

Algebra, Integers, and Equation Solving

Chapter 1 Variables and Equations

- Write and evaluate numerical and variable expressions.
- Use a variety of strategies to predict, find, and check results.
- Find lengths, perimeters, and areas in real-world situations.

Chapter 2 Integer Operations

- Use integers in numerical and variable expressions.
- Use number properties to solve problems.
- Plot points in a coordinate plane.

Chapter 3 Solving Equations and Inequalities

- Write and solve one- and two-step equations.
- Write and solve one-step inequalities.
- Model real-world situations with equations and inequalities.



From Chapter 3, p. 136

How fast can a polar bear swim?

Variables and Equations

BEFORE

In previous courses you've...

- Compared quantities
- Performed operations on numbers

Now

In Chapter 1 you'll study...

- Using graphs to analyze data
- Evaluating and writing numerical and variable expressions
- Solving equations using mental math
- A four-step problem solving plan

WHY?

So you can solve real-world problems about...

- volcanoes, p. 5
- cliff diving, p. 23
- tiger beetles, p. 35
- parachuting, p. 37

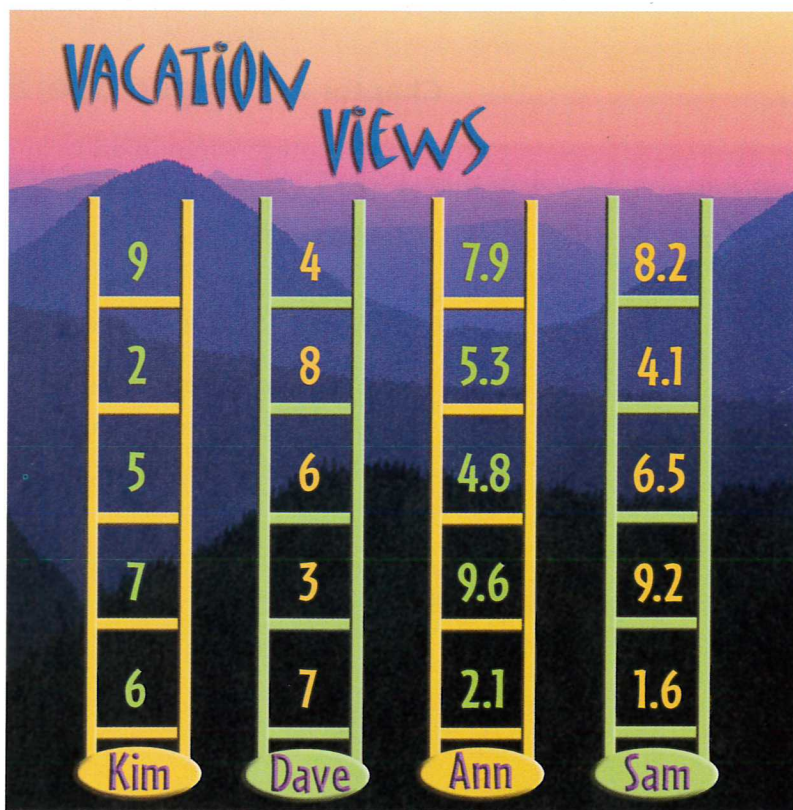


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Chapter Warm-Up Games

Review skills you need for this chapter in these quick games.



Key Skill:

- Finding the sums of whole numbers and decimals

On a family vacation trip the first stop is a mountain lookout tower. The four ladders lead to the top of the tower. Which child gets to the top first?

- Find the sum of the numbers on the rungs of each ladder.
- The ladder with the least sum is where the fastest person climbs.

NEXT STOP

410 M 415.79 420 U 430 E

17 D 19.45 18 A 19 N

8.16 A 8.178 8.17 T 8.18 H

589.6 C 589.63 589.7 R 589.8 S

600 L 627.4 700 E 899 N

Tens
?

Ones
?

Hundredths
?

Tenths
?

Hundreds
?

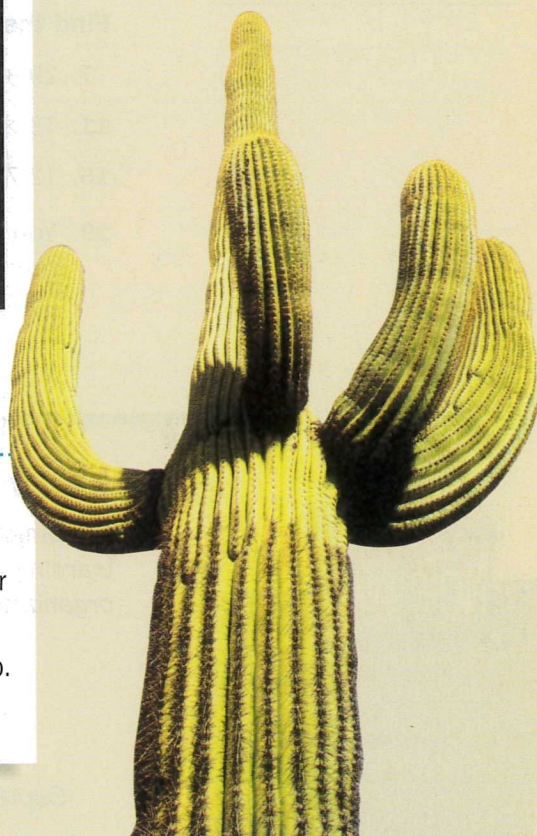


Key Skills:

- Rounding
- Identifying place value

Help the kids figure out what the next stop is on the family trip by solving the puzzle.

- Each number has been rounded to one of its digits. Select the answer that shows the number rounded correctly.
- On the right, write each letter below the place value it was rounded to.
- Put letters in correct place value order to figure out the next stop.



Stop and Think

1. **Critical Thinking** Order the names in *Vacation Views* from who gets to the top first to who gets there last (the least sum to the greatest).
2. **Writing** In *Next Stop*, a student thinks that the result of rounding 8.178 is 8.17 because the last digit is removed. What is wrong with the student's reasoning?

CHAPTER 1

Getting Ready to Learn

Word Watch

Review Words

whole number, p. 704
sum, p. 709
difference, p. 709
product, p. 713
quotient, p. 715

Review What You Need to Know



Using Vocabulary Copy and complete using a review word.

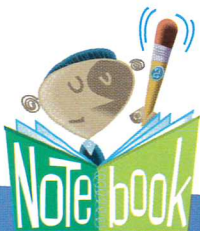
- When you add two numbers, the result is called the ?.
- When you multiply two numbers, the result is called the ?.

Write the place value of the red digit. (p. 704)

- 2**6**.10
- 45.**9**01
- 1**39.07
- 6.39**4**

Find the sum, difference, product, or quotient. (p. 709)

- $29 + 45$
- $103 + 8$
- $25 - 12$
- $72 - 56$
- 13×3
- 27×8
- $96 \div 6$
- $60 \div 12$
- $12.7 - 9.4$
- $17.8 + 26.3$
- $9.64 + 6.36$
- $20.24 - 16.5$
- You are shopping for new clothes for school. If you have \$75.00 and buy a pair of jeans for \$37.75, how much money do you have left?
(p. 709)



You should include material that appears on a notebook like this in your own notes.

Know How to Take Notes

Keeping a Notebook Your math notebook is an important tool for learning and reviewing the topics of this course. Here are some tips for organizing your notes. Organize your notes in the same way for each lesson.

Start with the date and topic.

September 7

Decimals

To add decimals, line up the decimal points.

Example: Adding Decimals

Copy examples shown in class.

$$\begin{array}{r} 23.40 \\ + 36.15 \\ \hline 59.55 \end{array}$$

In Lesson 1.4, you should organize your notes by labeling the examples that you copy.

LESSON 1.1

Interpreting Graphs

BEFORE

You compared quantities.

Now

You'll use graphs to analyze data.

WHY?

So you can make conclusions about mall businesses, as in Exs. 6–8.

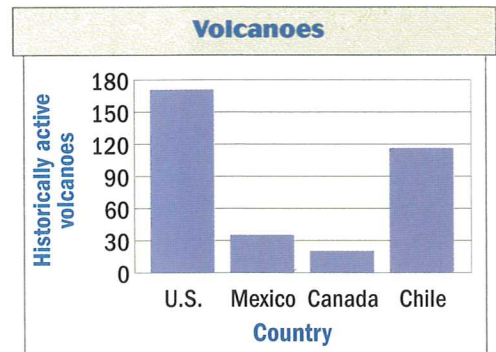
Word Watch

bar graph, p. 5
data, p. 5
frequency table, p. 6
histogram, p. 6

In the Real World

Volcanoes The *bar graph* at the right shows the number of historically active volcanoes in four countries. Which country has the most historically active volcanoes?

A **bar graph** is a type of graph in which the lengths of bars are used to represent and compare *data* in categories. **Data** are information, facts, or numbers that describe something.



EXAMPLE 1 Interpreting a Bar Graph

Use the bar graph above about volcanoes to answer the question or explain why you can't answer the question using the graph.

- Which country has the most historically active volcanoes?
- Which country has the most volcanic eruptions in a given year?

Solution

- The vertical axis in the bar graph is labeled *Historically active volcanoes*, so the tallest bar represents the country with the most historically active volcanoes. Because the United States has the tallest bar, it has the most historically active volcanoes.
- Having more historically active volcanoes doesn't necessarily mean having more eruptions, so you can't answer this question from the bar graph.

Your turn now Use the bar graph about historically active volcanoes.

- About how many more historically active volcanoes does Chile have than Mexico?
- Which country has the least number of historically active volcanoes?



Histograms When you have a large set of data to organize, you may be able to use a **frequency table** to group the data into *intervals*. The frequency of an interval is the number of values in the interval. You can graph data organized into equal intervals in a **histogram**. The height of each bar in a histogram indicates the frequency of an interval.



EXAMPLE 2 Making a Frequency Table

Roller Coasters The data show the heights, in meters, of the tallest roller coasters in the world. Make a frequency table of the data.

66.4, 94.5, 68.3, 115, 62.5, 97, 66.4, 126.5, 63.4, 74.7, 63.4, 70.1, 66.4, 64.9, 63.7, 79, 63.4, 63.1, 62.5, 61.9, 71.6

- 1 Choose intervals of equal size for the data.
- 2 Tally the data in each interval. Use tally marks to record each occurrence of a height in its interval.
- 3 Write the frequency for each interval by totaling the tally marks.

Height (m)	Tally	Frequency
60-69.9		13
70-79.9		4
80-89.9		0
90-99.9		2
100-109.9		0
110-119.9		1
120-129.9		1

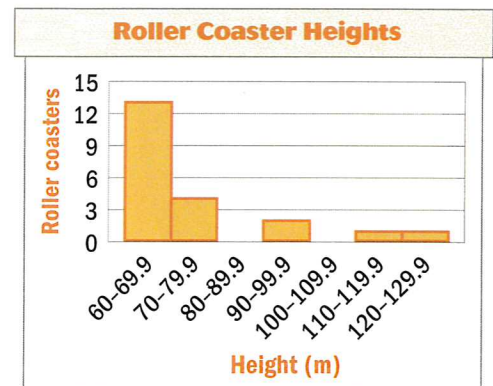
HELP with Review

For help with data displays, see p. 724.

EXAMPLE 3 Making a Histogram

Make a histogram of the data shown in the frequency table in Example 2.

- 1 Draw and label the horizontal and vertical axes. Start the vertical scale at 0 and end at 15. Use increments of 3.
- 2 Draw a bar to represent the frequency of each interval. The bars of neighboring intervals should touch.
- 3 Write a title.



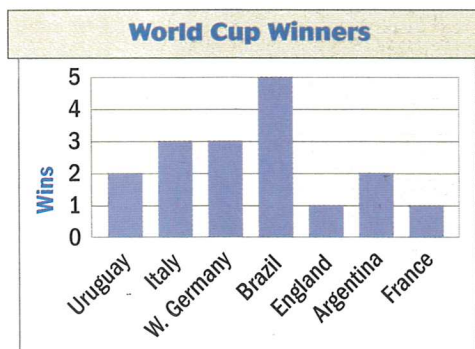
Your turn now

3. Which interval has the greatest number of roller coasters?
4. When the next roller coaster between 60 and 130 meters tall is built, in what interval do you think it will be? Explain.

Getting Ready to Practice

1. **Vocabulary** Copy and complete: A histogram is a graph that shows data that are divided equally into ? .

In Exercises 2–4, use the graph at the right. It displays the number of times each country has won the World Cup in soccer.



2. What type of graph is shown?
3. How many times has Italy won?
4. How many more times has Argentina won than France?
5. **Guided Problem Solving** The frequency table shows when new states were added to the United States. Use the frequency table to make a graph.

- (1) Decide what kind of graph to use.
- (2) Draw and label horizontal and vertical axes.
- (3) Draw bars. Write a title.

Years	States
1787–1836	25
1837–1886	13
1887–1936	10
1937–1986	2

Practice and Problem Solving

HELP

with Homework

Example Exercises

- 1 6–10, 15–17
- 2 12, 18–19
- 3 12–14, 18–20


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Use the bar graph at the right. It shows the number of businesses at a mall in each category.

6. Which category has the greatest number of businesses?
7. Which category has the least number of businesses?
8. About how many more shoe stores are there than jewelry stores?



9. **Writing** Can you tell from the graph which category of businesses uses the most floor space in the mall? Explain.



10. **Movies** The table shows the numbers of movies released in the United States from 1995 through 2000. Make a bar graph of the data.

Year	1995	1996	1997	1998	1999	2000
Movies	411	471	510	509	461	478

11. **Critical Thinking** If you need to know an exact amount, is it easier to find this information from a table or a bar graph? Explain.

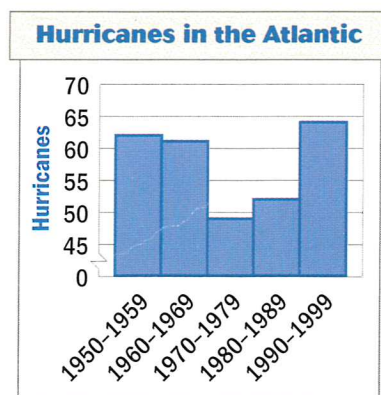
Meteors The data show the average numbers of meteors that fall per hour during 39 annual meteor showers. For example, in the first meteor shower, an average of 60 meteors fall each hour.

60, 4, 1, 5, 5, 1, 40, 4, 5, 20, 2, 15, 8, 6, 21, 15, 20, 30, 3, 15, 10, 62, 25, 26, 50, 12, 20, 12, 15, 30, 10, 10, 20, 12, 12, 60, 10, 12, 20

12. Make a frequency table to organize the data using intervals of 10, starting with 0–9.
13. Make a histogram of the data displayed in the frequency table.
14. Which display would you use to find the number of meteor showers that average 20 to 29 meteors falling per hour? Explain.

Hurricanes The histogram shows the numbers of hurricanes in the Atlantic Ocean from 1950 through 1999.

15. About how many hurricanes were there in the Atlantic Ocean from 1980–1989?
16. Can you determine the number of hurricanes there were in the Atlantic Ocean in 1965? Explain.
17. Can you use the histogram to predict the number of hurricanes in 2000–2009? Why or why not?

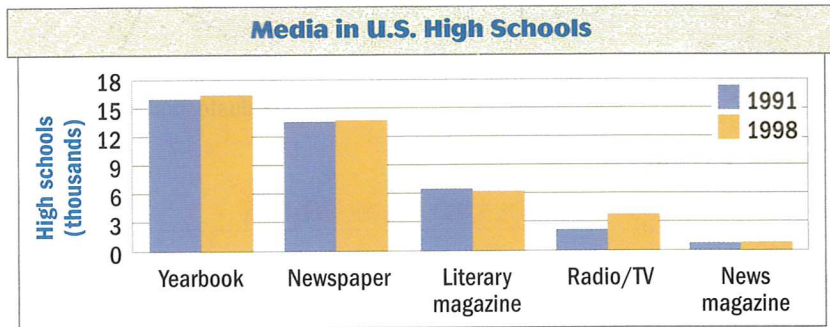


Extended Problem Solving The data show the numbers of hours 30 students in a class spent on the Internet in a week.

4, 2.5, 5.7, 1.8, 3.7, 5.4, 5.5, 11.6, 3.7, 6.5, 2, 10, 0.5, 4.5, 5, 9.5, 2.1, 4.5, 7.5, 2.5, 8, 1, 9, 4.2, 8, 7, 3, 7, 5, 6

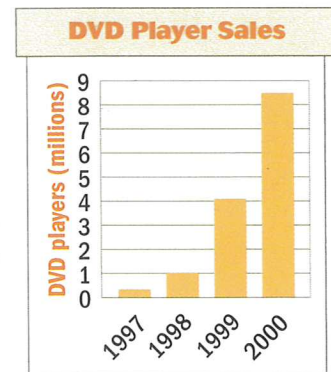
18. **Graph** Make a histogram of the data using the intervals 0–1.9, 2–3.9, 4–5.9, 6–7.9, 8–9.9, and 10–11.9.
19. **Graph** Make a histogram of the data using the intervals 0–2.9, 3–5.9, 6–8.9, and 9–11.9.
20. **Compare** Does the histogram in Exercise 18 or in Exercise 19 give a clearer representation of the data? Explain your reasoning.

Media In Exercises 21 and 22, use the *double bar graph*. It shows the numbers of U.S. high schools with media activities in 1991 and 1998.



21. About how many of the schools offered radio or TV in 1998?
22. Describe the trends in media at the schools from 1991 to 1998.

23. **Challenge** What trend do you notice in the number of DVD players sold in the United States shown in the graph at the right? Do you think that this trend continued? Explain your reasoning.



24. **Critical Thinking** You want to collect data about the pets students in your class have. What data would you collect to make a histogram? What data would you collect to make a bar graph?



Mixed Review

Find the product or quotient. (p. 713)

25. 34×4 26. 6×15 27. $140 \div 20$ 28. $84 \div 7$

Basic Skills Find the sum or difference.

29. $25.8 + 19.64$ 30. $106.58 - 56.33$ 31. $88.7 - 29.92$

Test-Taking Practice

32. **Extended Response** The data below are the number of medals the United States has won in each of the Winter Olympic Games since 1924.

4, 7, 12, 4, 9, 11, 7, 10, 6, 7, 8, 10, 12, 8, 6, 11, 13, 13, 34

Create a histogram of the data with intervals of 5 starting with 0–4 and a second histogram with intervals of 10 starting with 0–9. Tell which histogram you would use to predict how many medals the United States will win in the future and why.

LESSON 1.2

Order of Operations

BEFORE

You performed operations on numbers.

Now

You'll use order of operations to evaluate numerical expressions.

WHY?

So you can find how much money to raise for a team, as in Ex. 19.

Word Watch

numerical expression, p. 10
evaluate, p. 10
order of operations, p. 10
verbal model, p. 11

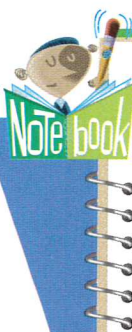
In the Real World

Visiting an Aquarium You and four friends visit an aquarium, but only three of you go to the movie at the aquarium. What is the total cost of the visit? You will find the total cost of the visit in Example 3.

Aquarium Prices	
Admission	\$13.50
Sea Lion show	Free
Movie	\$8.00



Order of Operations A **numerical expression** consists of numbers and operations. To **evaluate** a numerical expression is to find its value. When a numerical expression has more than one operation, you must use a set of rules called the **order of operations**.



Order of Operations

To evaluate an expression that has more than one operation:

1. Evaluate expressions inside grouping symbols.
2. Multiply and divide from left to right.
3. Add and subtract from left to right.

HELP with Solving

You can express multiplication by using parentheses or the symbols \cdot or \times .
 $3(4) = 12$
 $3 \cdot 4 = 12$
 $3 \times 4 = 12$

EXAMPLE 1 Using the Order of Operations

Evaluate the expression $7 + 16 \cdot 3 \div 6$.

$$\begin{aligned}
 7 + 16 \cdot 3 \div 6 &= 7 + 48 \div 6 && \text{Multiply 16 by 3.} \\
 &= 7 + 8 && \text{Divide 48 by 6.} \\
 &= 15 && \text{Add 7 and 8.}
 \end{aligned}$$

Watch Out!



You can express division using either the symbol \div or a fraction bar. To evaluate an expression with a fraction bar, evaluate the numerator and the denominator before you divide.

Grouping Symbols The most common grouping symbols are parentheses (), brackets [], and fraction bars.

EXAMPLE 2 Using Grouping Symbols

a. $(14 + 6) \cdot 8 = 20 \cdot 8$ **Add inside parentheses first.**

$= 160$ **Then multiply.**

b. $\frac{9 \times 8}{4 + 8} = \frac{72}{4 + 8}$ **Evaluate numerator.**

$= \frac{72}{12}$ **Evaluate denominator.**

$= 6$ **Divide.**

c. $45 \div [63 \div (56 \div 8)] = 45 \div [63 \div 7]$ **Divide inside the innermost set of grouping symbols.**

$= 45 \div 9$ **Divide inside brackets.**

$= 5$ **Divide.**

Your turn now Evaluate the expression.

1. $14 + 6 \div 2$

2. $20 - 7 \times 2 + 1$

3. $5 \cdot 7 - 2 \cdot 13$

4. $35 \div (9 - 4)$

5. $3 \cdot [(11 - 1) \div 5]$

6. $\frac{45 + 19}{2 \times 8}$

When you solve a problem, it may help to write a **verbal model** using symbols for operations and words to label necessary information.

EXAMPLE 3 Using a Verbal Model

To find the total cost of the visit to the aquarium described on the previous page, you can use a verbal model to write and evaluate an expression.

Total cost of visit	=	Admission price	\times	Number of people	+	Movie price	\times	Number of people
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$= 13.50 \times 5 + 8 \times 3$ **Substitute values.**

$= 67.50 + 24$ **Multiply first.**

$= 91.50$ **Then add.**

ANSWER The total cost of the visit is \$91.50.





Getting Ready to Practice

1. **Vocabulary** Use the order of operations to list in order the steps needed to evaluate the following expression: $8 + 2 \times 5 - 4$.

State the first step in evaluating the expression. Then evaluate.

2. $10 \cdot 6 - 20$ 3. $5 \times 15 \div 3$ 4. $4 + 8 \div 2$
5. $2 \times 5 + (15 - 7)$ 6. $6 + 14 - 10 \div 2$ 7. $10 \cdot [9 \div (5 - 2)]$

8. **Fundraising Walk** Your friend pledges \$10 to you for a fundraising walk and \$.25 for each mile you walk. You walk 6 miles. How much money will your friend contribute? Use the expression $10 + 0.25(6)$.

9. **Find the Error** Describe and correct the error in the solution.

$$\begin{aligned} & \times \quad 3 \times 3 + 63 \div 9 = 9 + 63 \div 9 \\ & \quad \quad = 72 \div 9 \\ & \quad \quad = 8 \end{aligned}$$

HELP

with Homework

Example Exercises

- 1 10-29, 33
2 10-18, 21-29
3 34



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Practice and Problem Solving

Evaluate the expression.

10. $12 + 10 - 4$ 11. $7 \cdot 3 + 2 \cdot 4$ 12. $\frac{16}{7-3}$
13. $9 \times 3 + 2 - 5$ 14. $16 - 6 + 2 \times 4$ 15. $26 - 15 + 8 \div 2$
16. $8 + 2 \times (4 - 3)$ 17. $120 \div [(6 + 2) \cdot 3]$ 18. $18 \div (8 + 4 - 9)$

19. **Softball Uniforms** Your school softball team has 25 members. The school contributes \$30 toward each \$40 uniform. To find how much money the team needs to raise, evaluate the expression $40 \cdot 25 - 30 \cdot 25$.

20. **Supplies** You buy 3 notebooks at \$2 each and 4 pens at \$1.50 each. What is the total cost? Use the expression $3 \times 2 + 4 \times 1.50$.

Evaluate the expression.

21. $\frac{7}{4} - \frac{5}{4} + \frac{1}{4}$ 22. $9 \div \left[3 \cdot \left(\frac{5}{3} + \frac{4}{3} \right) \right]$ 23. $3 \cdot \left(\frac{7}{2} + \frac{1}{2} \right)$
24. $(1.5 - 0.5) \times 2$ 25. $9.4 + 4.2 \div 6$ 26. $6 \times (2.4 - 0.4 + 3)$
27. $7.8 \times (5 + 2)$ 28. $8.4 \div (21 - 14)$ 29. $4 + 3.9 \div 1.3$



Critical Thinking Add parentheses to make the statement true.

30. $5 \cdot 2 + 3 - 8 = 17$

31. $12 \div 6 + 4 - 7 = 4$

Extended Problem Solving In Exercises 32–34, suppose Liz and Ty are making cookies for a school bake sale. Liz makes 5 batches of 36 cookies, and Ty makes 4 batches of 48 cookies.



32. **Translate** Translate 5 batches of 36 cookies plus 4 batches of 48 cookies into an expression.

33. **Evaluate** Evaluate the expression.

34. **Extend** Liz and Ty decide to make packages of three cookies. Write and evaluate an expression to find the number of packages they can make.

35. **Number Sense** Complete the statement $12 \text{ ? } 4 + 2$ using each of the operations $+$, $-$, \times , and \div . Which operation symbol gives the expression the greatest value? Find the greatest possible value if you add one set of parentheses to the four expressions.

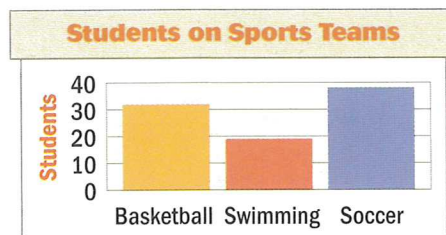
36. **Challenge** Your cousin is 14 years old. Your brother is 10 years less than twice your cousin's age. Write and evaluate an expression to find your brother's age.

Mixed Review

The bar graph shows the numbers of students on teams. (Lesson 1.1)

37. About how many students are on the basketball team?

38. Which team has the most students?



Basic Skills Find the missing number.

39. $11 - \underline{\quad} = 7$

40. $\underline{\quad} \div 4 = 8$

41. $9 \cdot \underline{\quad} = 54$

Test-Taking Practice

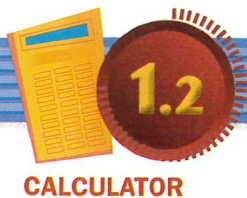


42. **Multiple Choice** In what order should the operations be performed in the expression $2 \times 4 - 6 \div 3 + 1$?

- A. $\times, \div, -, +$ B. $\times, -, \div, +$ C. $\times, \div, +, -$ D. $\times, +, -, \div$

43. **Multiple Choice** Which operation should be performed first when finding the difference of twenty and the quotient of eighteen and six?

- F. $20 - 18$ G. $18 \div 6$ H. $20 - 6$ I. $20 \div 6$



Technology Activity

Using Order of Operations

GOAL Use a calculator to evaluate numerical expressions with decimals.

Example

You and three friends are ordering a pizza. The cost of the pizza is \$15.90, but you have a coupon for \$1.50 off. How much should each of you pay if you want to divide the total cost equally?

Solution

$$\text{Cost per person} = \frac{\text{Price of a pizza} - \text{Coupon}}{\text{Number of friends} + \text{Yourself}}$$

Write a verbal model.

$$= \frac{15.90 - 1.50}{3 + 1}$$

Substitute.

To find the cost per person, use the order of operations.

Keystrokes

Display

(15.90 - 1.50) ÷ (3 + 1) = 3.6

ANSWER Each person should pay \$3.60 for the pizza.

Your turn now

Use a calculator to evaluate the expression.

1. $62 + 7 \times 6.4$

2. $8.32 - 9 \div 2$

3. $6.8 \div 4 + 15.9 \div 3$

4. $36.2 - 4.3 \cdot 5$

5. $\frac{14 + 11}{4 + 1}$

6. $\frac{20 - 3.5}{10.3 - 7}$

7. $\frac{10}{3.8 + 1.2}$

8. $\frac{17.7 - 13.7}{0.2 + 4.8}$

9. **Snacks** You buy 3 bags of snack mix for \$1.49 each, 2 boxes of raisins for \$1.79 each, and lemonade for \$2.39. Find the total cost using the expression $3 \cdot 1.49 + 2 \cdot 1.79 + 2.39$.

10. **Clothing** You buy 3 T-shirts at \$9.99 each, a pair of sneakers for \$44.89, a hat for \$10.59, and a pair of socks at a cost of 4 pairs for \$8.60. Find the total cost.

11. **Music** You pick out 2 CDs for \$12.99 each, 3 CDs for \$9.49 each, and a CD for \$15.97. At the register you find out that when you buy 5 CDs you get the sixth CD for half off. Find the total cost if you get the most expensive CD for half off. Round to the nearest cent.



with Technology

The keystrokes shown here may not be the same as on your calculator. See your calculator's instruction manual for the appropriate keystrokes.

LESSON 1.3

Variables and Expressions

BEFORE

You evaluated numerical expressions.

Now

You'll write and evaluate variable expressions.

WHY?

So you can find how far you travel on a bike, as in Exs. 23–24.

Word Watch

variable, p. 15

variable expression, p. 15

In the Real World

Hot Air Balloons You are riding in a hot air balloon. After traveling 5 miles, the balloon speed changes to 6 miles per hour. What is the total distance you travel if the balloon stays at this speed for 1 hour? for 2 hours? You will find the answer in Example 1.



Variable Expressions A **variable** is a symbol, usually a letter, that represents one or more numbers. A **variable expression** consists of numbers, variables, and operations. To evaluate a variable expression, substitute a number for each variable. Then find the value of the numerical expression.

You can write the product of a number and a variable by writing the number next to that variable. For example, you can write $5 \cdot n$ as $5n$.

EXAMPLE 1 Using a Variable Expression

To answer the questions above about distance traveled, let t represent the time in hours that the balloon travels at 6 miles per hour. So, the total distance traveled is *original distance* + *speed* • *time*, which is $5 + 6t$.

(1) Write hours traveled t .

(2) Substitute for t in the expression $5 + 6t$.

(3) Evaluate to find total distance.

1

$$5 + 6(1)$$

11

2

$$5 + 6(2)$$

17

ANSWER If the balloon travels at 6 miles per hour for 1 hour, you travel a total of 11 miles. After 2 hours you travel a total of 17 miles.

Your turn now Use the information above about hot air balloons.

1. If you travel for 3 hours more, what is the total distance?
2. If you travel for $\frac{1}{2}$ hour more, what is the total distance?



EXAMPLE 2 Evaluating Variable ExpressionsEvaluate the expression when $x = 8$ and $y = 2$.

$$\text{a. } 7x + 15 = 7(8) + 15 \quad \text{Substitute 8 for } x.$$

$$= 56 + 15 \quad \text{Multiply.}$$

$$= 71 \quad \text{Add.}$$

$$\text{b. } 3x - 5y = 3(8) - 5(2) \quad \text{Substitute 8 for } x \text{ and 2 for } y.$$

$$= 24 - 10 \quad \text{Multiply.}$$

$$= 14 \quad \text{Subtract.}$$

Writing Expressions Many words and phrases suggest mathematical operations. The following common words and phrases indicate addition, subtraction, multiplication, and division.

Addition	Subtraction	Multiplication	Division
plus the sum of increased by total more than added to	minus the difference of decreased by fewer than less than subtracted from	times the product of multiplied by of	divided by the quotient of per

HELP with Reading

Order is important when translating verbal expressions that suggest subtraction and division.

The difference of a number and 6 means $n - 6$, not $6 - n$.

The quotient of a number and 10 means $n \div 10$, not $10 \div n$.

EXAMPLE 3 Translating Verbal Phrases**Verbal Phrase****Variable Expression**

The sum of a number and 9

$$n + 9$$

The difference of a number and 21

$$n - 21$$

The product of 6 and a number

$$6n$$

The quotient of 48 and a number

$$\frac{48}{n}$$

One third of a number

$$\frac{1}{3}n$$

Your turn now Evaluate the expression when $a = 12$ and $b = 3$.

3. $9a$

4. ab

5. $b(a - 6)$

6. $\frac{6a}{a - b}$

Write the phrase as a variable expression using x .

7. a number increased by 15

8. 8 times a number

What do you think?

Sports



Heart Rate

To find a reasonable target heart rate during exercise, subtract your age from 220, then multiply that number by 0.7. What is your target heart rate?

EXAMPLE 4 Writing and Evaluating an Expression

Heart Rate To measure your heart rate in beats per minute, count the number of heartbeats n in 15 seconds. Then multiply by 4 to find your heart rate in beats per minute.

- Use n to write an expression for heart rate in beats per minute.
- You count 18 beats in 15 seconds. Find your heart rate.

Solution

- The phrase *multiply by* suggests multiplication. So, the variable expression for heart rate in beats per minute is $4n$.
- Substitute 18 for n in the expression $4n$ to find your heart rate.

$$\begin{aligned} 4n &= 4(18) \\ &= 72 \end{aligned}$$

ANSWER Your heart rate is 72 beats per minute.

1.3

Exercises

More Practice, p. 727

INTERNET



eWorkbook Plus
CLASSZONE.COM

Getting Ready to Practice

- Vocabulary** Copy and complete: $3t - 4$ is a(n) expression and $5 + 13$ is a(n) expression.

Match the phrase with the correct variable expression.

- | | |
|-----------------------------------|----------------------|
| 2. 8 times a number | A. $n + 8$ |
| 3. 8 fewer than a number | B. $8n$ |
| 4. a number increased by 8 | C. $n - 8$ |
| 5. the quotient of 8 and a number | D. $8 \div n$ |

Evaluate the expression when $p = 6$ and $s = 5$.

- | | | | |
|----------|-------------|--------------|---------------------------|
| 6. $11p$ | 7. $7s + 9$ | 8. $6s + 4p$ | 9. $\frac{50 - s}{p + 3}$ |
|----------|-------------|--------------|---------------------------|

- Guided Problem Solving** You buy a hat for \$8 and rent 5 videos for \$2.50 each. How much do you spend?

- Write a variable expression for the cost to rent m videos.
- Add the cost of the hat to this expression.
- Evaluate the expression for $m = 5$.





Example Exercises

- | | |
|---|--------------|
| 1 | 23-24 |
| 2 | 11-18, 29-36 |
| 3 | 19-22 |
| 4 | 26-28 |



Online Resources
CLASSZONE.COM

- More Examples
- eTutorial Plus

Practice and Problem Solving

Evaluate the expression for the given value(s) of the variable(s).

- | | |
|--|---|
| 11. $4x - 5$, $x = 7$ | 12. $10n + 115$, $n = 9$ |
| 13. $11c + 34$, $c = 0.5$ | 14. $2s - t$, $s = 8$, $t = 4$ |
| 15. $p + 2q$, $p = 3$, $q = 1$ | 16. $8a - 3b$, $a = 3$, $b = 8$ |
| 17. $\frac{3}{4}x + y$, $x = 4$, $y = 3$ | 18. $\frac{d + 10}{c - d}$, $c = 14$, $d = 8$ |

Translate Write the phrase as a variable expression. Let x represent the variable.

- | | |
|------------------------------|------------------------------------|
| 19. two fifths of a number | 20. a number subtracted from 10 |
| 21. 12 increased by a number | 22. the quotient of a number and 7 |

Bicycling Evaluate the expression $9t$ to find how many miles you go if you ride your bike for t hours at 9 miles per hour.

23. How far do you go if you ride your bike for 2 hours?
24. How far do you go if you ride your bike for $3\frac{1}{2}$ hours?



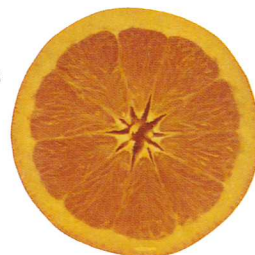
25. **Writing** Write a real world situation that can be modeled by $2 + 8d$.
26. **Television** You watch x thirty-minute TV shows and y sixty-minute TV shows in one week. Write a variable expression representing the total number of minutes you spend watching television that week.
27. **CD Club** You are purchasing CDs from a music club. You pay \$4 for shipping any number n of CDs, plus \$17 for each CD. Write a variable expression for the cost of n CDs. Then find the cost of 6 CDs.
28. **Estimation** A 17 inch vine grows 3 inches per week. Write a variable expression for the length of the vine after w weeks. Then estimate the vine's length after 19 weeks.

Evaluate the expression when $x = 2.4$ and $y = 8$.

- | | | | |
|---------------|-------------------|--------------------|-------------------------|
| 29. $7x + 2y$ | 30. $y - 2x$ | 31. $5xy$ | 32. $\frac{y}{x - 0.4}$ |
| 33. $4x - y$ | 34. $7.2y \div x$ | 35. $\frac{3y}{x}$ | 36. $1.6xy$ |

37. **Writing** Write a variable expression that requires the use of the order of operations to evaluate correctly. Explain the correct order to use.

38. **Nutrition** Rice has 13 grams of protein per serving, beans have 15 grams per serving, and an orange has 2 grams per serving. Write a variable expression for the total grams of protein in x servings of rice, y servings of beans, and z oranges.



39. **Movies** At the movies, popcorn costs \$2.75 and drinks cost \$1.25. Write an expression to find the total cost of p popcorns and d drinks. Find the total cost for snacks if 3 people buy popcorn and 4 people buy drinks.
40. **Challenge** Evaluate the expression $\frac{5(3x + 2z + 0.5425)}{x + y + z}$ when $x = 1.05$, $y = 1.3$, and $z = 0.9$.

Mixed Review

Evaluate the expression. (Lesson 1.2)

41. $12 \cdot 3 + 14$

42. $93 - 74 \div 2$

43. $16 + 6 \cdot 3 \div 2 - 7$

Basic Skills Find the product or quotient.

44. $17 \cdot 52$

45. $91 \cdot 45$

46. $123 \div 3$

47. $252 \div 6$

Test-Taking Practice

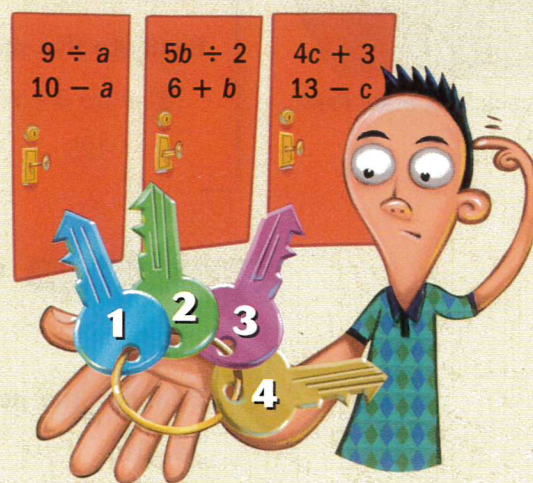
48. **Short Response** A personal CD player costs \$35 and CDs cost \$15 each. Write an expression to represent the total cost for the CD player and CDs. You buy a personal CD player and 4 CDs. Evaluate your expression to determine the total amount of money you spend.
49. **Multiple Choice** You are saving money to buy a bike that costs \$126. You want to buy the bike in 6 weeks by saving the same amount of money each day. How much money should you save each day?
- A. \$1 B. \$2 C. \$3 D. \$21



Find the Key

A key will unlock a door if the variable expressions on the door have the same value when the number on the key is substituted for the variable.

Which key opens each door?



LESSON 1.4

Powers and Exponents

BEFORE

You evaluated numerical and variable expressions.

Now

You'll evaluate expressions with powers.

WHY?

So you can find the height of a cliff, as in Example 3.

Word Watch

power, p. 20
exponent, p. 20
base, p. 20

In the Real World

Waterfall A stone falls over the edge of a cliff next to a waterfall. The stone hits the water 5 seconds later. How tall is the cliff?

To find the height of the cliff, you will use an expression with a **power** in Example 3. A **power** is a product with a repeated factor. The **exponent** tells how many times the **base** is used as a factor.

$$\begin{array}{c} \text{Base} \quad \text{Exponent} \\ b^8 = \underbrace{b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b \cdot b}_{\text{Power}} \end{array}$$

b is a factor 8 times.

EXAMPLE 1 Reading Powers

Power	Repeated Multiplication	Description in Words
4^2	$4 \cdot 4$	4 to the <i>second power</i> , or 4 <i>squared</i>
9^3	$9 \cdot 9 \cdot 9$	9 to the <i>third power</i> , or 9 <i>cubed</i>
y^5	$y \cdot y \cdot y \cdot y \cdot y$	y to the <i>fifth power</i>

EXAMPLE 2 Evaluating a Power

Evaluate five cubed.

$$\begin{array}{ll} 5^3 = 5 \cdot 5 \cdot 5 & \text{Write 5 as a factor 3 times.} \\ = 125 & \text{Multiply.} \end{array}$$

Your turn now Write the product as a power.

1. $7 \times 7 \times 7 \times 7 \times 7 \times 7$ 2. $10 \cdot 10 \cdot 10 \cdot 10$ 3. $w \cdot w$

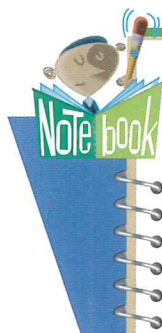
Describe the power in words and then evaluate.

4. 6^3 5. 2^5 6. 13^2 7. 3^1



Taughannock Falls State Park,
New York

Order of Operations When you evaluate expressions with powers, evaluate any powers before multiplying or dividing.



Order of Operations

1. Evaluate expressions inside grouping symbols.
2. Evaluate powers.
3. Multiply and divide from left to right.
4. Add and subtract from left to right.

HELP with Notetaking

In your notes, you may want to label the different examples that you copy.

EXAMPLE 3 Using a Power

To find the height of the cliff from the previous page, use the expression $16t^2$. This expression gives the distance in feet that an object has fallen t seconds after it begins to fall.

$$\begin{aligned} 16t^2 &= 16(5)^2 && \text{Substitute 5 for } t. \\ &= 16(25) && \text{Evaluate the power.} \\ &= 400 && \text{Multiply.} \end{aligned}$$

ANSWER The height of the cliff is 400 feet.

EXAMPLE 4 Using the Order of Operations

Evaluate the expression.

- a. $(6 - 4)^3 + 5 - 3^2 = 2^3 + 5 - 3^2$ Evaluate inside grouping symbols.
 $= 8 + 5 - 9$ Evaluate powers.
 $= 4$ Add and subtract from left to right.
- b. $2 \cdot (7 + 1)^2 \div 4^2 = 2 \cdot 8^2 \div 4^2$ Evaluate inside grouping symbols.
 $= 2 \cdot 64 \div 16$ Evaluate powers.
 $= 8$ Multiply and divide from left to right.

Your turn now Evaluate the expression.

8. $(5 - 2)^3 - 7 + 4^3$ 9. $12 + (4 + 2)^2 - 2^4$ 10. $7^3 + 24 \div (7 - 6)^4$
11. Use the expression in Example 3 to find the height of a cliff if a stone hits the water 8 seconds after falling over the edge.



Getting Ready to Practice

1. **Vocabulary** Write a power and label the base and the exponent.


Evaluate the power.

2. three squared 3. eleven cubed 4. one to the ninth
5. 2^6 6. 5^5 7. 0^7

Evaluate the expression.

8. $(2 + 1)^4 \div 9 - 4$ 9. $48 \div (9 - 7)^3$ 10. $(5 \times 3)^2 - 4$

11. **Find the Error** Describe and correct the error in the solution.

 $7^2 = 7 \times 2$
 $= 14$

Practice and Problem Solving

HELP

with Homework

Example Exercises

- 1 12-14
2 15-20
3 27-29, 35-37
4 21-29



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- More Examples
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Write the product as a power and describe the power in words.

12. $9 \cdot 9 \cdot 9 \cdot 9 \cdot 9$ 13. $3 \cdot 3 \cdot 3$ 14. $n \cdot n \cdot n \cdot n \cdot n \cdot n$

Evaluate the power.

15. 6^1 16. 11^2 17. 2^7
18. 10^3 19. 1^8 20. 20^2

Evaluate the expression.

21. $(2 \times 5)^2 + 9$ 22. $500 \div (12 - 7)^1$ 23. $6 \times 18 \div 3^2$
24. $(9 - 7)^5 + 17$ 25. $108 \div (5 + 1)^2$ 26. $9^2 - 3^3$

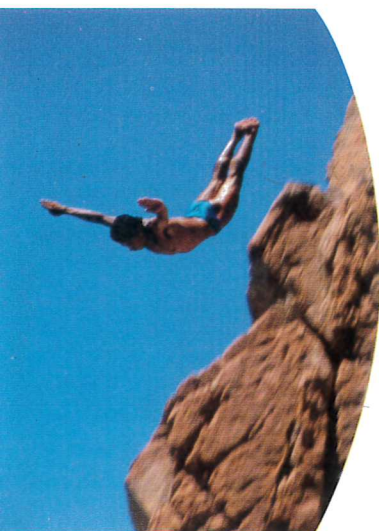
Evaluate the expression when $g = 4$.

27. $g^4 \div 16$ 28. $(3 + g)^3$ 29. $(3g)^2 - 25$

30. **Critical Thinking** If $x^2 = x^3$, give the two possible values for x .

31. **Football** The season attendance at your school's football games is 1000 people one year. The attendance doubles each year for the next 3 years. Write an expression with a power that shows the season attendance at the football games after 3 years.





Copy and complete the statement using $<$, $>$, or $=$.

32. 3^2 ? 2^3

33. 5^4 ? 4^5

34. 10^1 ? 1^{10}



Evaluate the expression when $x = 4.2$, $y = 5.9$, and $z = 11.8$.

35. $y^2 - x^2$

36. $10z^2 \div y$

37. $(x + y)^3$

38. **Writing** Describe how to find the value of 3^9 using the fact that $3^8 = 6561$.

39. **Cliff Diving** At Kaunolo in Hawaii, divers jump from a platform on top of a cliff 82 feet above the water. At time t seconds, a diver has fallen $16t^2$ feet. Do the divers reach the surface of the water in 2 seconds? Explain your reasoning.

Evaluate the expression when $a = 3$, $b = 7$, and $c = 11$.

40. a^3b^2

41. $(c - a)^3 - 210$

42. $2 \cdot (b + 2)^2 \div a$

43. **Challenge** The personal computers of the early 1980s had 64 kilobytes of memory. Computers today often have more than one gigabyte of memory. Use the table to find how much memory personal computers of the early 1980s had in bytes.

Name	Bytes
Kilobyte	2^{10}
Megabyte	2^{20}
Gigabyte	2^{30}

Mixed Review



Evaluate the expression when $x = 3$ and $y = 9$. (Lesson 1.3)

44. $5x - 12$

45. $6x - y$

46. $\frac{y}{x} + 20$

Choose a Strategy Use a strategy from the list to solve the following problem. Explain your choice of strategy.

47. You have 3 shirts and 2 pairs of pants that you are packing for a trip. You can wear each shirt with each pair of pants. How many different outfits are possible?

Problem Solving Strategies

- Look for a Pattern
- Draw a Diagram
- Make a List

Test-Taking Practice



48. **Multiple Choice** What is the value of the expression $5^3 - 3^4$?

A. 3

B. 19

C. 44

D. 128

49. **Multiple Choice** The *volume* of a cube is s^3 , where s is the length of one side of the cube. A cube has a side length of 14 centimeters. What is the volume of the cube in cubic centimeters?

F. 42

G. 196

H. 1400

I. 2744

Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

bar graph, p. 5

data, p. 5

frequency table, p. 6

histogram, p. 6

numerical expression, p. 10

evaluate, p. 10

order of operations, p. 10

verbal model, p. 11

variable, p. 15

variable expression, p. 15

power, p. 20

exponent, base, p. 20

Use Your Vocabulary

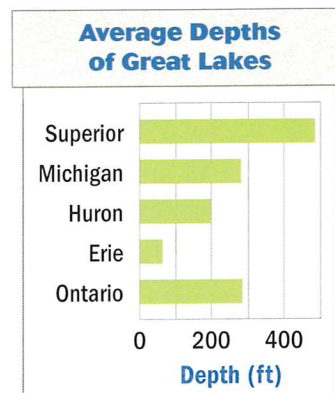
1. What is the first step in the order of operations?

1.1 Can you analyze data displays?



EXAMPLE The bar graph shows the average depths of the Great Lakes. Which of the lakes has the greatest average depth?

ANSWER Lake Superior has the longest bar, so it has the greatest average depth.



Use the bar graph above to answer the question or explain why you can't answer the question using the graph.

2. Which of the Great Lakes is the largest in area?
3. Which Great Lake is the shallowest on average?

1.2–1.3 Can you evaluate variable expressions?



EXAMPLE Evaluate the expression $4x - y + 12$ when $x = 7$ and $y = 10$.

$$\begin{aligned} 4x - y + 12 &= 4(7) - 10 + 12 \\ &= 28 - 10 + 12 \\ &= 30 \end{aligned}$$

Substitute 7 for x and 10 for y .

Multiply.

Add and subtract from left to right.



Evaluate the expression when $x = 3$ and $y = 6$.

4. $(x + 3) \cdot x$

5. $\frac{3y - 9}{x}$

6. $5 + y \div x$

1.4 Can you evaluate expressions with powers?

Review

EXAMPLE Evaluate the expression $4^3 \div (2 \times 2)^2$.

$$\begin{aligned} 4^3 \div (2 \times 2)^2 &= 4^3 \div 4^2 && \text{Multiply inside parentheses.} \\ &= 64 \div 16 && \text{Evaluate powers.} \\ &= 4 && \text{Divide.} \end{aligned}$$



Evaluate.

7. $9 \times 2^3 - 15$

8. $(2^5 + 8) \cdot 5^2$

9. $(18 \div 6)^3 + (11 - 4)^3$

Stop and Think about Lessons 1.1–1.4

10. **Critical Thinking** The numbers 100 and 1000 can be written as 10^2 and 10^3 . How does the number of zeros relate to the exponents of these powers of 10?

Review Quiz 1

1. **Home Runs** The table shows the record number of home runs hit in a single season by position. Make a bar graph that displays the data.
2. How many more home runs is the record for outfield than for pitcher?

Position	Home Runs
Catcher	41
1st base	69
Pitcher	9
2nd base	42
Shortstop	52
3rd base	48
Outfield	73

Evaluate the expression.

3. $21 - 2 \cdot 7$

4. $8 \times 10 - 40 + 25$

5. $24 - (9 + 7) \div 4$

6. $(3 + 1)^2 - 1^5$

7. $10^4 \div 5^3$

8. $3^4 + 7 \cdot 5$

9. **Plants** A plant is 14 inches tall and grows 4 inches each year. Another plant is 8 inches tall and grows 6 inches each year. Write variable expressions for the plants' heights. Then evaluate the expressions to find the heights in 5 years.

Evaluate the expression for the given value of the variable.

10. $5a - 3 + 7$ when $a = 4$

11. $8 + b + 4 \cdot 11$ when $b = 3$

12. $2 \cdot z^4 \div 8$ when $z = 4$

13. $(9 - x)^5 \cdot 3 - 16$ when $x = 7$

Look for a Pattern

Draw a Diagram

Act It Out

Work Backward

Guess, Check, and Revise

Make a Table

Solve a Simpler Problem

Guess, Check, and Revise

Problem Consecutive numbers are numbers that follow one after another. The numbers 1, 2, and 3 are consecutive numbers. The sum of three consecutive numbers is 66. What are these numbers?

1 Read and Understand

Read the problem carefully.

The problem asks for the three consecutive numbers that add up to 66.

2 Make a Plan

Decide on a strategy to use.

One way to solve the problem is to use the guess, check, and revise strategy. Guess the answer and check it to see if you are correct. If not, revise your guess and try again.

3 Solve the Problem

Reread the problem. Then make a guess, check the answer, and revise, if necessary.

Reasoning

Because 22 is one third of 66, you might choose 22, 23, and 24 for the first guess.

Guess

22, 23, 24

Check

$$22 + 23 + 24 = 69 \quad \times$$

Because the first guess was too high, revise your guess using smaller numbers.

20, 21, 22

$$20 + 21 + 22 = 63 \quad \times$$

Second guess is too low. Try again.

21, 22, 23

$$21 + 22 + 23 = 66 \quad \checkmark$$

So, the consecutive numbers that add up to 66 are 21, 22, and 23.

4 Look Back

Check your answer by adding the numbers again to see if their sum is 66.

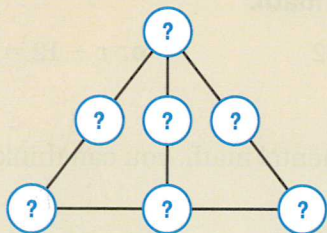
$$\begin{aligned} 21 + 22 + 23 &\stackrel{?}{=} 66 \\ 66 &= 66 \quad \checkmark \end{aligned}$$



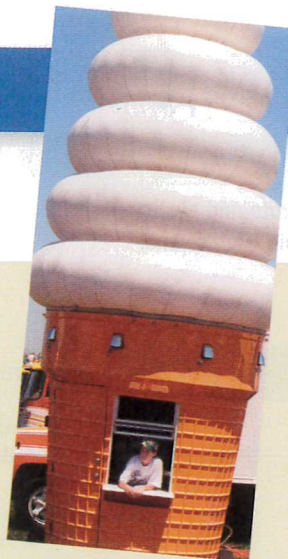
Practice the Strategy

Use the strategy *guess, check, and revise*.

- Consecutive Numbers** The sum of two consecutive numbers divided by 3 is 71. What are the numbers?
- Money** There are some nickels, dimes, and quarters in your pocket. You know you have exactly 15 coins, exactly 5 of them are nickels, and the total amount is \$2.30. How many dimes do you have? How many quarters?
- Game** You are playing a game where you collect blue chips and green chips. For every blue chip you get one point. For every green chip you lose a point. If you have a total of 20 chips and a total of 14 points, how many blue chips do you have? How many green chips do you have?
- Video Game** Damon has saved \$33 to buy a new video game that costs \$52. His mother offers to contribute \$5. How much more does he need to save?
- Triangle** Copy the triangle below. Fill in the circles using each of the numbers 1, 2, 3, 4, 5, 6, and 7 exactly once so that the sum of each side and the sum of the middle column is 10.



- Fundraising** You sell 14 items for a school fundraiser and make a total of \$142. A T-shirt costs \$11 and a hat costs \$9. How many T-shirts did you sell? How many hats did you sell?



Mixed Problem Solving

Use any strategy to solve the problem.

- Ice Cream** An ice cream shop offers week-long special deals when you purchase a large ice cream cake. They offer a free small ice cream cake every fifth week, a free pint of ice cream every sixth week, and a free ice cream cone every third week. How many times in one year will they offer all three deals in the same week if they offer all three the first week of the year?
- Flowers** Hannah is in charge of buying carnations to give away at a school dance. The flower shop sells carnations at a discount in groups of 12. Hannah needs 170 carnations for the dance. How many groups of 12 carnations should she buy?
- Height** Justin, Bob, Kelly, Michelle, and Tim are all different heights. Kelly is taller than Michelle and Justin. Tim is shorter than Justin but taller than Michelle. Bob is the tallest of the group. Put the students in order from tallest to shortest.
- Talent Show** Your school talent show allows people to sign up for 3 or 5 minute acts. There is one minute between acts. The talent show has 15 acts and lasts for 79 minutes. How many 3 minute acts are there?

LESSON 1.5

Equations and Solutions

BEFORE

You wrote and evaluated variable expressions.

Now

You'll write and solve equations using mental math.

WHY?

So you can find the weight of a baby elephant, as in Ex. 29.

Word Watch

equation, p. 28
solution, p. 28
solving an equation, p. 28

Activity

You can use algebra tiles to solve equations.

In an *equation*, the quantities on each side of the equal sign have the same value. The algebra tile model below represents the equation $x + 2 = 6$.



- 1 With how many 1-tiles should you replace the x-tile so that the quantities on both sides of the equal sign have the same value? Explain.
- 2 What value of x makes the equation $x + 2 = 6$ a true statement?

Make a model to represent the equation. Then tell what value of x makes the equation a true statement.

1. $x + 3 = 8$

2. $x + 4 = 5$

3. $6 + x = 10$

An **equation** is a mathematical sentence formed by placing an equal sign (=) between two expressions.

A **solution** of a variable equation is a number that you can substitute for a variable to make the equation true. Finding all the solutions of an equation is called **solving an equation**.

EXAMPLE 1

Using Mental Math to Solve Equations

Solve the equation using mental math.

a. $15 - n = 4$

b. $8x = 32$

c. $r \div 12 = 4$

Solution

To solve simple equations using mental math, you can think of the equation as a question.

a. 15 minus **what number** equals 4?

$15 - 11 = 4$, so $n = 11$.

b. 8 times **what number** equals 32?

$8(4) = 32$, so $x = 4$.

c. **What number** divided by 12 equals 4?

$48 \div 12 = 4$, so $r = 48$.

HELP with Reading

The \doteq symbol means *are these values equal?*

The \neq symbol means *is not equal to*.

EXAMPLE 2 Checking Solutions of Equations

Tell whether the value of the variable is a solution of $n - 8 = 20$.

a. $n = 12$

b. $n = 28$

Solution

Substitute for n and then simplify.

a. $n - 8 = 20$

$12 - 8 \doteq 20$

$4 \neq 20$

b. $n - 8 = 20$

$28 - 8 \doteq 20$

$20 = 20$

ANSWER 12 is not a solution of $n - 8 = 20$, and 28 is a solution.

Your turn now Solve the equation using mental math.

1. $5x = 45$

2. $16 + n = 21$

3. $t \div 6 = 9$

Tell whether the value of the variable is a solution of the equation.

4. $a + 9 = 16$; $a = 7$

5. $88 \div y = 8$; $y = 8$

6. $7n = 13$; $n = 2$

What do you think?

New Year's



Times Square

The Times Square New Year's Eve Ball in New York City has a total of 696 lights. Of these, 168 are on the exterior and 432 are on the interior. The remaining lights are strobe lights. How many strobe lights are there?

EXAMPLE 3 Writing an Equation

Times Square The Times Square New Year's Eve Ball drops a total of 77 feet in 60 seconds. After 54 seconds the ball has dropped 69 feet. How many more feet will the ball drop?



Solution

You can use a verbal model to write an equation. Let d represent the distance left to drop.

Total distance ball drops	=	Distance ball has dropped	+	Distance left to drop
---------------------------	---	---------------------------	---	-----------------------

Write a verbal model.

$77 = 69 + d$

Substitute.

$77 = 69 + 8$

Use mental math.

ANSWER Because $d = 8$, the ball will drop 8 more feet.

✓ **Check** You can check your answer by finding the sum of 8 and 69.

$8 + 69 \doteq 77$

$77 = 77$ ✓



Getting Ready to Practice

1. **Vocabulary** Give an example of an equation with a variable. Explain how to find the solution of the equation.

Solve the equation using mental math.

2. $9 + p = 21$ 3. $y - 10 = 34$ 4. $7x = 77$ 5. $56 \div k = 8$

Tell whether the value of the variable is a solution of the equation.

6. $35 - x = 21$; $x = 16$ 7. $75 \div x = 5$; $x = 15$
 8. $x + 29 = 42$; $x = 13$ 9. $7x = 84$; $x = 14$
 10. **Fireworks** Your town's fireworks show cost \$1000 per minute. The total cost was \$25,000. Use a verbal model to write and solve an equation to find how many minutes the fireworks show lasted.

HELP

with Homework

Example Exercises

- 1 11–14, 19–26
 2 15–18
 3 27



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Practice and Problem Solving

Match the equation with the corresponding question.

11. $24 \div t = 8$ A. What number divided by 24 equals 8?
 12. $t + 8 = 24$ B. 24 divided by what number equals 8?
 13. $24t = 8$ C. What number plus 8 equals 24?
 14. $\frac{t}{24} = 8$ D. 24 times what number equals 8?

Tell whether the value of the variable is a solution of the equation.

15. $15 + b = 28$; $b = 13$ 16. $37 - d = 14$; $d = 21$
 17. $6w = 72$; $w = 14$ 18. $9c = 108$; $c = 12$

Solve the equation using mental math.

19. $z + 8 = 19$ 20. $6m = 48$ 21. $c - 16 = 13$ 22. $51 \div k = 3$
 23. $\frac{32}{n} = 16$ 24. $26 - r = 17$ 25. $10y = 150$ 26. $7 + x = 31$

27. **Rainfall** The highest recorded rainfall in the United States in a 24 hour period is 43 inches. Write an equation to find how much more rain needs to fall in the remaining time to equal the record, if 14 inches has already fallen in less than 24 hours. Then solve the equation.



28. **Writing** Explain how you would tell whether 5 is a solution of the equation $4x = 20$.
29. **Elephants** A baby elephant at the Bronx Zoo would get on a scale only with its mother. The zoo weighed the mother as 5033 pounds. They weighed the mother and the baby together as 5396 pounds. Write and solve an equation to find the weight of the baby elephant.
30. **Measurement** Describe how you could use mental math to find the number of feet in 3600 inches.
31. **Invitations** You are writing invitations to a party. It takes you four minutes to complete each invitation. Write and solve an equation to find how many invitations you can complete in one hour.
32. **Guess, Check, and Revise** Find the value of x that makes the equation below true.

$$[(x + 3) \cdot 4 - 7] \div 3 = 3$$

Challenge Tell which of the given values is a solution of the equation.

33. $3x + 6 = x + 12$; $x = 1, 2, 3$ 34. $2x - 7 = x + 1$; $x = 8, 9, 10$
35. $8 - 4x = 4x$; $x = 0, 1, 2$ 36. $2x - 4.5 = x \div 2$; $x = 3, 4, 5$
37. **Marathon** To qualify for the Boston Marathon, Hillary has to run a qualifying time of 3 hours 40 minutes or less. Her best time so far is 4 hours 5 minutes. Write and solve an equation to find by how many minutes Hillary must improve her time to qualify.

Mixed Review

Evaluate the expression when $y = 8$. (Lesson 1.3)

38. $7y + 17$ 39. $(36 - 24) \cdot y$ 40. $y \cdot 4 + 20 \cdot y$

Basic Skills Estimate the sum or difference.

41. $8748 - 3109$ 42. $876 + 622$ 43. $147 + 89 + 791$

Test-Taking Practice

44. **Multiple Choice** Which of the following is a solution of $63 \div x = 9$?
- A. 6 B. 7 C. 9 D. 54
45. **Short Response** You and your friend volunteer at a zoo during the summer. One week you volunteer 12 hours. The sum of the hours you and your friend work that week is 23. Write an equation that can be used to determine how many hours your friend worked. Then solve the equation.

GOAL

Develop formulas for finding the areas of rectangles and squares.

MATERIALS

• square tiles


Modeling Area

You can use square tiles to find the *areas* of rectangles and squares.

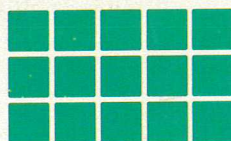
Explore

Find the area of a 5 unit by 3 unit rectangle.

- 1 Use square tiles to make a rectangle with side lengths of 5 units and 3 units.

 1 unit
1 unit One square unit

- 2 The area of the rectangle is equal to the number of square unit tiles that cover it. Count the square tiles to find the area of the rectangle.

 width = 3 units
length = 5 units

Your turn now

1. Use square tiles to make a rectangle that is the size given in the table. Copy and complete the table.

Dimensions	Length	Width	Number of square tiles	Area of rectangle
3 by 4	?	?	?	?
4 by 4	?	?	?	?
5 by 6	?	?	?	?
3 by 3	?	?	?	?

2. Write a variable equation to find the area of a rectangle and explain what each variable represents.
3. Write a different equation to find the area of a square and explain what each variable represents.

Stop and Think

4. **Critical Thinking** Area is measured in square units. Perimeter is the distance around a shape. Is perimeter measured in square units? Why or why not?

LESSON 1.6

Variables in Familiar Formulas

BEFORE

You evaluated variable expressions.

Now

You'll use formulas to find unknown values.

WHY?

So you can find the sizes of swimming pools, as in Ex. 22.

Word Watch

formula, p. 33
perimeter, p. 33
area, p. 33

A **formula** is an equation that relates two or more quantities such as *perimeter*, length, and width. The **perimeter** of a figure is the sum of the lengths of its sides. The **area** of a figure is the amount of surface the figure covers.

Perimeter is measured in linear units such as feet. Area is measured in square units such as square feet, or ft^2 .

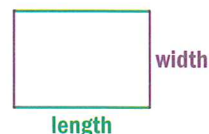
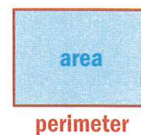


	Diagram	Perimeter	Area
Rectangle		$P = 2l + 2w$	$A = lw$
Square		$P = 4s$	$A = s^2$

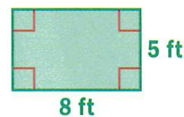
HELP

with Reading

The mark tells you that an angle measures 90° .

EXAMPLE 1 Finding Perimeter and Area

Find the perimeter and area of the rectangle.



Solution

Find the perimeter.

$$\begin{aligned} P &= 2l + 2w \\ &= 2(8) + 2(5) \\ &= 26 \end{aligned}$$

Write formula.

Substitute.

Multiply, then add.

Find the area.

$$\begin{aligned} A &= lw \\ &= (8)(5) \\ &= 40 \end{aligned}$$

Write formula.
Substitute.
Multiply.

ANSWER The perimeter is 26 feet, and the area is 40 square feet.

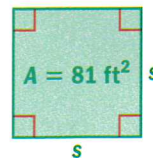
EXAMPLE 2 Finding Side Length

Find the side length of a square with an area of 81 square feet.

$$A = s^2 \quad \text{Write formula for area of a square.}$$

$$81 = s^2 \quad \text{Substitute 81 for } A.$$

$$9 = s \quad \text{Use mental math: } 9^2 = 81.$$



ANSWER The side length of the square is 9 feet.

Distance Formula Another useful formula is the distance formula. You can use the distance formula to find distance traveled.



Distance Formula

Words The distance traveled d is the product of the rate r and the time t .

$$\text{Algebra} \quad d = r \cdot t \quad \text{or} \quad d = rt$$

$$\text{Numbers} \quad d = 45 \frac{\text{miles}}{\text{hour}} \cdot 3 \text{ hours} = 135 \text{ miles}$$

HELP with Vocabulary

In the formula $d = rt$, rate is the speed of travel.



EXAMPLE 3 Using the Distance Formula

Rabbits A rabbit is running at a rate of 26.4 feet per second. How far does the rabbit travel in 5 seconds?

Solution

$$d = r \cdot t \quad \text{Write distance formula.}$$

$$= 26.4 \cdot 5 \quad \text{Substitute 26.4 for } r \text{ and 5 for } t.$$

$$= 132 \quad \text{Multiply.}$$

ANSWER The rabbit travels 132 feet in 5 seconds.

Your turn now Solve.

1. Find the perimeter and area of a square with a 7 inch side length.
2. Find the side length of a square that has an area of 100 square yards.
3. How far does a car travel in 2 hours at a rate of 40 miles per hour?

You can write the distance formula in different forms to find rate or time. Use $t = \frac{d}{r}$ to find the time and $r = \frac{d}{t}$ to find the rate.

EXAMPLE 4 Using the Distance Formula to Find Time

How long will it take a rabbit to travel 264 feet at a rate of 22 feet per second?

Solution

$$t = \frac{d}{r} \quad \text{Write distance formula.}$$

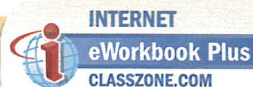
$$= \frac{264}{22} \quad \text{Substitute 264 for } d \text{ and 22 for } r.$$

$$= 12 \quad \text{Divide.}$$

ANSWER It will take a rabbit 12 seconds to travel 264 feet.

1.6 Exercises

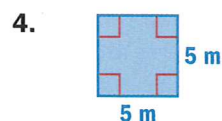
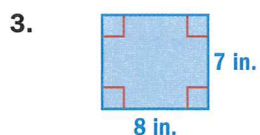
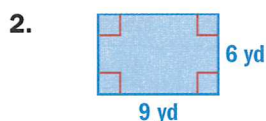
More Practice, p. 727



Getting Ready to Practice

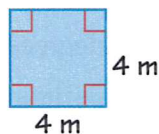
- Vocabulary** Describe the difference between area and perimeter.

Find the perimeter and area of the rectangle or square.



- Tiger Beetles** A tiger beetle runs at a rate of 53 centimeters per second for 3 seconds. How far does the beetle run?
- Find the Error** Describe and correct the error in the solution.

$A = s^2$
 $= 4^2$
 $= 16 \text{ meters}$



HELP with Homework

Example Exercises

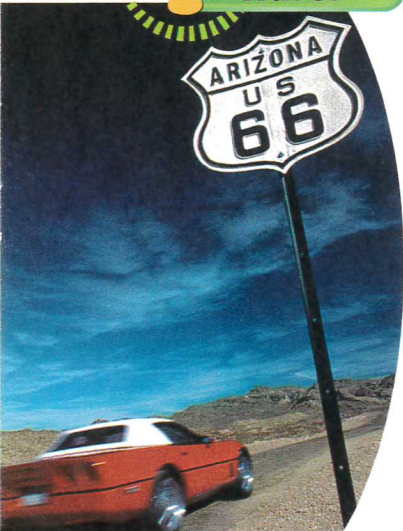
- 1 7-13, 22
- 2 14-15, 22
- 3 17-21, 27
- 4 17-20, 23



- More Examples
- eTutorial Plus

What do you think?

Travel

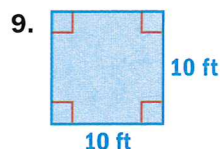
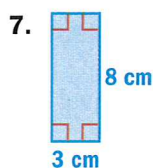


■ Arizona

U.S. Highway 66, often called Route 66, was commissioned in 1926. It connected Illinois to California traveling through eight states, including Arizona. Route 66 ceased to exist as an official highway in 1984. How many years was it an official highway?

Practice and Problem Solving

Find the perimeter and area of the rectangle or square.



In Exercises 10–13, find the perimeter and area of the rectangle or square.

10. length = 17 m, width = 9 m
11. side length = 18 in.
12. length = 11 ft, width = 2 ft
13. length = 14 cm, width = 13 cm
14. Find the side length of a square that has an area of 36 square yards.
15. Find the side length of a square that has a perimeter of 24 meters.
16. **Mental Math** The area of a rectangle is 88 square inches. The width is 8 inches. Use mental math to find the length of the rectangle.

Use the distance formula to find the unknown value.

17. $d = 36$ km, $r = ?$, $t = 4$ h
18. $d = ?$, $r = 0.5$ mi/min, $t = 10$ min
19. $d = ?$, $r = 7$ mi/h, $t = 1.5$ h
20. $d = 40$ ft, $r = 5$ ft/sec, $t = ?$
21. **Arizona** The speed limit on rural interstates in Arizona is 75 miles per hour. A car travels at this rate for 3 hours. How far does it travel?
22. **Swimming Pools** The table shows information about two swimming pools. Copy and complete the table.

	Length	Width	Area	Perimeter
Pool A	60 ft	22 ft	?	?
Pool B	?	30 ft	1800 ft ²	?

23. **Train** A train travels 226 miles from Washington, D.C., to New York City in about 2 hours 30 minutes. What is the average speed of the train in miles per hour? Round to the nearest mile per hour.
24. **Temperature Formula** To convert from degrees Celsius to degrees Fahrenheit, you can use the formula $F = \frac{9}{5}C + 32$. Convert 20°C to degrees Fahrenheit.
25. **Estimation** The driving distance between Houston and Dallas is 224 miles. Suppose a car travels at an average rate of 52 miles per hour. Estimate how long the trip from Houston to Dallas takes.
26. **Measurement** Write a formula for converting meters to centimeters.



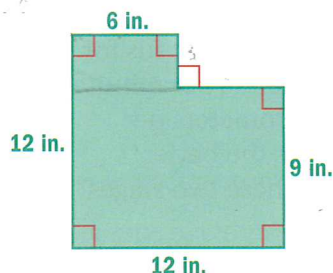
27. **Parachutist** A parachutist falls for 2 minutes at a speed of 13 feet per second. How far does the parachutist fall during this time?

Yard Fencing In Exercises 28 and 29, your rectangular yard has a length of 50 feet and a width of 45 feet.

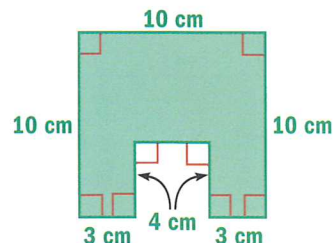
28. You want to fence in your yard. How much fencing do you need?
29. You want to fertilize your yard. Each bag of fertilizer covers 2000 square feet. How many bags should you buy?

Challenge Find the perimeter and area of the figure.

30.



31.



32. **Critical Thinking** Find the perimeter and area of a rectangle with a length of 6 inches and a width of 5 inches. Then find the perimeter and area of a rectangle with a length of 12 inches and a width of 10 inches. How does the perimeter of a rectangle change if length and width are doubled? How does the area of a rectangle change if the length and width are doubled?

Mixed Review



Solve the equation using mental math. (Lesson 1.5)

33. $8x = 72$

34. $g - 19 = 37$

35. $\frac{y}{3} = 10$

Basic Skills Round the number to the place value of the red digit.

36. 7.528

37. 15.538

38. 13.974

Test-Taking Practice



39. **Multiple Choice** You drive 50 miles per hour for 1 hour 30 minutes. Which expression can be used to find how many miles you travel?
- A. 50×130 B. 50×90 C. 50×1.5 D. $50 \div 90$
40. **Short Response** The area of a rectangle is 27 square meters. Explain how you can find the length of the rectangle if its width is 3 meters. What is the length of the rectangle?

LESSON 1.7

A Problem Solving Plan

BEFORE

You used problem solving strategies to solve problems.

Now

You'll use a problem solving plan to solve problems.

WHY?

To find how much cheese you need for lasagna, as in Ex. 9.

Word Watch

Review Word
formula, p. 33

In the Real World

Triathlon You and a friend decide to compete in a triathlon. You both swim 200 meters, bike 10 kilometers, and then run 2 kilometers.

The table shows your speeds for swimming, in meters per minute, and biking, in kilometers per minute. Who has the better total time after these two stages?

	Swimming (m/min)	Biking (km/min)
You	76.9	0.43
Friend	82.6	0.41

EXAMPLE 1 Understanding and Planning

To solve the triathlon problem, you need to make sure you understand the problem. Then make a plan for solving the problem.

Read and Understand

What do you know?

The table tells you each of your speeds for each stage.
You both swim 200 meters and bike 10 kilometers.

What do you want to find out?

Who has the better total time for swimming and biking

Make a Plan

How can you relate what you know to what you want to find out?

Find each of your swimming and biking times.

Find each of your total times and then compare these times.

You will solve the problem in Example 2.



Your turn now Use the information at the top of the page.

- Which formula would you use to find swimming and running times? Explain your reasoning.

A. $distance = rate \cdot time$ B. $time = \frac{distance}{rate}$ C. $rate = \frac{distance}{time}$

EXAMPLE 2 Solving and Looking Back

To solve the triathlon problem from the previous page, you need to carry out the plan from Example 1 and then check the answer.

Solve the Problem

To find each of your times, use the formula $time = \frac{distance}{rate}$.

	You	Friend
Swimming	$t = \frac{d}{r}$ $= \frac{200}{76.9}$ $\approx 2.6 \text{ min}$	$t = \frac{d}{r}$ $= \frac{200}{82.6}$ $\approx 2.4 \text{ min}$
Biking	$t = \frac{d}{r}$ $= \frac{10}{0.43}$ $\approx 23.26 \text{ min}$	$t = \frac{d}{r}$ $= \frac{10}{0.41}$ $\approx 24.39 \text{ min}$

Add to find the total time for each of you.

You $2.6 + 23.26 = 25.86 \text{ min}$

Friend $2.4 + 24.39 = 26.79 \text{ min}$

ANSWER You have the better total time after the two stages.

Look Back

Does your answer make sense?

Notice that you swim at a slower rate than your friend, so it makes sense that your swimming time is greater. You bike at a faster rate than your friend, so it makes sense that your biking time is less. So the calculations appear reasonable.

HELP

with Reading

The \approx symbol means is approximately equal to.



Problem Solving Plan

- 1. Read and Understand** Read the problem carefully. Identify the question and any important information.
- 2. Make a Plan** Decide on a problem solving strategy.
- 3. Solve the Problem** Use the problem solving strategy to answer the question.
- 4. Look Back** Check that your answer is reasonable.

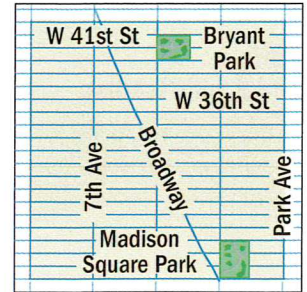
Unit Analysis You can use *unit analysis* to evaluate expressions with units of measure and to check that your answer uses the correct units.

For example, when you find the product of rate and time using the units below, the units for distance will be miles.

$$\frac{\text{miles}}{\text{hour}} \cdot \text{hour} = \text{miles}$$

EXAMPLE 3 Using a Problem Solving Plan

New York City In parts of New York City, the blocks between avenues are called *long blocks*. There are 4 long blocks per mile. Blocks between streets are called *short blocks*. There are 20 short blocks per mile. You walk 40 short blocks and 6 long blocks. How many miles do you walk?



Solution

Read and Understand You walk 40 short blocks and 6 long blocks. There are 20 short blocks per mile and 4 long blocks per mile. You are asked to find how many miles you walk.

Make a Plan Convert short blocks to miles and long blocks to miles using unit analysis. Then add to find the total miles.

Solve the Problem

Because there are 20 short blocks in one mile, you can multiply the number of short blocks you walk by $\frac{1 \text{ mile}}{20 \text{ short blocks}}$ to convert short blocks to miles.

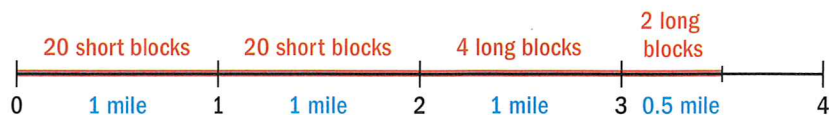
$$40 \text{ short blocks} \times \frac{1 \text{ mile}}{20 \text{ short blocks}} = 2 \text{ miles}$$

Multiply the number of long blocks you walk by $\frac{1 \text{ mile}}{4 \text{ long blocks}}$ to convert long blocks to miles.

$$6 \text{ long blocks} \times \frac{1 \text{ mile}}{4 \text{ long blocks}} = 1.5 \text{ miles}$$

ANSWER You walk a total of $2 + 1.5 = 3.5$ miles.

Look Back Check your answer by drawing a diagram.



From the diagram you can see that 40 short blocks are 2 miles and 6 long blocks are 1.5 miles, which totals 3.5 miles. So, your answer checks. ✓

Getting Ready to Practice

- Vocabulary** List the four steps of the problem solving plan.
- Tickets** You pay \$15 a ticket for 4 tickets and a service charge of \$2 for every ticket after the second one. You are charged \$64 for this order. Describe a way to check that this is the correct price.
- Guided Problem Solving** A monorail ride at an amusement park has 5 cars per trainload, and each car can hold 4 passengers. In one hour, 900 people can ride the monorail. How many trainloads run in one hour?
 - Write a verbal model of the problem.
 - Use the model to find the number of trainloads in one hour.
 - Check your answer.

HELP

with Homework

Example Exercises

- | | |
|---|-----|
| 1 | 4-9 |
| 2 | 4-9 |
| 3 | 4-9 |


 Online Resources
 CLASSZONE.COM

- More Examples
- eTutorial Plus

Practice and Problem Solving

- Find the Error** Daniel has enough film to take 96 pictures on a 5 day trip. He takes 45 pictures the first 2 days. He wants to take an equal number of pictures each day for the last 3 days. Describe and correct the error in the solution.

$$\times \quad \frac{96}{3} = 32$$

So, I can take 32 pictures each day.

- Saving** Fran is saving money for a color printer that costs \$210. She makes \$6 an hour baby-sitting, and her parents will contribute \$120. Use the problem solving plan to find how many hours she needs to baby-sit to earn enough money for the printer.
- Look for a Pattern** Draw the next two shapes in the pattern below.
- Music** You practice for 2 hours each weekday and for 3 hours on each weekend day. How many hours per week do you practice?
- Bicycle Race** A Tour de France bicycle race covered 3462 kilometers in 21 days. Riders traveled 3152 kilometers during the first 19 racing days and then traveled 160 kilometers the next day. How long was the ride on the last day?

9. **Community Service** You are making lasagna for 30 people at a homeless shelter. It takes 8 ounces of mozzarella cheese to make enough to serve 10 people. You have 12 ounces of mozzarella cheese. How much more do you need?

Critical Thinking In Exercises 10–13, complete the pattern.

10. 2, 7, 12, $\frac{?}{?}$, $\frac{?}{?}$

11. 9, 7, 5, $\frac{?}{?}$, $\frac{?}{?}$

12. 3, 12, 48, $\frac{?}{?}$

13. 21, 17, 13, $\frac{?}{?}$, $\frac{?}{?}$

14. **Writing** Is there enough information to answer the following question? Explain how to solve the problem, or tell what information is needed.

Amanda has sold magazine subscriptions worth \$330 for a school fundraiser. If she reaches a total of \$500, she wins a gift certificate. How many more subscriptions does she need to sell to reach \$500?

15. **Sales** During a 4 week period, a salesperson at a photography studio wants to sell photography packages worth a total of \$16,000. Sales for the first 3 weeks are \$1240, \$3720, and \$5980. What does the sales amount need to be in week 4 to reach the \$16,000 goal?
16. **Number Sense** The product of two numbers is 48. Their sum is 16. Find the two numbers.

Critical Thinking In Exercises 17–20, complete the pattern.

17. $2x$, $4x$, $6x$, $\frac{?}{?}$, $\frac{?}{?}$

18. $65x$, $52x$, $39x$, $\frac{?}{?}$, $\frac{?}{?}$

19. $7x^2$, $15x^2$, $23x^2$, $\frac{?}{?}$, $\frac{?}{?}$

20. $81x$, $78x^2$, $75x^3$, $72x^4$, $\frac{?}{?}$, $\frac{?}{?}$

21. **Garden** You have 28 feet of fencing and want to construct a rectangular garden with the largest possible area with whole number dimensions. Find the side lengths of the largest possible garden. What is its area?

Guess, Check, and Revise In Exercises 22–25, find the solution of the equation.

22. $4x = 2x + 14$

23. $6x = 9x - 15$

24. $2x + 3 = 5x - 9$

25. $9 - 3x = 2x - 11$

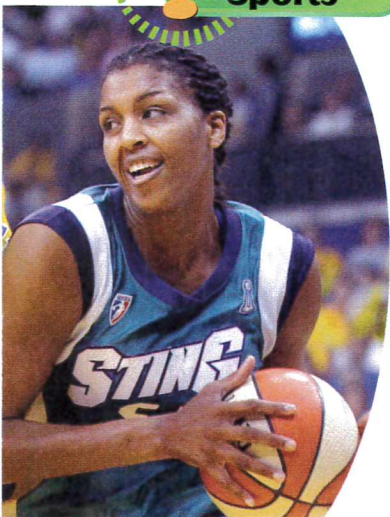
26. **Basketball** The table shows the numbers of people who attended Women's National Basketball Association (WNBA) games from 1997 through 2001. Describe how you could predict the attendance for WNBA games in 2002. What is your prediction? How can you check your prediction?

Year	1997	1998	1999	2000	2001
Attendance	1,082,093	1,630,315	1,959,733	2,322,429	2,323,164

27. **Challenge** Bill's house is third in a row of 12 houses. There are 5 houses between Chris's house and Audrey's house, and 2 between Chris's house and Bill's house. How many houses are between Audrey's house and the first house? Explain how you got your answer.

What do you think?

Sports



■ Basketball

In 1997, the WNBA had eight teams. Two teams were added in 1998. In 1999, two more teams were added. Four teams were added in 2000. How many teams were in the WNBA in 2000?

Mixed Review



Evaluate the expression. (Lesson 1.2)

28. $7 + 4 \times 3 - 6$

29. $24 \div (2 \times 4) - 3$

30. $70 \div [14 - 2 \times 2]$

Find the perimeter and area of the figure. (Lesson 1.6)

31. a 16 in. by 3 in. rectangle

32. a square with a 237 ft side

Basic Skills Complete the statement using $<$ or $>$.

33. $23.2 \underline{\quad} 23$

34. $0.5 \underline{\quad} 5$

35. $0.1 \underline{\quad} 0.01$

36. $1.4 \underline{\quad} 4.1$

Test-Taking Practice



37. **Multiple Choice** You are trying to earn 400 points in a game. In the first round you get 154 points. The next round you get 78 points. How many more points do you need?

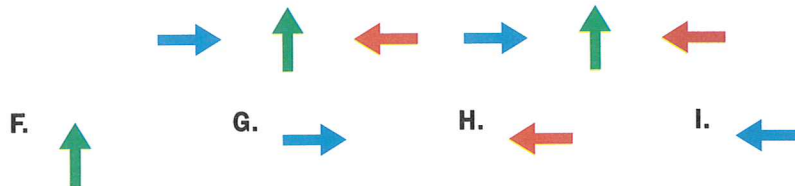
A. 76

B. 168

C. 176

D. 268

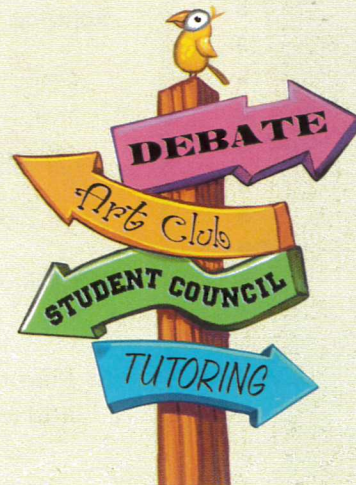
38. **Multiple Choice** Which picture represents the next arrow in the pattern?



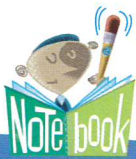
What's Happening?

Scott, John, Annie, and Rebecca are each doing a different activity. Who is doing what?

- Scott and John are not at the debate.
- Scott can't go to the student council meeting.
- Annie is not going to student council or to art club.
- Rebecca is not a member of the student council.
- Annie and Rebecca do not tutor.



Notebook Review



Review the vocabulary definitions in your notebook.

Copy the review examples in your notebook. Then complete the exercises.

Check Your Definitions

equation, p. 28

solving an equation, p. 28

perimeter, p. 33

solution, p. 28

formula, p. 33

area, p. 33

Use Your Vocabulary

1. What is the formula for the perimeter of a rectangle?

1.5 Can you solve equations using mental math?



EXAMPLE Solve $32 \div n = 8$.

$$32 \div n = 8$$

Write original equation.

$$32 \div 4 = 8, \text{ so } n = 4.$$

Solve equation using mental math.



Use mental math to solve the equation.

2. $5 + m = 18$

3. $t - 9 = 3$

4. $7h = 21$

5. $\frac{d}{3} = 6$

1.6 Can you use formulas to find unknown values?



EXAMPLE In 1990, Arie Luyendyk set a record at the Indianapolis 500 race with an average speed of about 186 miles per hour. About how long did it take him to complete the 500 mile race?

Solution

$$t = \frac{d}{r}$$

Write distance formula.

$$= \frac{500}{186}$$

Substitute 500 for d and 186 for r .

$$\approx 2.69$$

Divide. Round to the nearest hundredth.

ANSWER Arie Luyendyk completed the race in about 2.69 hours.



6. Find the perimeter and area of a rectangle with a length of 7 meters and a width of 4 meters.

1.7 Can you use a problem solving plan?

Review

EXAMPLE You are filling a 55 gallon aquarium with water using a pitcher from your kitchen. It takes 3 trips with the pitcher to fill a 5 gallon aquarium. How many trips with the pitcher will you need to fill the 55 gallon aquarium?

Read and Understand and Make a Plan Find how many times 5 gallons goes into 55 gallons. Multiply that number by 3, because it takes 3 pitchers to make 5 gallons.

Solve the Problem $\frac{55 \text{ gallons}}{5 \text{ gallons}} = 11$

$$11 \cdot 3 \text{ trips} = 33 \text{ trips}$$

ANSWER It will take 33 trips with the pitcher to fill the aquarium.



7. If you like 2 teaspoons of sugar in an 8 ounce glass of iced tea, how much sugar should you add to a 36 ounce thermos of iced tea?

Stop and Think about Lessons 1.5–1.7

8. **Critical Thinking** Can you tell whether area or perimeter is being measured if you know only the unit of measurement? Explain.

Review Quiz 2

Solve the equation using mental math.

1. $h + 12 = 21$ 2. $22 - y = 8$ 3. $54 = 6x$ 4. $\frac{108}{r} = 9$

5. **Video Games** You have \$24 to spend on video game rentals. Each rental costs \$3. How many video games can you rent?
6. **Geometry** Find the perimeter and area of a rectangle with a length of 14 feet and a width of 11 feet.
7. **Driving** On the highway you drive at a speed of 55 miles per hour for 3 hours. How far do you drive?
8. **Exercise** You plan to exercise 200 minutes over 5 days. The first four days you exercise 45 minutes, 30 minutes, 20 minutes, and 1 hour. Use the problem solving plan to find the number of minutes you need to exercise on the fifth day to meet your goal.

Chapter Review

Vocabulary

bar graph, p. 5	verbal model, p. 11	solution, p. 28
data, p. 5	variable, p. 15	solving an equation, p. 28
frequency table, p. 6	variable expression, p. 15	formula, p. 33
histogram, p. 6	power, p. 20	perimeter, p. 33
numerical expression, p. 10	exponent, p. 20	area, p. 33
evaluate, p. 10	base, p. 20	
order of operations, p. 10	equation, p. 28	

Vocabulary Review

Copy and complete the statement.

1. You can graph data organized in a frequency table using a(n) ?.
2. ? is the amount of surface covered by a figure.
3. To evaluate an expression that has more than one operation, use the ?.
4. A(n) ? is a symbol, usually a letter, that represents one or more numbers.
5. A power has an exponent and a(n) ?.

Tell whether the statement is *true* or *false*.

6. A variable expression is a mathematical sentence that is formed by placing an equal sign between two expressions.
7. A formula is an equation that has only one variable.
8. The perimeter of a figure is the sum of the lengths of its sides.
9. A solution of an equation is a number that, when substituted for a variable, makes the equation true.

Review Questions

In Exercises 10 and 11, use the table at the right. It shows the numbers of volunteers at a local animal shelter. (Lesson 1.1)

10. Which age group has the most volunteers? Which age group has the fewest volunteers?
11. Can you determine the number of volunteers who are teenagers? Explain.

Age group	Volunteers
15-24	24
25-34	30
35-44	31
45-54	30
55-64	27
65-74	12
75-84	11

Evaluate the expression. (Lesson 1.2)

12. $16 + 5 \times 3 + 8$

13. $40 \div [(14 + 6) \cdot 2]$

14. $10 + \frac{60}{31 - 26}$

Review Questions

- 15. Clothes** You are saving money to buy two sweaters that each cost \$28.50. You have already saved \$20. To find out how much more money you need to save, translate *2 times 28.5 minus 20* into an expression and then evaluate. (Lesson 1.2)

Evaluate the expression when $x = 4$ and $y = 9$. (Lesson 1.3)

16. $\frac{xy}{3x}$

17. $\frac{y+19}{x+3}$

18. $5y - 6x$

19. $3xy - xy$

- 20. Dolphins** After swimming 22 miles, a dolphin changes direction and swims at a rate of 18 miles per hour. Use the expression $22 + 18t$ to find the total distance traveled by the dolphin after 2 more hours. (Lesson 1.3)



Evaluate the power. (Lesson 1.4)

21. 15^2

22. 4^5

23. 10^4

24. 9^3

Evaluate the expression. (Lesson 1.4)

25. $(5 + 4)^2 \div 3$

26. $5 \cdot (6 - 3)^5 + 45$

27. $[10 + (4 \times 2)^3] \div 2$

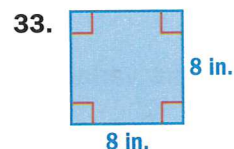
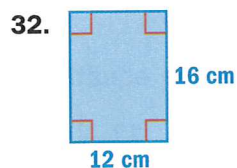
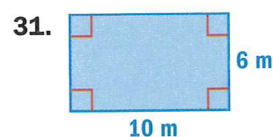
Solve the equation using mental math. (Lesson 1.5)

28. $7b = 56$

29. $\frac{84}{x} = 12$

30. $98 - t = 35$

Find the perimeter and area of the rectangle or square. (Lesson 1.6)



- 34. Cars** A car travels at an average rate of 50 miles per hour for 3 hours. How far does it travel? (Lesson 1.6)

- 35. Radio** You are the disc jockey for a 15 minute radio show at your school. You must leave 3 minutes open for announcements, and you want to play 3 songs. Use the table at the right to determine the 3 songs you can play. (Lesson 1.7)

Song	A	B	C	D	E
Length (minutes)	6	4	3	5	6

Chapter Test

Sports In a survey, 3000 people in Japan were asked about their participation in ten sports. The results for four sports are in the table.

Sport	Participants
Gymnastics	1002
Bowling	996
Jogging	807
Swimming	717

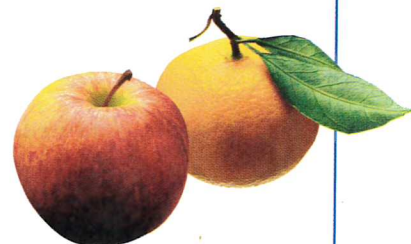
1. Make a bar graph of the data.
2. Is it possible to make a histogram of the data? Explain.

Evaluate the expression.

3. $20 + 12 \div 4$
4. $6 \times 5 - 20 \div 2$
5. $(3 + 7) \div 5 + 10$

6. **Plumbing** A plumber charges a flat rate of \$25 plus an additional \$55 for each hour of work. To find how much money the plumber makes in 5 hours at one location, evaluate the expression $25 + 55 \cdot 5$.

7. **Fruit** You are buying 3 apples and 4 oranges for a fruit salad. The cost of one apple is x dollars. The cost of one orange is y dollars. Write a variable expression to represent the cost of 3 apples and 4 oranges. If one apple costs \$.75 and one orange costs \$.50, what is the total cost?



Evaluate the expression.

8. $(2 + 3)^4 \div 5$
9. $10^2 - 3^4 + 22$
10. $(11 - 5)^4 - 300 \div 12$

Solve the equation using mental math.

11. $17 - t = 5$
12. $9n = 72$
13. $49 \div b = 7$
14. $21 + a = 27$

Tell whether the value of the variable is a solution of the equation.

15. $z + 2 = 15$; $z = 13$
16. $65 \div y = 16$; $y = 4$
17. $11x = 45$; $x = 4$

18. **Court Area** The lengths and widths of three different types of courts are listed in the table. Find the area of each court. Which court has the largest area? Which court has the smallest area?

Court	Length	Width
Squash	32 feet	21 feet
Tennis	78 feet	27 feet
Racquetball	40 feet	20 feet

19. **Horses** A horse travels at a rate of 60 feet per second. How far does the horse travel in 4 seconds?
20. **Park** A rectangular park that is 90 feet long and 60 feet wide needs to be planted with sod. A roll of sod covers 1 square yard. Use the problem solving plan to find how many rolls of sod are needed to cover the park.

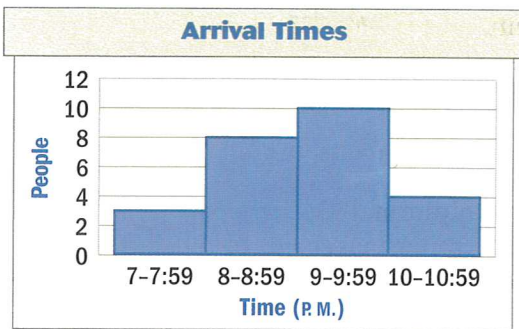


Chapter Standardized Test

Test-Taking Strategy Most standardized tests are based on concepts and skills taught in school. The best way to prepare is to keep up with your daily studies.

Multiple Choice

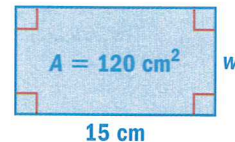
1. The histogram shows the times 25 people arrived at a party. How many people arrived between 9 and 10:59?



- A. 4 B. 14 C. 21 D. 25
2. In what order should the operations be performed in the expression $3 + 7 \times 4 \div 2 - 6$?
- F. $\times, -, \div, +$ G. $+, \times, \div, -$
H. $\times, \div, +, -$ I. $+, -, \times, \div$
3. Which expression has a value of 20?
- A. $15 + 5 \times 4 \div 2 - 1$
B. $(15 + 5) \times (4 \div 2 - 1)$
C. $(15 + 5) \times 4 \div 2 - 1$
D. $(15 + 5) \times 4 \div (2 - 1)$
4. What is the correct value of the expression $(11 - 9)^4 + 6 \times 3$?
- F. 26 G. 34 H. 42 I. 66
5. Which statement is true?
- A. $2^6 < 6^2$ B. $4^7 < 7^4$
C. $1^9 > 9^1$ D. $3^5 > 5^3$
6. Which equation represents this statement: *The quotient of twenty and a number is five?*
- F. $20 \div r = 5$ G. $t \div 20 = 5$
H. $5 \div p = 20$ I. $20g = 5$
7. What is the solution of the equation in Exercise 6?
- A. $\frac{1}{4}$ B. 2 C. 4 D. 100
8. If $a = 4$ and $b = 9$, which equation is true?
- F. $a = 5 + b$ G. $ab = 13$
H. $b \div 3 = a$ I. $2a + b = 17$

Short Response

9. The area of the rectangle is 120 square centimeters. Write an equation you can use to find the width w . Then solve the equation for w .



Extended Response

10. Your car's fuel gauge is broken. The car can go 22 miles on one gallon of gasoline. You start a trip with 13 gallons of gasoline. If you want to always have at least a gallon in the tank, what is the farthest you should drive before stopping for more gasoline? Explain.

Integer Operations

BEFORE

In previous chapters you've...

- Performed operations on whole numbers
- Evaluated expressions

Now

In Chapter 2 you'll study...

- Operations on integers
- Using properties to evaluate expressions
- Identifying and plotting points in the coordinate plane

WHY?

So you can solve real-world problems about...

- space shuttles, p. 56
- dinosaurs, p. 66
- diving, p. 70
- murals, p. 89

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- State Test Practice
- More Examples

Chapter Warm-Up Game

Review skills you need for this chapter in this quick game. Work with a partner.

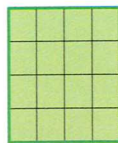
Key Skill:

Multiplying whole numbers

FOUR IN A ROW

MATERIALS

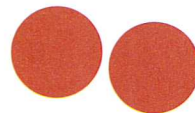
- 2 Answer Cards



- 24 Expression Cards



- 24 Markers



PREPARE Fill in your Answer Card with 16 of the 24 answers given below. Place the Expression Cards face down in a pile. On each turn follow the steps on the next page.

168	196	240	315	338	342
352	361	405	414	418	441
516	522	529	595	720	792
832	851	918	961	975	1020

