**SIMPLIFYING RADICAL EXPRESSIONS** **Simplify the expression.**

**46.** $\sqrt{75m^2np^4}$

**47.** $\sqrt{512rs^6} \cdot \sqrt{t^3}$

**48.** $\sqrt{\frac{600a}{4b^3}}$

**49.** $\sqrt{\frac{50gh^2}{125f^3}}$

**50.** $\frac{4}{\sqrt{3}} + \frac{7}{\sqrt{12}}$

**51.** $\frac{2\sqrt{6}}{\sqrt{30}} - \frac{3}{\sqrt{20}}$

**52.** $\frac{7}{\sqrt{x}} + \frac{3}{2\sqrt{x}}$

**53.** $\frac{3}{\sqrt{x^3}} + \frac{4}{\sqrt{x}}$

**54.** $\frac{6m}{\sqrt{m^3}} - \frac{8}{\sqrt{m}}$

**CONJUGATES** **In Exercises 55–62, use the example to simplify the expression.**

**EXAMPLE** **Rationalize the denominator using conjugates**

**Simplify** $\frac{9}{2 - \sqrt{3}}$.

**Solution**

The binomials $a\sqrt{b} + c\sqrt{d}$ and $a\sqrt{b} - c\sqrt{d}$ are called *conjugates*. They differ only by the sign of one term. The product of two conjugates $a\sqrt{b} + c\sqrt{d}$ and $a\sqrt{b} - c\sqrt{d}$ does not contain a radical: $(2 + \sqrt{3})(2 - \sqrt{3}) = 2^2 - (\sqrt{3})^2 = 4 - 3 = 1$. You can use conjugates to simplify the expression.

$$\frac{9}{2 - \sqrt{3}} = \frac{9}{2 - \sqrt{3}} \cdot \frac{2 + \sqrt{3}}{2 + \sqrt{3}}$$ Multiply the numerator and denominator by the conjugate of the denominator.

$$= \frac{9(2 + \sqrt{3})}{(2 - \sqrt{3})(2 + \sqrt{3})}$$ Multiply fractions.

$$= \frac{18 + 9\sqrt{3}}{4 - 3}$$ Simplify numerator and denominator.

$$= 18 + 9\sqrt{3}$$ Simplify.

**55.** $\frac{1}{\sqrt{7} + 1}$

**56.** $\frac{2}{5 - \sqrt{3}}$

**57.** $\frac{\sqrt{10}}{7 - \sqrt{2}}$

**58.** $\frac{\sqrt{5}}{6 + \sqrt{5}}$

**59.** $\frac{3}{\sqrt{7} + \sqrt{6}}$

**60.** $\frac{11}{\sqrt{11} - \sqrt{7}}$

**61.** $\frac{\sqrt{6}}{\sqrt{2} - \sqrt{3}}$

**62.** $\frac{\sqrt{7} + 1}{\sqrt{7} + \sqrt{2}}$

**63.** **REASONING** Multiply the binomials $a\sqrt{b} + c\sqrt{d}$ and $a\sqrt{b} - c\sqrt{d}$ to show that the product does not contain a radical.

**64.** **WRITING** According to the definition of square root, a number $b$ is a square root of a number $a$ if $b^2 = a$. How can you use the definition to show that $\sqrt{x^2} = x$? *Explain*.

**65.** **MULTIPLYING FUNCTIONS** Let $f(x) = \sqrt{x} - \sqrt{4x}$, and let $g(x) = \sqrt{x}$. Find $h(x) = f(x) \cdot g(x)$.

**66.** **CHALLENGE** Consider the expression $\sqrt{2^m}$. Assume $m$ is a positive integer. For what values of $m$ will the expression contain a radical when simplified? For what values of $m$ will the expression contain no radical when simplified? *Explain*.



= WORKED-OUT SOLUTIONS on p. WS1

= MULTIPLE REPRESENTATIONS