SECTION 4A Ready to Go On? Quiz

4-1 Exponents

Evaluate.

1. 7^3 — 343

2. $(-5)^4$ — 625

3. 9^1 — 9

4. $(-2)^7$ — -128

5. Write $6 \times 6 \times 6 \times 6 \times 6$ in exponential form. 6^5

6. Evaluate $r^4 - 5s$ for $r = 4$ and $s = -2$. 266

4-2 Look for a Pattern in Integer Exponents

Evaluate.

7. 10^{-7} 0.000001

8. $(-4)^{-3}$ $\frac{-1}{64}$

9. $(-3)^{-4}$ $\frac{1}{81}$

10. 8^{-1} $\frac{1}{8}$

11. $6 + 10^{-2}(-3)$ 5.97

12. $4^{-1} + 6(4)^{-2}$ $\frac{5}{8}$

13. $-5^{-2} + 9^0$ $\frac{26}{25}$

14. $8^{-2} - (2^0 - 2^{-3})$ $-\frac{55}{64}$

4-3 Properties of Exponents

Evaluate each expression. Write your answer as a power.

15. $7^6 \cdot 7^5$ — 7^{11}

16. $\frac{12^3}{12^3}$ — 12^0

17. $\frac{t^8}{t^4}$ — t^4

18. $6^5 \cdot 6^{-2}$ — 6^3

Simplify.

19. $(9^4)^{-3}$ — 9^{-12}

20. $(5^6)^0$ — 5^0

21. $(-w^6)^2$ — w^{12}

22. $(7^{-3})^5$ — 7^{-15}

23. The hard drive on a computer holds 2^{35} bytes of data, which is 2^5 gigabytes. How many bytes is one gigabyte? 2^{30} bytes

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SECTION 4A Ready to Go On? Quiz continued

4-4 Scientific Notation

Write each number in scientific notation.

24. 0.000027 — 2.7×10^{-5}

25. 115,000,000 — 1.15×10^8

26. 0.6412 — 6.412×10^{-1}

27. 10,000 — 1×10^4

Write each number in standard notation.

28. 7.29×10^5 — 729,000

29. 8×10^9 — 8,000,000,000

30. 4.5×10^{-4} — 0.00045

31. 5.26×10^{-6} — 0.00000526

32. In 2004, California had the greatest population of all the states. Its population was approximately 3.589×10^7 people. The population of the United States was about 8.18 times as large as California's population. What was the approximate population of the United States in 2004? Write your answer in scientific notation.

2.935802×10^8

33. The diameter of a rhinovirus, which causes the common cold, is 0.00000002 meter. The diameter of a human hair is 10,000 times as large as a rhinovirus. What is the diameter of a human hair? Write your answer in scientific notation.

2×10^{-4} meter

34. An adult human may have as many as 30,000,000,000,000 red blood cells. Write 30,000,000,000,000 in scientific notation.

3×10^{13}

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SECTION 4A Ready to Go On? Enrichment

Other Number Systems

The number system used by computers is the base 2, or binary number system.

- Place values are powers of 2.
- Digits are 0, 1.

1011_{binary} = 1 eight + 0 fours + 1 two + 1 one

2^3	2^2	2^1	2^0
1	0	1	1
$1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$ 8 + 0 + 2 + 1 11			

$1011_{binary} = 11_{decimal}$

To change a number in base 10 to a number in base 2, divide by powers of 2.

Change $28_{decimal}$ to base 2.

28 is between 2^4, or 16, and 2^5, or 32.

Divide by 2^4, 2^3, 2^2, 2^1, and 2^0.

$28 \div 2^4 = 28 \div 16 = \mathbf{1}$ R12
$12 \div 2^3 = 12 \div 8 = \mathbf{1}$ R4
$4 \div 2^2 = 4 \div 4 = \mathbf{1}$ R0
$0 \div 2^1 = 0 \div 2 = \mathbf{0}$ R0
$0 \div 2^0 = 0 \div 1 = \mathbf{0}$ R0
$28_{decimal} = 11100_{binary}$

Change each number in base 2 to base 10.

1. 11_{binary} — $3_{decimal}$

2. 1010_{binary} — $10_{decimal}$

3. 111010_{binary} — $58_{decimal}$

Change each number in base 10 to base 2.

4. $13_{decimal}$ — 1101_{binary}

5. $222_{decimal}$ — 11011110_{binary}

6. $1024_{decimal}$ — 10000000000_{binary}

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LESSON 4-5 Ready to Go On? Skills Intervention

Squares and Square Roots

Every positive number has two square roots, one positive and one negative. The positive square root is called the **principal square root.** A **perfect square** is a number that has integers as its square roots.

Vocabulary
principal square root
perfect square

Perfect squares 25; 36; 196

Not perfect squares 12; 37; 186

The opposite of squaring a number is taking the square root.
$10^2 = 100$ $\sqrt{100} = 10$ $(-10)^2 = 100$ $-\sqrt{100} = -10$

Finding the Positive and Negative Square Roots of a Number
Find the two square roots of 49.

49

$\sqrt{49} =$ 7 — What two numbers multiplied together equal 49? 7 and 7

$-\sqrt{49} =$ -7 — What other two numbers multiplied together equal 49? -7 and -7

Geometry Application
The area of a square rug is 1,024 square feet. What is the length of its side?

$A = s^2$ — Use the formula for area of a square to find the side length, s.

$1{,}024 = s^2$ — Taking the square root of a number is the opposite of squaring a number.

$\sqrt{1{,}024} = \sqrt{s^2}$ — Find the square root of both sides.

32 ft $= s$ — What is the length of the square rug? What are the units?

Can the length of a side of the rug be negative? Explain.
No, length can only be positive.

Evaluating Expressions
Evaluate the expression $3\sqrt{36} + 5$ using the principal square root.

$3\sqrt{36} + 5$

$3(\underline{6}) + 5$ — What is the square root of 36?

18 + 5 — Following the order of operations what should you do first? multiply

23 — Add.

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LESSON 4-8

Ready to Go On? Skills Intervention

The Pythagorean Theorem

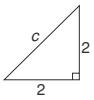
The **Pythagorean Theorem** states that in a right triangle, the sum of the squares of the lengths of the two **legs** is equal to the square of the length of the **hypotenuse.**

$a^2 + b^2 = c^2$



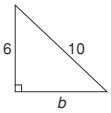
Vocabulary
Pythagorean Theorem
leg
hypotenuse

Finding the Length of a Hypotenuse
Find the length of the hypotenuse.



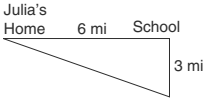
$a^2 + b^2 = c^2$	Write the Pythagorean Theorem.
$2^2 + 2^2 = c^2$	Substitute 2 for *a* and 2 for *b*.
$4 + 4 = c^2$	Simplify.
$\sqrt{8} = c$	How do you isolate *c*?
	Take the square root of both sides.
$2.83 \approx c$	Use a calculator.

Finding the Length of a Leg in a Right Triangle
Solve for the unknown side in the right triangle.



$6^2 + b^2 = 10^2$	Substitute values for *a* and *c*.
$36 + b^2 = 100$	Simplify.
$b^2 = 64$	Isolate the variable.
$b = \sqrt{64}$	Take the square root of both sides.
$b = 8$	The length of the unknown leg is 8.

Using the Pythagorean Theorem for Measurement
Sam and Julia go to the same school. Sam lives 3 miles south of the school. Julia lives 6 miles west of the school. How far apart do Sam and Julia live from each other?



The distance Sam and Julia live from each other is the hypotenuse of a right triangle.

$a^2 + b^2 = c^2$	State the Pythagorean Theorem.
$3^2 + 6^2 = c^2$	Substitute values for *a* and *b*.
$9 + 36 = c^2$	Simplify.
$45 = c^2$	Add.
$\sqrt{45} = c$	Take the square root of both sides.
$6.7 = c$	Use a calculator. Round to the nearest tenth.

Sam and Julia live 6.7 miles apart from each other.

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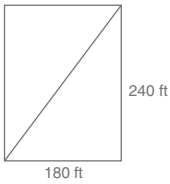
LESSON 4-8

Ready to Go On? Problem Solving Intervention

The Pythagorean Theorem

You can use the Pythagorean Theorem to help you find an unknown measurement.

A rectangular park is 240 feet long and 180 feet wide. What is the length of a diagonal path that connects two corners of the park?



Understand the Problem

1. Draw a diagram of the park. Label the side lengths. Show the diagonal path on your diagram.
2. What kind of triangles are formed by the diagonal and the sides of the park? right triangles

Make a Plan

3. How does the Pythagorean Theorem relate the sides lengths of a right triangle?
   The sum of the squares of the legs equals the square of the hypotenuse.
4. What equation states the Pythagorean Theorem? $a^2 + b^2 = c^2$
5. How can you use this equation to solve the problem?
   Substitute the lengths of the legs for *a* and *b* and solve for *c*.

Solve

6. Substitute the values into in the Pythagorean Theorem. $240^2 + 180^2 = c^2$
7. Solve for *c*. Use your calculator. $c = 300$
8. How long is the diagonal path? 300 feet

Check

9. Is your answer reasonable? Explain.
   Possible answer: Yes; The diagonal path is the hypotenuse of a right triangle with sides of 240 ft and 180 ft, so it must be longer than 240 ft. The third side of a triangle cannot be longer than the sum of the other two sides. $300 < 240 + 180$, or 420.

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SECTION 4B

Ready to Go On? Quiz

4-5 Squares and Square Roots

Find the two square roots of each number.

1. 64 — 8; −8
2. 6,084 — 78; −78
3. 1,000,000 — 1,000; −1,000
4. 324 — 18; −18

5. Amy wants to put together a jigsaw puzzle that will be 24 in. × 20 in. when finished. Will the puzzle fit on a square board with an area of 529 square inches? Explain your answer.
   No; $\sqrt{529} = 23$, so the board is 23 in. × 23 in. It is wide enough, but not long enough for the puzzle.
6. How many 6 in. × 6 in. square tiles will fit around the edges of a square hallway that has an area of 1,296 square inches? 24

4-6 Estimating Square Roots

Each square root is between two integers. Name the integers. Explain your answer.

7. $-\sqrt{56}$ — −7 and −8; 56 is between 49 and 64
8. $\sqrt{300}$ — 17 and 18; 300 is between 289 and 324
9. $-\sqrt{250}$ — −15 and −16; 250 is between 225 and 256
10. $\sqrt{860}$ — 29 and 30; 860 is between 841 and 900

11. A square quilt has an area of 28 square feet. To the nearest hundredth, what length of edging is needed to go around all the edges of the quilt? 21.16 feet

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SECTION 4B

Ready to Go On? Quiz continued

4-6 Estimating Square Roots (continued)

12. The area of a square painting is 120 square inches. Find the length of one side of the painting to the nearest hundredth. 10.95 inches

4-7 The Real Numbers

Write all the names that apply to each number.

13. 0.26 — rational, real
14. $\sqrt{35}$ — irrational, real
15. $\sqrt{400}$ — whole, integer, rational, real
16. $\frac{-\sqrt{100}}{5}$ — whole, integer, rational, real

17. Give an example of an irrational number that is less than −8. Possible answer: $-\sqrt{70}$
18. Find a real number between $\sqrt{49}$ and 8. Possible answer: 7.6

4-8 The Pythagorean Theorem

Find the missing length for each right triangle. Round your answer to the nearest tenth.

19. $a = 6$, $b = 10$, $c = ?$ — 11.7
20. $a = 4$, $b = ?$, $c = 12$ — 11.3
21. $a = ?$, $b = 15$, $c = 17$ — 8
22. $a = 36$, $b = 48$, $c = ?$ — 60
23. $a = 10$, $b = ?$, $c = 25$ — 22.9
24. $a = ?$, $b = 8$, $c = 18$ — 16.1

25. Jason is putting a fence around a garden. The measures of two sides that meet at a corner are 25 feet and 38 feet. For the corner to be a right angle, what would the length of the diagonal have to be? 45.5 feet

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