

8.1 EXERCISES

HOMEWORK KEY

- = **WORKED-OUT SOLUTIONS**
on p. WS1 for Exs. 31 and 55
- ★ = **STANDARDIZED TEST PRACTICE**
Exs. 2, 40, 41, 50, and 58
- ◆ = **MULTIPLE REPRESENTATIONS**
Ex. 55

4 PRACTICE AND APPLY

Assignment Guide

Answer Transparencies available for all exercises

Basic:

Day 1: pp. 492–494
Exs. 1, 2, 3–15 odd, 19–39 odd,
40–42, 52–57, 60–74 even

Average:

Day 1: pp. 492–494
Exs. 1, 2, 4–18 even, 29–49, 53–58,
61, 64, 67, 73

Advanced:

Day 1: pp. 492–494
Exs. 1, 2, 8–18 even, 31–38, 40–51*,
54–59*, 62, 65, 68, 74

Block:

pp. 492–494
Exs. 1, 2, 4–18 even, 29–49, 53–58,
61, 64, 67, 73 (with 8.2)

Differentiated Instruction

See *Algebra 1 Best Practices Toolkit* for suggestions on addressing the needs of a diverse classroom.

Homework Check

For a quick check of student understanding of key concepts, go over the following exercises:

Basic: 6, 11, 15, 27, 52

Average: 8, 12, 16, 33, 53

Advanced: 10, 14, 18, 36, 54

Extra Practice

- Student Edition, p. 945
- Chapter 8 Resource Book:
Practice levels A, B, C, pp. 6–8

Practice Worksheet

An easily-readable reduced practice page (with answers) for this lesson can be found on p. 486C.

SKILL PRACTICE

A

1. **VOCABULARY** Copy and complete: The ? of the quantity 93,534,004 people is the power of 10 nearest the quantity, or 10^8 people. **order of magnitude**
2. **★ WRITING** Explain when and how to use the product of powers property.
When powers have the same base, their product is the base raised to the sum of the exponents.

EXAMPLES 1, 2, 3, and 4
on pp. 489–491
for Exs. 3–41

SIMPLIFYING EXPRESSIONS Simplify the expression. Write your answer using exponents.

- | | | | |
|---|---|---|---|
| 3. $4^2 \cdot 4^6$ 4^8 | 4. $8^5 \cdot 8^2$ 8^7 | 5. $3^3 \cdot 3$ 3^4 | 6. $9 \cdot 9^5$ 9^6 |
| 7. $(-7)^4(-7)^5$ $(-7)^9$ | 8. $(-6)^6(-6)$ $(-6)^7$ | 9. $2^4 \cdot 2^9 \cdot 2$ 2^{14} | 10. $(-3)^2(-3)^{11}(-3)$ $(-3)^{14}$ |
| 11. $(3^5)^2$ 3^{10} | 12. $(7^4)^3$ 7^{12} | 13. $[(-5)^3]^4$ $(-5)^{12}$ | 14. $[(-8)^9]^2$ $(-8)^{18}$ |
| 15. $(15 \cdot 29)^3$ $15^3 \cdot 29^3$ | 16. $(17 \cdot 16)^4$ $17^4 \cdot 16^4$ | 17. $(132 \cdot 9)^6$ $132^6 \cdot 9^6$ | 18. $((-14) \cdot 22)^5$ $(-14)^5 \cdot 22^5$ |

SIMPLIFYING EXPRESSIONS Simplify the expression.

- | | | | |
|--|--|--|---|
| 19. $x^4 \cdot x^2$ x^6 | 20. $y^9 \cdot y$ y^{10} | 21. $z^2 \cdot z \cdot z^3$ z^5 | 22. $a^4 \cdot a^3 \cdot a^{10}$ a^{17} |
| 23. $(x^5)^2$ x^{10} | 24. $(y^4)^6$ y^{24} | 25. $[(b-2)^2]^6$ $(b-2)^{12}$ | 26. $[(d+9)^7]^3$ $(d+9)^{21}$ |
| 27. $(-5x)^2$ $25x^2$ | 28. $(-5x)^2$ $-25x^2$ | 29. $(7xy)^2$ $49x^2y^2$ | 30. $(5pq)^3$ $125p^3q^3$ |
| 31. $(-10x^6)^2 \cdot x^2$ $100x^{14}$ | 32. $(-8m^4)^2 \cdot m^3$ $64m^{11}$ | 33. $6d^2 \cdot (2d^5)^4$ $96d^{22}$ | 34. $(-20x^3)^2(-x^7)$ $-400x^{13}$ |
| 35. $(-2p^4)^3(-1.5p^7)$ $12p^{19}$ | 36. $(\frac{1}{2}y^5)^3(2y^2)^4$ $2y^{23}$ | 37. $(3x^5)^3(2x^7)^2$ $108x^{29}$ | 38. $(-10n)^2(-4n^3)^3$ $-6400n^{11}$ |

39. **ERROR ANALYSIS** Describe and correct the error in simplifying $c \cdot c^4 \cdot c^5$.
Sample answer: The exponents should be added, not multiplied; $c^1 \cdot c^4 \cdot c^5 = c^{1+4+5} = c^{10}$.

$$\begin{aligned} c \cdot c^4 \cdot c^5 &= c^1 \cdot c^4 \cdot c^5 \\ &= c^{1 \cdot 4 \cdot 5} \\ &= c^{20} \end{aligned}$$



B

40. **★ MULTIPLE CHOICE** Which expression is equivalent to $(-9)^6$? **B**
 (A) $(-9)^2(-9)^3$ (B) $(-9)(-9)^5$ (C) $[(-9)^4]^2$ (D) $[(-9)^3]^3$
41. **★ MULTIPLE CHOICE** Which expression is equivalent to $36x^{12}$? **D**
 (A) $(6x^3)^4$ (B) $12x^4 \cdot 3x^3$ (C) $3x^3 \cdot (4x^3)^3$ (D) $(6x^5)^2 \cdot x^2$

SIMPLIFYING EXPRESSIONS Find the missing exponent.

- | | | | |
|------------------------------------|---------------------------------|-----------------------------------|--|
| 42. $x^4 \cdot x^? = x^5$ 1 | 43. $(y^8)^? = y^{16}$ 2 | 44. $(2z^3)^3 = 8z^{15}$ 5 | 45. $(3a^3)^? \cdot 2a^3 = 18a^9$ 2 |
|------------------------------------|---------------------------------|-----------------------------------|--|

46. **POPULATION** The population of New York City in 2000 was 8,008,278. What was the order of magnitude of the population of New York City? **10^7 people**

SIMPLIFYING EXPRESSIONS Simplify the expression.

- | | | |
|--|--|---|
| 47. $(-3x^2y)^3(11x^3y^5)^2$ $-3267x^{12}y^{13}$ | 48. $(-xy^2z^3)^5(x^4yz)^2$ $x^{13}y^{12}z^{17}$ | 49. $(-2s)(-5r^3st)^3(-2r^4st^7)^2$ $1000r^{17}s^6t^{17}$ |
|--|--|---|

- C** 50. **★ OPEN-ENDED** Write three expressions involving products of powers, powers of powers, or powers of products that are equivalent to $12x^8$.
Sample answer: $3x^2 \cdot 4x^6$, $12(x^4)^2$, $3(2x^4)^2$
51. **CHALLENGE** Show that when a and b are real numbers and n is a positive integer, $(ab)^n = a^n b^n$. **See margin.**

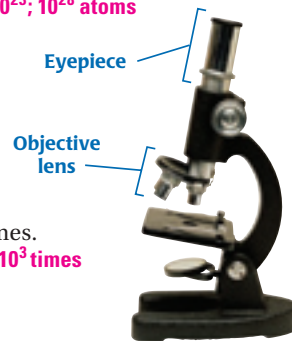
PROBLEM SOLVING

EXAMPLE 5 **A**
 on p. 491
 for Exs. 52–56

52. **ICE CREAM COMPOSITION** There are about 954,930 air bubbles in 1 cubic centimeter of ice cream. There are about 946 cubic centimeters in 1 quart. Use order of magnitude to find the approximate number of air bubbles in 1 quart of ice cream. **10^9 air bubbles**
- @HomeTutor** for problem solving help at classzone.com
53. **ASTRONOMY** The order of magnitude of the radius of our solar system is 10^{13} meters. The order of magnitude of the radius of the visible universe is 10^{13} times as great. Find the approximate radius of the visible universe. **10^{26} m**
- @HomeTutor** for problem solving help at classzone.com
54. **COASTAL LANDSLIDE** There are about 1 billion grains of sand in 1 cubic foot of sand. In 1995 a stretch of beach at Sleeping Bear Dunes National Lakeshore in Michigan slid into Lake Michigan. Scientists believe that around 35 million cubic feet of sand fell into the lake. Use order of magnitude to find about how many grains of sand slid into the lake. **10^{16} grains of sand**
55. **◆ MULTIPLE REPRESENTATIONS** There are about 10^{23} atoms of gold in 1 ounce of gold.
- a. **Making a Table** Copy and complete the table by finding the number of atoms of gold for the given amounts of gold (in ounces).

Gold (ounces)	10	100	1000	10,000	100,000
Number of atoms	?	?	?	?	?

- b. **Writing an Expression** A particular mine in California extracted about 96,000 ounces of gold in 1 year. Use order of magnitude to write an expression you can use to find the approximate number of atoms of gold extracted in the mine that year. Simplify the expression. Verify your answer using the table. **$10^5 \cdot 10^{23}$; 10^{28} atoms**
56. **MULTI-STEP PROBLEM** A microscope has two lenses, the objective lens and the eyepiece, that work together to magnify an object. The total magnification of the microscope is the product of the magnification of the objective lens and the magnification of the eyepiece.
- a. Your microscope's objective lens magnifies an object 10^2 times, and the eyepiece magnifies an object 10 times. What is the total magnification of your microscope? **10^3 times**
- b. You magnify an object that is 10^2 nanometers long. How long is the magnified image? **10^5 nanometers**



Vocabulary

Exercise 2 Encourage students to write out explanations and give specific examples for all three properties covered in this lesson.

Avoiding Common Errors

Exercises 3–38 Watch for students who fail to account for numerical or variable bases that have an exponent of 1. Remind these students that a base without an exponent is raised to the power of 1 and that they need to add 1 or multiply by 1 when simplifying expressions. Also, some students may overlook the numerical factor when simplifying powers with numerical and variable bases. Remind these students to evaluate the numerical power first.

Study Strategy

Exercise 54 You may want to suggest that students write the standard form of 1 billion and 35 million before they determine the order of magnitude. Students may want to review order of magnitude and estimation on page 491 before they begin this exercise.

51. Sample answer: $(ab)^n = (ab) \cdot (ab) \cdot \dots \cdot (ab)$ so that there are n total terms (ab) . By the commutative property, the n a 's can be grouped as a repeated multiplication equal to a^n and the n b 's can be grouped as a repeated multiplication equal to b^n . $(ab)^n$ is equal to the product of these two groups, or $a^n \cdot b^n$.

5 ASSESS AND RETEACH

Daily Homework Quiz

Transparency Available

Simplify the expression. Write your answer using exponents.

1. $14^5 \cdot 14^2$ **14^7**

2. $[(-8)^4]^3$ **$(-8)^{12}$**

Simplify the expression.

3. $[(m - 3)^6]^4$ **$(m - 3)^{24}$**

4. $-(2s)^3$ **$-8s^3$**

5. A website had about 102 hits after a week. After a year, it had about 103 times the number of hits of the first week. About how many hits did it have at the end of the year? **about 10,000 hits**

Online Quiz

Available at classzone.com

Diagnosis/Remediation

- Practice A, B, C in Chapter 8 Resource Book, pp. 6–8
- Study Guide in Chapter 8 Resource Book, pp. 9–10
- Practice Workbook, pp. 119–120
- @HomeTutor

Challenge

Additional challenge is available in the Chapter 8 Resource Book, p. 13.

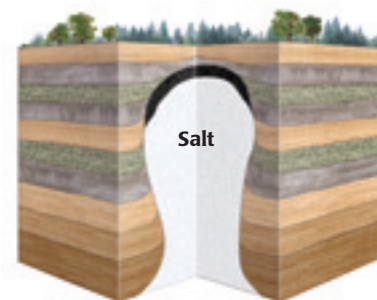
58c. Increases the volume by 10^8 . Sample answer: Since the radius is squared in the formula for volume, multiplying the radius by 10 would raise the volume by a factor of $10 \cdot 10$, or 10^2 .

- B** 57. **VOLUME OF THE SUN** The radius of the sun is about 695,000,000 meters.

The formula for the volume of a sphere, such as the sun, is $V = \frac{4}{3}\pi r^3$.

Because the order of magnitude of $\frac{4}{3}\pi$ is 1, it does not contribute to the formula in a significant way. So, you can find the order of magnitude of the volume of the sun by cubing its radius. Find the order of magnitude of the volume of the sun. **10^{27}**

58. **★ EXTENDED RESPONSE** Rock salt can be mined from large deposits of salt called salt domes. A particular salt dome is roughly cylindrical in shape. The order of magnitude of the radius of the salt dome is 10^3 feet. The order of magnitude of the height of the salt dome is about 10 times that of its radius. The formula for the volume of a cylinder is $V = \pi r^2 h$.



- Calculate** What is the order of magnitude of the height of the salt dome? **10^4**
- Calculate** What is the order of magnitude of the volume of the salt dome? **10^{10}**
- Explain** The order of magnitude of the radius of a salt dome can be 10 times the radius of the salt dome described in this exercise. What effect does multiplying the order of magnitude of the radius of the salt dome by 10 have on the volume of the salt dome? **Explain.**

- C** 59. **CHALLENGE** Your school is conducting a poll that has two parts, one part that has 13 questions and a second part that has 10 questions. Students can answer the questions in either part with “agree” or “disagree.” What power of 2 represents the number of ways there are to answer the questions in the first part of the poll? What power of 2 represents the number of ways there are to answer the questions in the second part of the poll? What power of 2 represents the number of ways there are to answer all of the questions on the poll? **2^{13} ways; 2^{10} ways; 2^{23} ways**

MIXED REVIEW

PREVIEW

Prepare for Lesson 8.2 in Exs. 60–65.

Find the product. (p. 88)

60. $\left(\frac{1}{2}\right)\left(-\frac{4}{5}\right)$ **$-\frac{2}{5}$**

61. $\left(-\frac{2}{3}\right)\left(\frac{7}{4}\right)$ **$1\frac{1}{6}$**

62. $\left(-\frac{6}{5}\right)\left(-\frac{3}{8}\right)$ **$\frac{9}{20}$**

Evaluate the expression for the given value of the variable. (p. 2)

63. x^4 when $x = 3$ **81**

64. x^2 when $x = -2.2$ **4.84**

65. x^3 when $x = \frac{3}{4}$ **$\frac{27}{64}$**

Graph the equation or inequality. 66–74. See margin.

66. $y = -4$ (p. 215)

67. $3x - y = 15$ (p. 225)

68. $7x - 6y = 84$ (p. 225)

69. $y = -5x + 3$ (p. 244)

70. $y = \frac{1}{2}x - 5$ (p. 244)

71. $x \geq -3$ (p. 405)

72. $y < 1.5$ (p. 405)

73. $x + y \leq 7$ (p. 405)

74. $2x - y < 3$ (p. 405)