NAME _____ DATE _____

11–4 Irrational Square Roots

Objective: To simplify radicals and to find decimal approximations of irrational square roots.

Vocabulary

Irrational numbers Real numbers that can't be expressed in the form $\frac{a}{b}$, where a and b are integers. Their exact values can't be expressed as either terminating or repeating decimals.

Property

Property of Completeness Every decimal represents a real number, and every real number can be represented by a decimal.

Example 1 Simplify: **a.** $\sqrt{256}$ **b.** $\sqrt{50}$ **c.** $2\sqrt{80}$ **d.** $\sqrt{704}$

Solution

a. $\sqrt{256} = \sqrt{4 \cdot 64}$ Factor within the radical sign.
$= \sqrt{4} \cdot \sqrt{64}$ Use the product property of square roots.
$= 2 \cdot 8$ Simplify.
$= 16$

b. $\sqrt{50} = \sqrt{25 \cdot 2}$
$= \sqrt{25} \cdot \sqrt{2}$
$= 5\sqrt{2}$

c. $2\sqrt{80} = 2\sqrt{16 \cdot 5}$
$= 2 \cdot 4\sqrt{5}$
$= 8\sqrt{5}$

d. $\sqrt{704} = \sqrt{64 \cdot 11}$
$= 8\sqrt{11}$

Simplify.

1. $\sqrt{27}$	**2.** $\sqrt{20}$	**3.** $\sqrt{72}$	**4.** $\sqrt{32}$	**5.** $\sqrt{48}$
6. $\sqrt{45}$	**7.** $\sqrt{196}$	**8.** $\sqrt{80}$	**9.** $2\sqrt{63}$	**10.** $4\sqrt{98}$
11. $7\sqrt{28}$	**12.** $4\sqrt{40}$	**13.** $\sqrt{441}$	**14.** $\sqrt{289}$	**15.** $3\sqrt{50}$
16. $12\sqrt{50}$	**17.** $\sqrt{729}$	**18.** $\sqrt{432}$	**19.** $8\sqrt{75}$	**20.** $2\sqrt{90}$
21. $\sqrt{147}$	**22.** $\sqrt{288}$	**23.** $\sqrt{4225}$	**24.** $5\sqrt{800}$	**25.** $5\sqrt{1025}$

NAME _____ DATE _____

11–4 Irrational Square Roots *(continued)*

Example 2 Approximate $\sqrt{396}$ to the nearest hundredth. Use your calculator or the table at the back of your textbook.

Solution

$$\sqrt{396} = \sqrt{2^2 \cdot 3^2 \cdot 11}$$
$$= \sqrt{2^2} \cdot \sqrt{3^2} \cdot \sqrt{11}$$
$$= 6\sqrt{11}$$

From the table: $\sqrt{11} \approx 3.317$

$$6\sqrt{11} \approx 6(3.317) \approx 19.902$$

Therefore $\sqrt{396} \approx 19.90$.

Example 3 Approximate $\sqrt{0.6}$ to the nearest hundredth. Use your calculator or the table at the back of your textbook.

Solution

$$\sqrt{0.6} = \frac{\sqrt{60}}{\sqrt{100}} = \frac{\sqrt{60}}{10} \approx \frac{7.746}{10} = 0.7746$$

Therefore $\sqrt{0.6} \approx 0.77$.

In Exercises 26–37, use your calculator or the table at the back of the book. Approximate each square root to the nearest tenth.

26. $\sqrt{600}$ **27.** $\sqrt{200}$ **28.** $-\sqrt{800}$ **29.** $-\sqrt{500}$

30. $-\sqrt{2700}$ **31.** $-\sqrt{2200}$ **32.** $\pm\sqrt{6600}$ **33.** $\pm\sqrt{4800}$

Approximate each square root to the nearest hundredth.

34. $\sqrt{56}$ **35.** $\sqrt{32}$ **36.** $-\sqrt{0.7}$ **37.** $-\sqrt{0.2}$

Mixed Review Exercises

Find the indicated square roots.

1. $\sqrt{100}$ **2.** $-\sqrt{144}$ **3.** $\sqrt{\frac{9}{25}}$

4. $-\sqrt{\frac{36}{121}}$ **5.** $\sqrt{154^2}$ **6.** $\sqrt{\left(\frac{2}{5}\right)^2}$

Simplify.

7. $(13x)^2$ **8.** $(2y^3z^6)^2$ **9.** $(x + 2y)^2$

10. $[10(a + 1)]^2$ **11.** $(9a^3b^7c)^2$ **12.** $(4z^2 + 3y^3)(4z^2 - 3y^3)$