RATIONALIZING THE DENOMINATOR Example 4 shows how to eliminate a radical from the denominator of a radical expression by multiplying the expression by an appropriate value of 1. The process of eliminating a radical from an expression's denominator is called **rationalizing the denominator.**

> **EXAMPLE 4** **Rationalize the denominator**

MULTIPLY BY 1
In part (a), notice that $\frac{\sqrt{7}}{\sqrt{7}}$ is equal to 1, so multiplying by it does not change the value of the expression.

a. $\dfrac{5}{\sqrt{7}} = \dfrac{5}{\sqrt{7}} \cdot \dfrac{\sqrt{7}}{\sqrt{7}}$ **Multiply by $\dfrac{\sqrt{7}}{\sqrt{7}}$.**

$= \dfrac{5\sqrt{7}}{\sqrt{49}}$ **Product property of radicals**

$= \dfrac{5\sqrt{7}}{7}$ **Simplify.**

b. $\dfrac{\sqrt{2}}{\sqrt{3b}} = \dfrac{\sqrt{2}}{\sqrt{3b}} \cdot \dfrac{\sqrt{3b}}{\sqrt{3b}}$ **Multiply by $\dfrac{\sqrt{3b}}{\sqrt{3b}}$.**

$= \dfrac{\sqrt{6b}}{\sqrt{9b^2}}$ **Product property of radicals**

$= \dfrac{\sqrt{6b}}{\sqrt{9} \cdot \sqrt{b^2}}$ **Product property of radicals**

$= \dfrac{\sqrt{6b}}{3b}$ **Simplify.**

SUMS AND DIFFERENCES You can use the distributive property to simplify sums and differences of radical expressions when the expressions have the same radicand.

> **EXAMPLE 5** **Add and subtract radicals**

a. $4\sqrt{10} + \sqrt{13} - 9\sqrt{10} = 4\sqrt{10} - 9\sqrt{10} + \sqrt{13}$ **Commutative property**

$= (4 - 9)\sqrt{10} + \sqrt{13}$ **Distributive property**

$= -5\sqrt{10} + \sqrt{13}$ **Simplify.**

b. $5\sqrt{3} + \sqrt{48} = 5\sqrt{3} + \sqrt{16 \cdot 3}$ **Factor using perfect square factor.**

$= 5\sqrt{3} + \sqrt{16} \cdot \sqrt{3}$ **Product property of radicals**

$= 5\sqrt{3} + 4\sqrt{3}$ **Simplify.**

$= (5 + 4)\sqrt{3}$ **Distributive property**

$= 9\sqrt{3}$ **Simplify.**

✓ **GUIDED PRACTICE**   **for Examples 4 and 5**

Simplify the expression.

3. $\dfrac{1}{\sqrt{3}}$ **4.** $\dfrac{1}{\sqrt{x}}$ **5.** $\dfrac{3}{\sqrt{2x}}$ **6.** $2\sqrt{7} + 3\sqrt{63}$