt{3}}{2}$

L ⑪  $\frac{3\sqrt{10}}{5} - \frac{2\sqrt{90}}{5} + 4\sqrt{\frac{1}{10}} = \frac{7\sqrt{10}}{5}$

W ⑫  $3\sqrt{\frac{2}{9}} + \frac{1}{2}\sqrt{32} + \sqrt{\frac{9}{8}}$   
 $\frac{4\sqrt{2}}{3} + \frac{2\sqrt{2}}{4} + \frac{3\sqrt{2}}{4} = \frac{15\sqrt{2}}{4}$

Answers:

Ⓕ  $\frac{7\sqrt{2}}{2}$

Ⓚ  $\frac{5\sqrt{3}}{2}$

Ⓣ  $\frac{7\sqrt{6}}{12}$

ⓗ  $3\sqrt{10}$

Ⓦ  $\frac{15\sqrt{2}}{4}$

Ⓛ  $\frac{7\sqrt{10}}{5}$

Ⓡ  $\sqrt{6}$

Ⓑ  $2\sqrt{2}$

I T W A S N T A W E L L B U C K E T