TEST BANK

HOW TO USE THIS TEST BANK

In this section you will find one chap-ter test for each of the 14 chapters in *Algebra: Themes, Tools, Concepts.* For Chapters 3, 5, 6, 7, 9, 10, and 13, you will also find some additional problems. Solutions for all the problems in this section follow the test for Chapter 14.

Most of the problems in the chapter tests are based on the Essential Ideas which appear at the end of each chapter in the student text. If your students have a good understanding of the Essential Ideas, they should be well prepared for these tests. However, some of the tests may require more time to complete than your students have in a typical class period. You may want to omit some problems, or spread your in-class testing over two days. Do not rush your students. Instead, give them sufficient time to complete their tests and emphasize the quality of their explanations. This course encourages students to be reflective and thorough in their work, and this same encouragement should carry over into test-taking.

You can use the additional problems for mid-chapter quizzes, bonus problems, or as a resource when creating your own tests. Some teachers break the tests into two components: an in-class part and a take-home part. Because some of the additional problems are more challenging than those in the tests, they can provide a source of problems for the take-home part of the test.

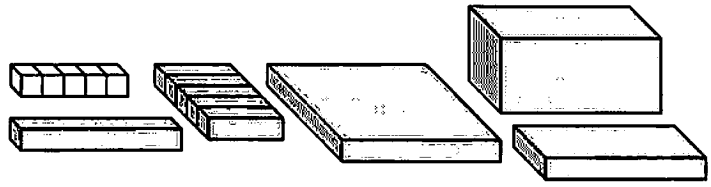
If you prefer to give a cumulative test at the end of each chapter, keep a record of the most frequently missed problems. On subsequent tests, you can use the frequently missed problems from previous tests along with problems selected from the chapter tests and additional problems.

Note: It is assumed your students will have access to graph paper and dot paper for certain tests in this section.

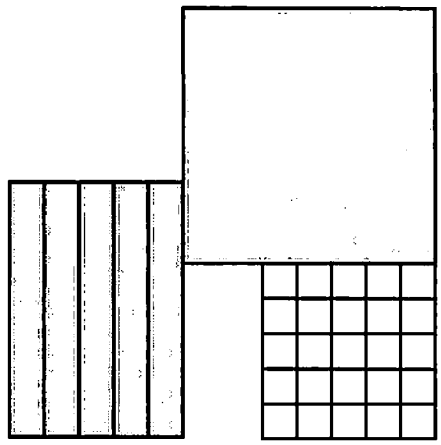
Chapter 1 • Test

Name

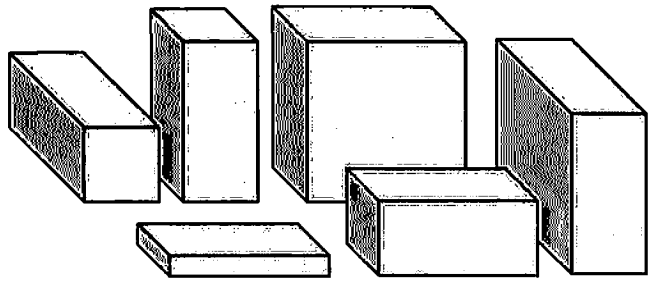
1. a. What expression do these blocks show?
   b. Evaluate the expression for $x = \frac{1}{2}$ and $y = 4$. Show your work.



2. Sketch a figure having the same area as the figure below, but a different perimeter. Find the area and the perimeter of each figure.



3. a. Write the name of the block on each block illustrated below.
   b. Write the expression you get when you combine like terms.
   c. Evaluate the expression for $x = 0$ and $y = 1$.



4. An algebra student combined terms incorrectly on all these problems. Every equation below is *incorrect*. Sketch both sides of each equation to show that the two sides are *not* equal.

   a. $x^2 + x^2 = x^4$ b. $10x - x = 10$
   c. $3x + y = 3xy$ d. $2x + 4x = 6x^2$

5. Tell whether each of the following problems is *sometimes*, *always*, or *never* true. Explain your answers, using sketches of the Lab Gear. If it is sometimes true, give an example of when it is true.

   a. $25 - 5x = 20x$ b. $3(x + 6) = 3x + 6$

6. Use the Lab Gear to show each expression. Sketch.

   a. $5 + 2x + 3y$ b. $5 + 5xy$
   c. $5 + 6xy$ d. $7x + 3y$

7. Find values for x and y so that
   a. all four expressions in problem 6 have different values;
   b. as many as possible of the given expressions are equal to each other.

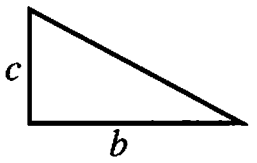
Use the corner piece for problems 8 and 9.

8. Find the area of a rectangle having sides y and $y + 3$. Write a multiplication of the form *length times width = area*.

9. These equations are of the form *length times width = area*. Use the blocks to help you fill in the blanks.

   a. $x \cdot$ _____ $= x^2 + 3x$ b. $(5 + x) \cdot$ _____ $= 10y + 2xy$
   c. (_____ $+ 4) \cdot x = 3xy +$ _____

10. What is the area of the triangle in the figure below, if $b = 12$ and $c = 3x$?



Chapter 2 • Test

Name

1. If $x = 2$, $-x$ is negative. If $x = -2$, $-x$ is positive. Find a value of x so that:
   a. $-6x$ is negative b. $6 - x$ is negative c. $-(x - 6)$ is negative
   d. $-6x$ is positive e. $6 - x$ is positive f. $-(x - 6)$ is positive

2. The opposite of an expression is the one you have to add to it to get zero. Write the opposite of the following expressions. Do not use parentheses in your final answer.
   a. $3x$ b. $3 + x$ c. $3 - x$

3. a. $30xy$ can be written as a product of two factors. Find five different ways to do it.
   b. $30xy$ can be written as a product of three factors. Find three different ways to do it.

4. Write equivalent expressions without parentheses.
   a. $4(y - 5)$ b. $-1(y - 5)$ c. $(x + y - 5)(1 + x)$

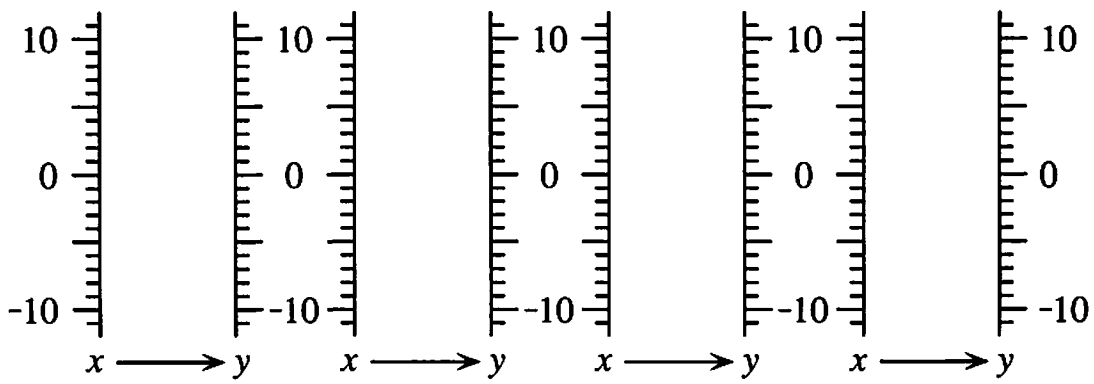
Problems 5 through 8 are about the function diagrams below. The input is x and the output is y. For each problem:
   a. Make a function diagram satisfying the given condition. (Use a ruler on the diagrams below. Show at least five in-out lines. Use zero, some negative values, and some positive values for x.)
   b. Write a function for the diagram, in the form $y = \ldots$.

5. The output is three times the input.

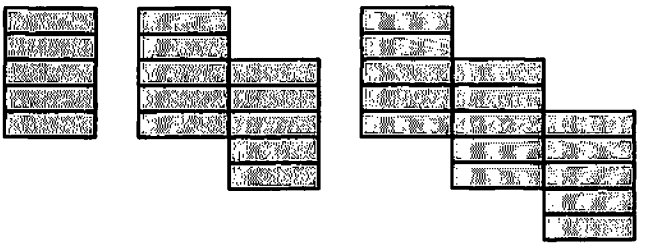
6. The output is one third of the input.

7. The output is always 0.

8. The in-out lines cross each other in a point.



9. Look at the sequence of Lab Gear figures. Think about how it would continue, following the same pattern.

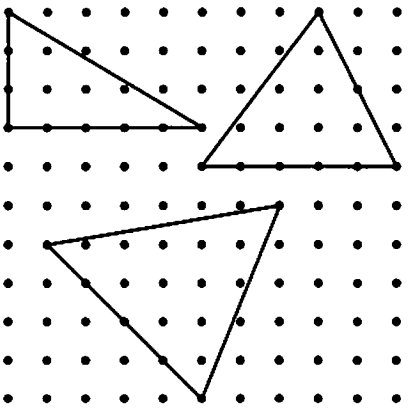


(1) (2) (3)

Figure #	Perimeter
1	
2	
3	
4 ⋮ 10 ⋮ 100 ⋮ *n*	

a. Sketch the next figure in the sequence, following the same pattern.
b. Complete the table.

10. Explain how to find the area of geoboard triangles. Use the three triangles below as examples. You may mention division by two, addition, and subtraction.



Chapter 3 • Test

Name

1. Simplify.
   a. $6 - (-7)$ b. $-[6 - (-7)]$ c. $-6 - (-7)$ d. $(-6) \cdot (-7)$
2. If possible, find a value of x that satisfies the condition. If it is not possible, explain.
   a. $12x$ is positive b. $-12x$ is positive c. $-12x^4$ is positive
   d. $3 - 12x$ is negative e. $-6x$ is negative f. $-6x^3$ is negative
   g. $x^2 - 4$ is zero h. $3 - 12x$ is zero
3. a. Translate each step into algebra.
   (1) *Think of a number.*
   (2) *Multiply the number by 6.*
   (3) *Subtract 4 from the result.*
   b. If the result after step 3, is -1, what was the original number? Explain how you got this answer, showing all your work.
4. a. Translate into algebra this rule for a function:
   Subtract 3 from x and multiply the result by $\frac{1}{2}$.
   b. Write in words the rule for the inverse of the function in part a.
   c. Translate into algebra the rule you wrote in part b.

Problems 5 through 7 are about the Celsius, Fahrenheit, and Kelvin temperature scales.

- To convert Celsius temperatures to Fahrenheit, multiply the Celsius temperature by 1.8, then add 32.
- To convert Celsius temperatures to Kelvin, add 273.

5. Describe in words or use an arrow diagram to show what you would do to convert
   a. Fahrenheit to Celsius; b. Fahrenheit to Kelvin.
6. Which of the following equations would be used for converting Fahrenheit to Kelvin? Defend your choice.
   a. $K = \frac{F - 32}{1.8} + 273$ b. $K = \frac{F + 32}{1.8} - 273$ c. $K = \frac{F - 273}{1.8} + 32$
7. a. Convert 59° Fahrenheit to Kelvin.
   b. Convert 373° Kelvin to Fahrenheit.
8. Simplify. (Perform the operations and combine like terms.)
   a. $12xy - (3x \cdot -2y) - 2xy$ b. $12xy - 3x - (2y - 2xy)$
   c. $12xy - 3x(-2y - 2xy)$ d. $(x + y + 2)(x + 3y)$

9. Let N be a number greater than 2.
   a. If you multiply 30 by $\frac{2}{N}$, will the result be greater than or less than 30? Explain.
   b. If you divide 30 by $\frac{2}{N}$, will the result be greater than or less than 30? Explain.
10. Possible or impossible? If it is possible, give an example. If it is impossible, explain.
    a. Subtract a negative number from a positive number and get a negative number.
    b. Subtract a negative number from a negative number and get a negative number.

Chapter 3 • Additional Problems

1. Give the answer if it exists. If the answer does not exist, explain why not.
   a. $\frac{0}{0}$ b. $4 \cdot 0$ c. $0 \cdot 0$ d. $\frac{4}{0}$ e. $\frac{0}{4}$
2. Is the reciprocal of the opposite of x *always*, *sometimes*, or *never* equal to the opposite of the reciprocal of x? Explain, using at least two examples.
3. Find all the numbers that satisfy the given condition.
   a. The number is its own reciprocal.
   b. The number does not have a reciprocal.
   c. The number is its own opposite.
   d. The number does not have an opposite.
4. Find at least two numbers that:
   a. are more than their reciprocals
   b. are less than their reciprocals
   c. are more than their opposites
   d. are less than their opposites
5. What is the result when you:
   a. multiply a number by its reciprocal?
   b. divide a number by its reciprocal?

Chapter 4 • Test

Name

1. Write the equation of:
   a. a line through the origin containing the point (3, 8)
   b. another first-degree polynomial containing the point (3, 8)
   c. a second-degree polynomial containing the point (3, 8)

Problems 2 through 4 are about the graph of the equation $y = -x^2 - 5$.

2. Which of these points are on the graph? Explain how you know.
   (2, -9) (-2, 9) (-2, -9) (2, 9)
3. The point (-6, y) is on the graph. Find y.
4. The point (x, -54) is on the graph. What are the two possible values of x?
5. If possible, find an (x, y) pair on the graph of $y = -5x$ for which:
   a. x is negative and y is positive
   b. x is positive and y is negative
   c. x and y are both negative
   d. x and y are both positive
6. Repeat problem 5 for $y = x^2 + 3$.

For problems 7 and 8:

a. Plot the points given in the table.
b. Use the pattern you find to add more points to your table and graph.
c. Write an equation that tells how to get the y-value from the x-value.

7.

x	y
0	-1
1	2
2	5
-1	-4

8.

x	y
3	7
2	2
1	-1
0	-2
-1	-1
-2	2

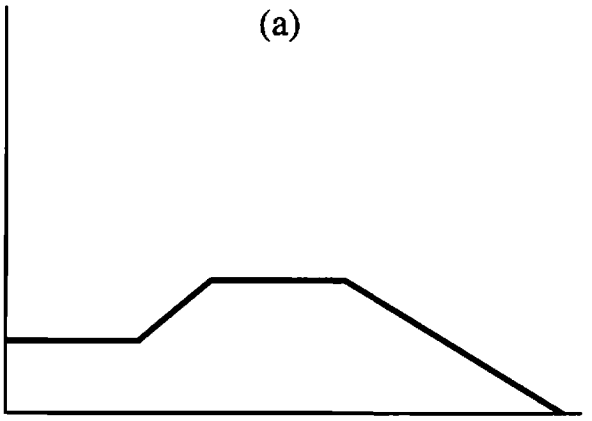
9. Without graphing, tell which of the following lines pass through the origin.
   a. the line containing the points (7, 5) and (14, 10)
   b. the line containing the points (6, 4) and (30, 20)
   c. the line containing the points (6, 4) and (11, 9)
10. Explain how you got the answers to problem 9 without graphing the lines.

11. A line containing the point (4, 6) crosses the y-axis at the point (0, 1). Without graphing, tell whether or not it contains the point (20, 30). Explain your reasoning.

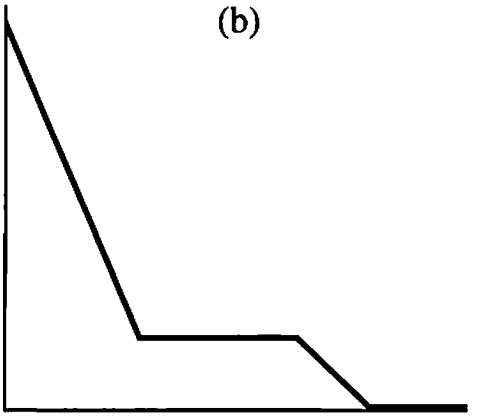
12. If y is 7 when x is 4, and y is 12 when x is 5, is the relationship between y and x direct variation? Explain your reasoning.

13. These graphs represent the motion of Teal's car. The vertical axis shows distance from her house, and the horizontal axis shows time. For each graph, add scales to the axes and write a short paragraph describing the trip it summarizes.

(a)



(b)



Chapter 5 • Test

Name

1. If possible, write an equation of the form $x + y = S$ such that its graph:
   a. passes through the point (-3, -4)
   b. passes through the point (-2.8, 1.4)
   c. lies in the 1st, 2nd, and 4th quadrants
   d. does not intersect the x-axis
2. If possible, write an equation of the form $x \cdot y = P$ such that its graph:
   a. lies in the 1st and 3rd quadrants
   b. contains the point (0.1, -52)
   c. intersects the graph of $y = x$ at the point (-4, -4)
   d. intersects the x-axis
3. Write one equation of the form $x + y = S$ and one of the form $x \cdot y = P$ such that the two graphs intersect at (-3, -6) and (-6, -3).
4. Write an equivalent expression without parentheses. Combine like terms.
   a. $(2x \cdot 3)(4x \cdot 5)$ b. $(2x \cdot 3)(4x + 5)$ c. $(2x + 3)(4x + 5)$
5. In which parts of problem 4 did you use the distributive law to remove parentheses? Explain.
6. Multiply. Combine like terms.
   a. $(2x + 5)(x + 1)$ b. $(2x + 5)(x - 1)$
   c. $(2x - 5)(x + 1)$ d. $(2x - 5)(x - 1)$
7. Divide.
   a. $\frac{3xy + 3y}{3y}$ b. $\frac{4x + 8y}{2}$
8. Factor completely.
   a. $x^3 + 3x^2 + 2x$ b. $(9x^2 + 3x)(4x + 16)$
9. How many x-intercepts does the parabola $y = x^2 + 6x + 8$ have? Explain your reasoning.
10. Find all the whole numbers that you can put in the blank so that $x^2 + 14x +$ ___ can be factored into a product of two binomials. For each case, write the factored form. Explain how you got your answer.

Chapter 5 • Additional Problems

1. Find all the whole numbers that you can put in the blank so that $x^2 + \_\_\_x + 16$ can be factored into a product of two binomials. For each case, write the factored form. Explain how you got your answer.
2. Find all the integers that you can put in the blank so that $x^2 + \_\_\_x + 16$ can be factored into a product of two binomials. For each case, write the factored form. Explain how you got your answer.
3. The graph of $xy = 36$ has two branches that do not connect. Sketch the graph and explain why the branches are not connected.
4. Explain, without graphing $x + y = 8$, how you know that it does not contain any points in the third quadrant.
5. A rack for displaying books in the library has eleven books on the bottom shelf and three on the top shelf. Each shelf will hold one more book than the one above it. What is the total number of books that the rack will hold?
6. What is the answer to problem 5 if there are T books on the top shelf and B on the bottom shelf?

For problems 7 through 9, you will need the Lab Gear and graph paper.

7. a. Find as many rectangles as possible that can be made using x^2, $10x$, and as many ones as you like. Write a *length* · *width* = *area* expression for each one.
   b. Which rectangle in part a is a square? Give its length, width, and area.
8. a. Find at least four parabolas of the form $y = x^2 + 10x + \_\_\_$ that have two x-intercepts. Graph each one and label its intercepts.
   b. Find a parabola of the form $y = x^2 + 10x + \_\_\_\_$ that has only one x-intercept.
9. How are your answers to problems 7b and 8b related? Explain.
10. Write without parentheses. Combine like terms.
    a. $6 - 8(x - 3)$
    b. $(6 - 8)(x - 3)$
    c. $(6x - 8)(x - 3)$
    d. $6x - 8(x - 3)$

Chapter 6 • Test

Name

1. On the same pair of axes, make an accurate graph of these four functions. Label each one with its equation.

   a. $y = -x$ b. $y = x + 5$
   c. $y = 2x + 1$ d. $y = 3(x - 1)$

2. On your graph, mark and label the point of intersection of $y = -x$ and $y = x + 5$.

3. Find the value of x that will satisfy each equation. Graphs may help you find or check the solutions.

   a. $-x = x + 5$ b. $2x + 1 = -x$
   c. $2x + 1 = 3(x - 1)$ d. $3x - 1 = -x$

4. Solve this compound inequality: $2x + 1 < -x < x + 5$. (Hint: It may help to refer to problems 1 and 3 above.)

5. Solve these inequalities. It may help to draw graphs.

   a. $2x < 7$ b. $x + 2 < 7$ c. $2x + 2 < 7$

6. Solve these equations.

   a. $\frac{2}{3}(x - 5) = 6$ b. $\frac{x - 2}{9} + 5 = 16$

   c. $\frac{2y - 5}{6} = \frac{5y + 2}{4}$ d. $(7 - d)(d + 3) = (5 - d)(d + 5)$

7. Solve for y in terms of x.

   a. $6x + 3y = 9$
   b. $6x - 3y = 8$

8. Joe's Pronto Pizza charges a certain amount for a plain cheese pizza and an additional amount for each topping. How much would you have to pay

   a. if the plain pizza cost \$10.95, toppings were \$1.50 each, and you ordered a pizza with three toppings?
   b. if the plain pizza cost \$10.95, toppings were \$$T$ each, and you ordered a pizza with three toppings?
   c. if the plain pizza cost \$$P$, toppings were \$$T$ each, and you ordered a pizza with n toppings?

9. The Statue of Liberty is about 111 feet 1 inch from her heel to the top of her head. Suppose the designer had used as his model a woman who was 5 feet 1 inch tall. If the woman had a thumb that was 2 inches long, about how long would you expect the thumb of the Statue of Liberty to be?

Chapter 6 • Additional Problems

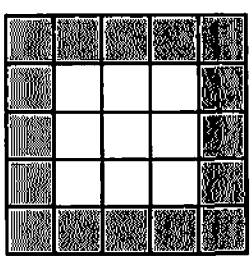
1. At the end of January, Janet was running R miles per day. She wanted to increase her daily distance by $\frac{1}{4}$ mile per month. For example, after 1 month (at the end of February), she would be running $R + \frac{1}{4}$ miles per day.
   a. If she continued this plan, how far would she be running by the end of May?
   b. When would her daily distance reach $R + 2$ miles?
   c. What would her daily distance be after M months? (Express your answer in terms of R.)
   d. After how many months would her daily distance be 12 miles? (Express your answer in terms of R.)
2. A man in Indiana calls his granddaughter in Iowa every weekend. He has a choice of two long distance telephone plans. The Family Circle Plan costs \$7.50 for the first hour of phone calls each month and \$0.15 per minute after that. The Square Deal Plan costs \$0.20 per minute for all calls. How much would he spend for n minutes of long distance calls per month:
   a. using the Family Circle Plan?
   b. using the Square Deal Plan?
3. Compare the Family Circle Plan and the Square Deal Plan in problem 2. Show the calculations you would make to decide which plan is better, and explain your conclusions.

Chapter 7 • Test

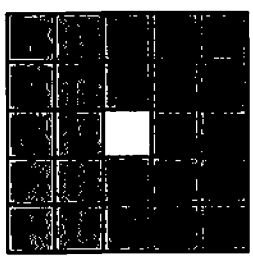
Name

1. Multiply. Combine like terms.
   a. $(2x + 6)(x - 4)$ b. $(x + y + z)(y - x)$
2. Find the square of each binomial.
   a. $ax + b$ b. $ax - b$ c. $b - ax$ d. $bx + a$
3. Find the middle term that will make this a perfect square trinomial. Then write it as the square of a binomial.
   a. $25b^2 +$ ____ $+ 64c^2$ b. $\frac{1}{16}x^2 +$ ____ $+ y^2$
4. Find the missing terms.
   a. $y^2 - b^2 =$ (_____)$(y + b)$ b. $(3y +$ ___$)^2 = 9y^2 +$ ____ $+ a^2$
5. Solve for x. There may be no solution, one solution, or more than one solution.
   a. $x^2 = 49$ b. $25x^2 = 4$
   c. $x^2 - 12x + 36 = 4$
6. Solve these compound inequalities. Graphs may help.
   a. $-3 < 2x + 5 < 6$ b. $3 < 2x + 5 < 5$
7. Factor these polynomials.
   a. $9x^2 - 16$ b. $16 - 9x^2$ c. $9x^2 - 24x + 16$
8. a. Explain why 10^2 is in scientific notation and 2^{10} is not.
   b. Write 2^{10} in scientific notation.

The B. A. Regal Company sells kits of tiles for building square patios of different sizes. They are made with square colored tiles, each tile measuring one foot on each side. Red tiles are used for the interior and blue tiles for a border that goes all the way around the patio. As shown in the figure, one design has a border one tile wide, and the other design has a border two tiles wide.



One-tile border



Two-tile border

9. Make a sketch of what an 8-foot-by-8-foot patio would look like if the border is:
   a. one tile wide
   b. two tiles wide
10. a. If an n-by-n patio has a border one tile wide, how many tiles of each color are used?
    b. Check your answers to part a by showing algebraically that the sum of the two expressions is n^2.
11. Repeat problem 10 for an n-by-n patio having a border two tiles wide.
12. The Galers ordered a kit for an n-by-n patio having a border one tile wide from the B. A. Regal Company. They changed their minds, and decided to make an $(n + 1)$-by-$(n + 1)$. How many additional tiles of each color will they need to increase the size of the patio? Explain your answer. Sketches may help.

Chapter 7 • Additional Problems

1. Use graphs to solve these inequalities.
   a. $x^2 < 25$
   b. $x^2 > 25$
   c. $-x^2 < -4$
   d. $-x^2 > -4$
   e. $16 < x^2 < 25$
   f. $3 < 5 - 2x < 5$
2. Find the area of the square having side:
   a. $3 + y$
   b. $\frac{x}{4}$
   c. $2x - 3$
   d. $4x$
3. Multiply. Combine like terms.
   a. $(x - 1 - y)(x - 1 + y)$
   b. $(3x + 6y - 2)(3x + 6y + 2)$
   c. $(a + b - c)(a + b - c)$
   d. $(a + b - c)(a - b + c)$
4. Find the missing terms.
   a. $(xy - \_\_\_)^2 = \_\_\_ - 2axy + \_\_\_$
   b. $a^2b^2 - \_\_\_ = (ab - c)(\_\_\_ + c)$
5. Factor. (Hint: First look for common factors.)
   a. $3x^2 - 75$
   b. $4x^2 + 40x + 100$
   c. $4x^2 - 40x + 100$
   d. $12xy^2 + 72xy + 108x$

Chapter 8 • Test

Name

1. Find the slope of the line joining each pair of points.
   a. (3, 2) and (4, -5)
   b. (2, 3) and (-5, 4)
   c. (3, 2) and (-5, 4)
   d. (2, 3) and (4, -5)

2. The points in the table lie on a line of the form $y = mx + b$.

x	y
-2	18
-1	13
0	8
3	-7

   a. Explain how you can tell by inspecting the table whether m is positive or negative.
   b. Find m and b for this line.

3. Possible or impossible? If possible, give an equation of the form $y = mx + b$ that fits the description. If it is impossible, explain.
   a. The line does not pass through the third quadrant, and both m and b are negative.
   b. The line does not pass through the third quadrant, and both m and b are positive.
   c. The line never crosses the y-axis.
   d. The line never crosses the x-axis.

4. Possible or impossible? If possible, give equations of a pair of lines that fit the description. If it is impossible, explain.
   a. The two lines intersect, and they have the same value of b.
   b. The two lines intersect, and they have the same value of m.

5. Write the equation of any line that does not intersect the line that passes through the points (-1.8, 3.4) and (3.2, 13.4). Explain your reasoning.

6. Give the equation of a line that satisfies the given conditions.
   a. It slopes uphill from left to right, has a smaller slope than the line $y = x$, and passes through the point (0, -4).
   b. It does not contain any points in the third quadrant and has a greater slope than $y = -x$.

7. Find the equation of the line that passes through the point:
   a. (3, -4) and never crosses the x-axis
   b. (5, -2) and never crosses the y-axis

8. A bacterial population weighs 20 grams and triples in weight every hour. How much does it weigh after
   a. 2 hours? b. x hours?

9. If possible, write as a power of 4.
   a. $2 \cdot 2^7$ b. $(2 \cdot 2)^5$ c. $2^3 \cdot 2^3$ d. $2^3 \cdot 2^4$

10. If possible, write as a power of 5. $25 \cdot 5^2 \cdot (5^5)^4 \cdot 2^0$

11. Simplify each ratio.
    a. $\frac{3y^4}{y^4}$ b. $\frac{(3y)^4}{y^4}$
    c. Explain why your answers to parts a and b are different.

12. Write in scientific notation.
    a. 60 million b. 60 millionths

13. Find the number or expression that makes each equation true. Write your answer as a power.
    a. $(6x)^4 = \_\_\_\_ \cdot x^4$ b. $(20xy)^5 = \_\_\_\_ \cdot (10xy)^5$

14. Simplify.
    a. $\frac{24 \cdot 10^{a+2}}{6 \cdot 10^a}$ b. $\frac{6 \cdot M^{b+3}}{24 \cdot M^b}$ c. $\frac{8 \cdot P^{c+4}}{2 \cdot P^c}$

15. Mr. A. B. Galer invested \$20,000 in an account that earned 5% compound interest every year. Ms. G. Balear invested \$22,000 per year in an account that earned 5.5% simple interest every year. They both left the interest in the account.
    a. What is the dollar amount that Ms. Balear earns in interest every year?
    b. Why does the dollar amount that Ms. Balear earns stay fixed, and why does the amount that Mr. Galer earns change?
    c. How will the amount of money in their accounts compare after two years? Five years? Show your computations.
    d. In how many years will Mr. Galer have more in his account than Ms. Balear?

16. Write as a power of 5. $\frac{5^{5+x}}{5^{5-x}}$.