

## Section 8.3

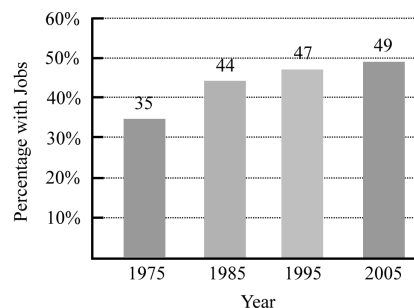
### Operations with Radicals

#### *College and Jobs!!!!!!*

If you are a full-time college student with a job then you are part of the data for a radical model.

The graph at right shows the percentage of full-time college students with jobs for various years.

In this section of your textbook, we will explore a function that models this data, and we will use the concepts of the section to simplify the formula to a manageable form.



Source: Department of Education

#### **First Steps:**

- Take comprehensive notes** from your instructor's lecture and insert your notes into this section of the *Learning Guide*. Be sure to write down all examples, definitions, and other key concepts. Additional learning resources include the *Lecture Series on DVD*, the *PowerPoints*, and Section 8.3 of your textbook which begins on page 584.
- Complete the *Concept and Vocabulary Check* on page 588 of the textbook.

#### **Guided Practice:**

- Review each of the following *Solved Problems* and complete each *Pencil Problem*.

**Objective #1:** Add and subtract radicals.

#### **✓ Solved Problem #1**

**1a.** Add or subtract as indicated:  $8\sqrt{13} + 9\sqrt{13}$

$$\begin{aligned}8\sqrt{13} + 9\sqrt{13} &= (8+9)\sqrt{13} \\ &= 17\sqrt{13}\end{aligned}$$

#### **Pencil Problem #1**

**1a.** Add or subtract as indicated:  $17\sqrt{6} - 2\sqrt{6}$

**1b.** Add or subtract as indicated:  $5\sqrt{27} + \sqrt{12}$

$$\begin{aligned} 5\sqrt{27} + \sqrt{12} &= 5\sqrt{9 \cdot 3} + \sqrt{4 \cdot 3} \\ &= 5 \cdot 3\sqrt{3} + 2\sqrt{3} \\ &= 15\sqrt{3} + 2\sqrt{3} \\ &= 17\sqrt{3} \end{aligned}$$

**1b.** Add or subtract as indicated:  $\sqrt{50} + \sqrt{18}$

**1c.** Add or subtract as indicated:  $6\sqrt{18x} - 4\sqrt{8x}$

$$\begin{aligned} 6\sqrt{18x} - 4\sqrt{8x} &= 6\sqrt{9 \cdot 2x} - 4\sqrt{4 \cdot 2x} \\ &= 6 \cdot 3\sqrt{2x} - 4 \cdot 2\sqrt{2x} \\ &= 18\sqrt{2x} - 8\sqrt{2x} \\ &= 10\sqrt{2x} \end{aligned}$$

**1c.** Add or subtract as indicated:  $2\sqrt{45x} - 2\sqrt{20x}$

**Objective #2:** Multiply radical expressions with more than one term.

 **Solved Problem #2**

**2a.** Multiply:  $\sqrt{2}(\sqrt{5} + \sqrt{11})$

Use the distributive property.

$$\begin{aligned} \sqrt{2}(\sqrt{5} + \sqrt{11}) &= \sqrt{2}\sqrt{5} + \sqrt{2}\sqrt{11} \\ &= \sqrt{10} + \sqrt{22} \end{aligned}$$

 **Pencil Problem #2** 

**2a.** Multiply:  $\sqrt{7}(\sqrt{6} - \sqrt{10})$

**2b.** Multiply:  $(4 + \sqrt{3})(2 + \sqrt{3})$

Use FOIL.

$$\begin{aligned}(4 + \sqrt{3})(2 + \sqrt{3}) &= 4 \cdot 2 + 4\sqrt{3} + 2\sqrt{3} + (\sqrt{3})^2 \\ &= 8 + 4\sqrt{3} + 2\sqrt{3} + 3 \\ &= 11 + 6\sqrt{3}\end{aligned}$$

**2b.** Multiply:  $(5 + \sqrt{2})(6 + \sqrt{2})$

**2c.** Multiply:  $(3 + \sqrt{5})(8 - 4\sqrt{5})$

Use FOIL.

$$\begin{aligned}(3 + \sqrt{5})(8 - 4\sqrt{5}) &= 3 \cdot 8 - 3 \cdot 4\sqrt{5} + 8\sqrt{5} - 4(\sqrt{5})^2 \\ &= 24 - 12\sqrt{5} + 8\sqrt{5} - 4 \cdot 5 \\ &= 24 - 12\sqrt{5} + 8\sqrt{5} - 20 \\ &= 4 - 4\sqrt{5}\end{aligned}$$

**2c.** Multiply:  $(6 - 3\sqrt{7})(2 - 5\sqrt{7})$

**Objective #3:** Multiply conjugates.

 **Solved Problem #3**

**3a.** Multiply:  $(3 + \sqrt{11})(3 - \sqrt{11})$

Use the special-product formula

$$(A + B)(A - B) = A^2 - B^2.$$

$$\begin{aligned}(3 + \sqrt{11})(3 - \sqrt{11}) &= 3^2 - (\sqrt{11})^2 \\ &= 9 - 11 \\ &= -2\end{aligned}$$

 **Pencil Problem #3** 

**3a.** Multiply:  $(1 - \sqrt{6})(1 + \sqrt{6})$

**3b.** Multiply:  $(\sqrt{7} - \sqrt{2})(\sqrt{7} + \sqrt{2})$

Use the special-product formula

$$(A + B)(A - B) = A^2 - B^2.$$

$$\begin{aligned}(\sqrt{7} - \sqrt{2})(\sqrt{7} + \sqrt{2}) &= (\sqrt{7})^2 - (\sqrt{2})^2 \\ &= 7 - 2 \\ &= 5\end{aligned}$$

**3b.** Multiply:  $(2\sqrt{3} + 7)(2\sqrt{3} - 7)$

---

**Answers for Pencil Problems (Textbook Exercise references in parentheses):**

**1a.**  $15\sqrt{6}$  (8.3 #3)

**1b.**  $8\sqrt{2}$  (8.3 #27)

**1c.**  $2\sqrt{5x}$  (8.3 #33)

**2a.**  $\sqrt{42} - \sqrt{70}$  (8.3 #45)

**2b.**  $32 + 11\sqrt{2}$  (8.3 #51)

**2c.**  $117 - 36\sqrt{7}$  (8.3 #55)

**3a.**  $-5$  (8.3 #65)    **3b.**  $-37$  (8.3 #71)

**Homework:**

- Review the Section 8.3 summary** on page 614 of the textbook.
- Insert your homework** into this section of the *Learning Guide*. Show all work neatly and check your answers. Strive to work through difficulties when possible, making note of any exercises where you need additional help. Remember, even if your instructor assigns homework through *MyMathLab*, you should still write out your work.