Contents Include:

113 worksheets—
one for each lesson
To The Student:

This Extra Practice Workbook gives you additional examples and problems for the concept exercises in each lesson. The exercises are designed to aid your study of mathematics by reinforcing important mathematical skills needed to succeed in the everyday world. The material is organized by chapter and lesson, with one skills practice worksheet for every lesson in MathMatters 3.

To the Teacher:

Answers to each worksheet are found in MathMatters 3 Chapter Resource Masters.
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EXTRA PRACTICE 1-1
THE LANGUAGE OF MATHEMATICS

EXERCISES

Define each set using roster notation.
1. odd natural numbers greater than 10
2. weeks having 8 days
3. integers less than −3
4. \(\{x \mid x \text{ is a positive integer and } x > 4\}\)

Determine if each statement is true or false.
5. \(-2 \in \{x \mid x \text{ is a whole number}\}\)
6. \(\{4, 7, 9\} \subset \{1, 2, 3, \ldots\}\)
7. \(5 \in \{x \mid x \text{ is a natural number and } 3 \leq x < 5\}\)

Write all the subsets of each set.
8. \(\{3\}\)
9. \(\{-1, 0, 5\}\)
10. \(\{a, v\}\)

Which of the given values is a solution of the equation?
11. \(r - 4 = -3; -1, 1\)
12. \(9 + x = 4; -5, 13\)
13. \(a + 2 = -8; -10, -6\)
14. \(-2d = 14; -28, -7\)
15. \(\frac{m}{6} = 4; 2, 24\)
16. \(2w + 2 = 20; 9, 11\)
17. \(5 - 3z = -10; 5, 30, 45\)
18. \(\frac{2p}{5} = -4, -18, -10, 2\)

Use mental math to solve each equation.
19. \(h + 3 = 10\)
20. \(m - 2 = 6\)
21. \(7w = -21\)
22. \(\frac{h}{-5} = -2\)
23. \(4 + j = -2\)
24. \(8 - p = -7\)
**Real Numbers**

**Exercises**

Determine if each statement is true or false.

1. 8 is an irrational number. 
2. 5 is a real number. 
3. \( \sqrt{4} \) is not a natural number. 
4. \(-3.1235278...\) is an integer. 
5. \( \frac{6}{7} \) is a rational number. 
6. \( \pi \) is not a real number. 
7. All irrational numbers are real numbers. 
8. A natural number is a rational number. 
9. Some rational numbers are integers. 

Graph each set of numbers on a number line on your own paper.

10. \( \left\{ -2 \frac{1}{2}, -1, 0, \sqrt{5}, 4.75, 8 \frac{2}{3} \right\} \)
11. natural numbers less than 5
12. real numbers less than or equal to \(-2\)
13. real numbers greater than 8
14. whole numbers less than 9
15. integers greater than or equal to \(-4\)
16. integers from \(-5\) to 2 inclusive
17. real numbers from \(-7\) to \(-1\) inclusive

Evaluate each expression.

18. \( |w| \), when \( w = -3 \) 
19. \( |f| \), when \( f = -5 \) 
20. \( |- (m)| \), when \( m = 7 \) 
21. \( |-b| \), when \( b = 6 \) 
22. \( -(|-t|) \), when \( t = -2 \) 
23. \( |-(-y)| \), when \( y = -4 \) 

Replace each \( \_\_\_\_ \) with <, >, or =.

24. \( -(4) \text{} \_\_\_\_ \| -4 \| \) 
25. \( |-6| \text{} \_\_\_\_ \| -16 \| \) 
26. \( |-3| \text{} \_\_\_\_ \| -13 | \) 
27. \( |5| \text{} \_\_\_\_ \| -(5) \| \) 
28. \( |-7| \text{} \_\_\_\_ \| 2 | \) 
29. \( |8| \text{} \_\_\_\_ \| -(8) | \)

Use <, >, or = to write an inequality for each statement.

30. The low temperatures on Monday and Tuesday were \(-4^\circ F\) and \(10^\circ F\). 
31. Thad rushed for \(-3\) yards and \(6\) yards on the last two plays.
EXTRA PRACTICE 1-3

UNION AND INTERSECTION OF SETS

Refer to the diagram. Find the set named by listing the members.

1. \( A \cup B \)
2. \( A \cap B \)
3. \( A \cup C \)
4. \( A \cap C \)
5. \( B \cup C \)
6. \( B \cap C \)
7. \( (A \cup B) \cup C \)
8. \( (A \cap C) \cup B \)

Let \( U = \{0, 2, 4, 6, 8, 10, 12\} \), \( X = \{2, 4, 6, 8, 10\} \), \( Y = \{4, 6, 8\} \), and \( Z = \{2, 10\} \). Find each union or intersection.

9. \( X' \)
10. \( Y' \)
11. \( Z' \)
12. \( X \cup Y \)
13. \( Y \cap Z \)
14. \( (X \cup Y)' \)
15. \( X' \cup Y' \)
16. \( (X \cap Y)' \)
17. \( Y' \cap Z' \)
18. \( (X \cup Z)' \)
19. \( (X \cup Y) \cap Z \)
20. \( (X \cup Z) \cap Y \)

Use the replacement set of real numbers to find the solution set for each compound inequality. Graph the solution set on a number line on your own paper.

21. \( x < 2 \) and \( x > 5 \)
22. \( x \leq -2 \) or \( x \geq 2 \)
23. \( x \leq -4 \) or \( x \geq 1 \)
24. \( x \leq -3 \) and \( x > 1 \)
EXTRA PRACTICE 1-4

ADDITION, SUBTRACTION, AND ESTIMATION

**EXERCISES**

Add or subtract.

1. \(-3 + 14\) 
2. \(-7 + (-6.7)\)

3. \(3.245 - 8.18\) 
4. \(-2\frac{1}{3} + 1\frac{1}{2}\)

5. \(-10.6 - 7.2\) 
6. \(-23.1 - (-25.3)\)

7. \(\frac{43}{5} - \left(-\frac{7}{10}\right)\) 
8. \(-\frac{74}{9} - 2\frac{1}{6}\)

9. \(-14 + 18 - (-13) + 12\) 
10. \(-16 + 9 - 7 - 11\)

11. \(1.5 + 5.6 - 3.2 - (-2.1)\) 
12. \(-\frac{5}{6} + 2\frac{4}{9} - 3\frac{1}{2}\)

Evaluate each expression when \(m = 15\) and \(n = -12\).

13. \(m - n\) 
14. \(-m - n\) 
15. \(n - m\)

16. \(-m - (-n)\) 
17. \(-m + n\) 
18. \(-n - m\)

19. \(m + n\) 
20. \(m - (-n)\) 
21. \(-n + m\)

Replace each ___ with <, >, or =.

22. \(-15.3 + 3.5\) ___ \(12.6 - 9.6\) 
23. \(-90 - (-76)\) ___ \(23 - 50\)

24. \(-\frac{23}{4} - 6\frac{1}{2}\) ___ \(1\frac{1}{4} - 10\frac{1}{2}\) 
25. \(-6\frac{2}{3} - 2\frac{1}{6}\) ___ \(3\frac{1}{3} - 7\frac{5}{6}\)

26. Anna makes the following transactions to her checking account: previous balance, $654.89; deposit, $235.00; withdrawal, $146.50; check 1401, $56.89; deposit, $325.80. What is her new balance?

27. Ron has landscape timbers that are 4.5 ft, 5.6 ft, 8.3 ft, and 9.4 ft long. He wants to place the timbers end-to-end along the front of a flower bed that is 30 ft long. Will the timbers be long enough? If not, how much too short are they? If so, how much will he have left over?

28. The temperature at midnight on Saturday was 15°F. Between midnight and noon, the temperature then fell 4°, rose 1°, fell 8° and rose 3°. What was the temperature at noon on Saturday?
EXTRA PRACTICE 1-5
MULTIPLICATION AND DIVISION

EXERCISES

Perform the indicated operations.

1. \(6(-3)\) ________________
2. \(-14 \div 7\) ________________
3. \(-5(-8)\) ________________
4. \(-63 \div (-9)\) ________________
5. \(3(4.5)(-2.8)\) ________________
6. \(-100 \div (-2.5)\) ________________
7. \(-1\frac{1}{2} \div 2\frac{1}{4}\) ________________
8. \(\frac{1}{3}\left(-\frac{5}{6}\right)\left(\frac{3}{10}\right)\) ________________
9. \(8.5 + (-9)(-6.3)\) ________________
10. \(\frac{5\frac{9}{10}}{(-10)} + (-2)\) ________________
11. \(6.3 \div 0.2 - 5.6\) ________________
12. \(3[-2.2 + 3.2 \div (-0.8)]\) ________________
13. \((3.5 - 8.9)(-1.6)\) ________________
14. \((-3.7 - 4.1) \div (-0.2)\) ________________

Evaluate each expression when \(a = -4\), \(b = -2.2\), and \(c = \frac{4}{5}\).

15. \(ab\) ________________
16. \(bc\) ________________
17. \(b + ac\) ________________
18. \(ab + bc\) ________________
19. \(a(b + c)\) ________________
20. \(ab - c\) ________________
21. \((a + b) \div c\) ________________
22. \(c(a - b)\) ________________
23. \(a \div b + c\) ________________
24. \(b \div c + a\) ________________
25. \(\frac{a}{c} + b\) ________________
26. \(c - \frac{b}{a}\) ________________

27. On Sunday, the temperature dropped 24° in 6 hours. What was the average change in temperature per hour? ________________

28. Raul has $400 to spend on stereo equipment. He buys two speakers for $78.99 each and a receiver for $198.59. How much money does he have left? ________________

29. A plane descended an average of 200 feet per second for 15 seconds. How far had the plane descended at the end of the 15 seconds? ________________

30. At noon, the temperature was 59°. The temperature rose an average of 2° per hour for the next 6 hours. What was the temperature at 6:00 P.M.? ________________
EXTRA PRACTICE 1-6

PROBLEM SOLVING SKILLS: USE TECHNOLOGY

A spreadsheet is a tool for working with and analyzing numerical data. The data is entered into a table in which each row is numbered and each column is labeled by a letter. You can use a spreadsheet to find solutions of open sentences.

Example

Use a spreadsheet to find the solution set for $4(x - 3) < 31$ if the replacement set is \{7, 8, 9, 10, 11, 12\}.

You can solve the open sentence by replacing $x$ with each value in the replacement set.

Step 1 Use the first column of the spreadsheet for the replacement set. Enter the numbers using the formula bar. Click on a cell of the spreadsheet, type the number, and press ENTER.

Step 2 The second column contains the formula for the left side of the open sentence. To enter a formula, enter an equals sign followed by the formula. Use the name of the cell containing each replacement value to evaluate the formula for that value. For example, in cell B2, the formula contains A2 in place of $x$.

Step 3 The third column determines whether the open sentence is true or false for the value in the replacement set. These formulas will return TRUE or FALSE.

The solution set contains the values for which the open sentence is true. The solution set is \{7, 8, 9, 10\}.

EXERCISES

Use a spreadsheet to find the solution of each equation or inequality using the given replacement set.

1. $x - 7.5 = 18.3; \{8.8, 9.8, 10.8, 11.8\}$

2. $6(x + 2) = 18; \{0, 1, 2, 3, 4, 5\}$

3. $4x + 1 = 17; \{0, 1, 2, 3, 4, 5\}$

4. $4.9 - x > 2.2; \{2.6, 2.7, 2.8, 2.9, 3.0\}$

5. $2.7x > 18; \{6.1, 6.3, 6.5, 6.7, 6.9\}$

6. $12x - 8 < 22; \{2.1, 2.2, 2.3, 2.4, 2.5, 2.6\}$
EXTRA PRACTICE 1-7
DISTRIBUTIVE PROPERTY AND PROPERTIES OF EXPONENTS

EXERCISES

Use the distributive property to find each product.

1. \(12 \cdot 8 + 12 \cdot 2\)  
2. \(19 \cdot 24\)
3. \(4.5 \cdot 12 - 4.5 \cdot 2\)
4. \(26 \cdot 78\)
5. \(18(2\frac{1}{2})\)
6. \(54(10\frac{5}{9})\)
7. \(1.6 \cdot 12\)
8. \(\frac{4}{7} \cdot 3 + \frac{4}{7} \cdot 4\)

Evaluate each expression when \(x = -4\) and \(y = 5\).

9. \(x^2\)
10. \(y^2\)
11. \(x^2 - y^2\)
12. \(x^3\)
13. \(y^3\)
14. \(xy^2\)
15. \(-x^2y\)
16. \((-xy)^2\)
17. \((3 - y)^2\)
18. \((x^2 + 3)^2\)

Simplify.

19. \(3^2 \cdot 3^5\)
20. \(a^6 \cdot a^3\)
21. \(\frac{m^7}{m^4}, m \neq 0\)
22. \((t^3)^5\)
23. \(q^4 \cdot q^9\)
24. \(\left(\frac{2}{d}\right)^4, d \neq 0\)
25. \((w^4)^3\)
26. \((k^3)(k^4)(k^6)\)
27. \((g^4g^6)^3\)
28. \((-3p^6p^2)^2\)

Evaluate mentally each sum or product when \(r = 2.5\), \(s = 0\), and \(t = 3\). Use the properties of mathematics as needed.

29. \(rst\)
30. \(-2r^2s^2t^2\)
31. \((3.5 + r)(2t) + s\)
32. \(\frac{s^2}{rt^2}\)
33. \(s(12r + 2t)\)
34. \(r(s + t)\)
EXTRA PRACTICE 1-8
EXponents AND ScienTiFiC Notation

Exercises

Simplify.

1. \((-3)^{-2}\) 
   
2. \((-1)^{-10}\) 
   
3. \(2^{-4}\) 
   
4. \(d^{-3}\) 
   
5. \(w^4 \div w^8\) 
   
6. \(m^{-10} \div m^{-3}\) 
   
7. \(y^{-3} \div y^{-6}\) 
   
8. \(r^{-5} \cdot r^{-4}\) 
   
9. \((k^4)^{-2}\) 
   
10. \((t^{-3})^6\) 
    
11. \((h^{-6})^{-4}\) 
    
12. \(c^4 \div c^{-5}\) 
    
Evaluate each expression when \(n = 3\) and \(m = -2\).

13. \(n^{-3}\) 
    
14. \(m^{-2}\) 
    
15. \((mn)^{-2}\) 
    
16. \(m^2n^{-2}\) 
    
17. \(m^{-4}n^2\) 
    
18. \(m^0n^{-3}n^0\) 
    
19. \(m^4m^{-5}n^{-2}\) 
    
20. \(m^4n^{-5}n^2\) 
    
21. \((m^{-2}n^{-2})^{-3}\) 
    
22. \((m^3n^{-4})^0\) 
    
Write each number in scientific notation.

23. 8500 
    
24. 0.00098 
    
25. 455,000 
    
26. 67,920,000 
    
27. 0.00000764 
    
28. 0.00000703 
    
29. 2,000,000 
    
30. 0.0000008 
    
Write each number in standard form.

31. \(4.9 \cdot 10^{-3}\) 
    
32. \(6.2 \cdot 10^7\) 
    
33. \(8.94 \cdot 10^{-5}\) 
    
34. \(9.18 \cdot 10^{-6}\) 
    
35. \(6.7321 \cdot 10^6\) 
    
36. \(1.954 \cdot 10^3\) 
    
37. \(9 \cdot 10^{-9}\) 
    
38. \(2 \cdot 10^8\)
EXTRA PRACTICE  2-1

PATTERNS AND ITERATION

EXERCISES

Identify the rule relating each term. Find the next three terms in each sequence.

1. 4, 6, 8, 10, ______, ______, ______
   rule: ________________

2. 1, 3, 7, 13, 21, ______, ______, ______
   rule: ________________

3. 200, 190, 180, 170, ______, ______, ______
   rule: ________________

4. –16, –13, –10, –7, ______, ______, ______
   rule: ________________

5. 4, 8, 16, 32, ______, ______, ______
   rule: ________________

6. 9, 6, 3, 0, ______, ______, ______
   rule: ________________

7. 8, –24, 72, –216, ______, ______, ______
   rule: ________________

8. 15, 14, 12, 9, ______, ______, ______
   rule: ________________

9. 4, 2, 1, \( \frac{1}{2} \), ______, ______, ______
   rule: ________________

10. 2, 1.5, 1, 0.5, ______, ______, ______
    rule: ________________

11. 6, 0, –6, –12, ______, ______, ______
    rule: ________________

12. –4, 16, –64, 256, ______, ______, ______
    rule: ________________

13. 4, –1, \( \frac{1}{4} \), \( \frac{-1}{16} \), ______, ______, ______
    rule: ________________

14. 6, 12, 18, 24, ______, ______, ______
    rule: ________________

15. 8, –4, 2, –1, ______, ______, ______
    rule: ________________

16. Start with 4. Use the rule “subtract 2” six times. _______________________________

17. Start with 100. Use the rule “add 25” six times.
    _______________________________

18. Start with 30. Use the rule “multiply by –2” six times.
    _______________________________

19. Start with 500. Use the rule “divide by 5” six times. _______________________________
EXTRA PRACTICE 2-2
THE COORDINATE PLANE, RELATIONS, AND FUNCTIONS

EXERCISES

Graph each point on the coordinate plane at the right.

1. A(2, 4)  2. B(−3, 5)  3. C(6, 0)
4. D(0, −3)  5. E(7, −6)  6. F(1, −1)
7. G(−2, 3)  8. H(−6, −5)  9. I(−3, −4)

Give \( f(x) = 3x - 2 \), evaluate each function.

10. \( f(-1) \)  11. \( f(3) \)  12. \( f(0) \)
13. \( f(-3) \)  14. \( f\left(\frac{1}{3}\right) \)  15. \( f(5) \)

Determine if each relation is a function. Give the domain and range.

16. 

17. 

18. 

19. 

Given \( f(x) = -x + 4 \), \( g(x) = 5x - 3 \), and \( h(x) = 2x^2 \), find each value.

20. \( f(4) \)  21. \( g(2) \)
22. \( h(-1) \)  23. \( f(-3) \)
EXTRA PRACTICE 2-3
LINEAR FUNCTIONS

EXERCISES

Graph each function.

1. \( y = x + 2 \)

2. \( y = -3x \)

3. \( y - 2 = -x + 1 \)

4. \( 2y = -4x + 2 \)

5. \( y = |x - 1| \)

6. \( y = \begin{cases} 2 & \text{for } x < -2 \\ -x - 1 & \text{for } x \geq -2 \end{cases} \)

Evaluate \( f(x) = | -2x - 1 | \) for the given value of \( x \).

7. \( f(-2) \) ______________________

8. \( f(0) \) ______________________

9. \( f(1) \) ______________________

10. \( f(-4) \) ______________________
EXTRA PRACTICE 2-4
SOLVE ONE-STEP EQUATIONS

EXERCISES

Solve each equation.

1. \( n + 13 = 24 \)  
2. \( 35 - b = 19 \)
3. \( 5r = -45 \)  
4. \( -12 = q - 3 \)
5. \( 15j = 30 \)  
6. \( 0.4h = 1.6 \)
7. \( 14 = \left( -\frac{7}{8} \right) x \)  
8. \( \left( \frac{5}{9} \right) d = 20 \)
9. \( 6.32 = t - 4.16 \)  
10. \( \frac{3}{4} = f + \frac{1}{2} \)

Translate each sentence into an equation using \( n \) to represent the unknown number. Then solve the equation for \( n \).

11. When a number is decreased by 13, the result is \(-2\).
12. Twelve more than a number is the product of \(-3\) and 6.
13. One-fourth of a number is the same as the square of \(-3\).
14. Sixteen is the same as the quotient of a number and 12.
15. Increasing a number by 14 yields the same result as taking one-half of 40.
16. The quotient of a number and \(-2\) is the same as the sum of \(-4\) and 10.

Solve each equation.

17. \( (-1)(-4)(5) = 20d \)  
18. \( |14 - 22| = 4y \)
19. \( 2^2 + v = 3^2 \)  
20. \( (1.5)(10) = f - 13 + 7 \)
21. \( 15 + 4 - s = (-3)(-2) \)  
22. \( 0.02g = (0.5)(4.2) \)

Find all solutions in each equation.

23. \( |x| + 4 = 12 \)  
24. \( -16 = -2 |q| \)
25. \( |p| - 5 = 10 \)  
26. \( 8 - |r| = -2 \)
EXTRA PRACTICE 2-5

SOLVE MULTI-STEP EQUATIONS

EXERCISES

Solve each equation and check the solution.

1. \(2c + 3 = 15\)  
2. \(-3s + 4 = -2\)
3. \(-14 = 4d + 6\)  
4. \(19 = 25 - 3w\)
5. \(2(b + 3) = 2\)  
6. \(5y + 3 = 2y + 12\)
7. \(5 - 2x = x - 19\)  
8. \(7t - 5 + 3t = 15\)
9. \(2 - 3(m + 4) = 2\)  
10. \(1 - 6r = -4 - 3r\)
11. \(\frac{1}{3}(6p - 12) = 5\)  
12. \(4(0.5 - w) = -18\)

Translate each sentence into an equation. Then solve.

13. Six more than twice a number is 16. Find the number.  
14. Four times a number decreased by 12 is 8. Find the number.  
15. When 15 is decreased by three times a number, the result is 21. Find the number.

16. Eight more than five times a number is the same as one less than eight times the number. Find the number.

17. When the sum of twice a number and 2 is multiplied by 3, the result is the same as 4 times the sum of the number and 4. Find the number.

Solve each equation and check the solutions.

18. \(-3(r + 5) = 3(r - 1)\)
19. \(\frac{1}{2}(4m + 8) = \frac{1}{3}(3m - 3)\)
20. \(6(2 - 3x) + 8 = 2 - 9x\)
21. \(3 - 10k = -3(5k + 2) - 4k\)

22. Juan bought 4 T-shirts and a leather jacket. The T-shirts were all the same price, and the price of the leather jacket was 6 times the cost of one T-shirt. If the total cost of the T-shirts and the leather jacket was $209.00, what was the price of each T-shirt?
Solve linear inequalities

**Exercises**

Solve each inequality and graph the solution on a number line. Use your own paper.

1. \(2d + 1 \geq 13\)  
2. \(8 - 3r < -4\)

3. \(14 \leq 5a + 4\)  
4. \(-5k - 3 > 12\)

5. \(-10 - 6z \leq 20\)  
6. \(6r - 4 < -10\)

7. \(\frac{1}{2}q + 4 > 1\)  
8. \(5 - 2k \leq -19\)

9. \(5n - 6 \leq 12 - n\)  
10. \(8 - z > 2z - 10\)

Graph each inequality on the coordinate plane. Use your own paper.

11. \(y < 2x\)  
12. \(y \leq 5\)  
13. \(x \leq -1\)

14. \(y \geq x + 3\)  
15. \(y \leq -x - 2\)  
16. \(x - y < 4\)

17. \(x \leq 2y - 6\)  
18. \(9 < 6x - 3y\)  
19. \(4x + 2y \leq 10\)

20. \(y < \frac{3}{4}x + 1\)  
21. \(2x + \left(\frac{2}{3}\right)y \leq 4\)  
22. \(8 < 5x - 3y\)

23. Five times some number \(n\) decreased by 3 is greater than 7. What values are possible for \(n\)?

24. Twelve less than four times some number \(n\) is at least three more than the number. What values are possible for \(n\)?

25. Six minus twice a number \(n\) is less than or equal to the opposite of one-half the number. What values are possible for \(n\)?

Solve each inequality and graph the solution on a number line. Use your own paper.

26. \(0.6m - 8.3 \geq 0.9 - 91.4m\)

27. \(4 - (r + 3) \leq 3(2r - 13) - 2\)

28. \(3(2a + 5) - 6a < 2(3 - 3a)\)

29. \(4(2b - 1) > 4b + 3(b + 2) - 7\)
EXTRA PRACTICE 2-7
DATA AND MEASURES OF CENTRAL TENDENCY

EXERCISES

Twenty students were randomly sampled and surveyed as to the number of hours per week they study. The results are shown below.

\[
\begin{array}{cccccccccccc}
5 & 6 & 5 & 2 & 4 & 6 & 3 & 2 & 1 & 5 \\
4 & 4 & 6 & 3 & 3 & 5 & 2 & 1 & 6 & 4
\end{array}
\]

1. Construct a frequency table for these data.

2. Find the mean, median, and mode of the data.

The number of hours worked in one week by employees at The Print Shop are listed below.

\[
\begin{array}{cccccccccccc}
25 & 36 & 18 & 43 & 40 & 38 & 39 & 40 & 16 \\
20 & 24 & 29 & 30 & 45 & 42 & 19 & 20 & 28
\end{array}
\]

3. Construct a frequency table for these data. Group the data into intervals.

4. Which interval contains the median of the data?
EXTRA PRACTICE 2-8
DISPLAYING DATA

EXERCISES

The ages of instructors at a health club are listed below.

24  28  29  35  37  22  48  56  42  47
20  66  43  40  19  18  25  29  30  32

1. Construct a stem-and-leaf plot to display the data.

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

2. Identify any outliers, clusters, and gaps in the data.

3. Find the mode of the data. ____________

4. Find the median of the data. ____________

5. Find the mean of the data. ____________

Refer to the histogram for Exercises 6–9.

6. How many players scored 15 points or fewer?

7. What percent of the players scored between 11 and 25 points?

8. Which interval contains the median number of points scored?

9. Is it possible to identify the mean of the data? Explain.
EXTRA PRACTICE  2-9

MISLEADING STATISTICS

EXERCISES

For Exercises 1–3, refer to the graphs below.

1. What was the U.S. consumption of hydroelectric power in 1990? ________________

2. Which graph gives the impression that the use of hydroelectric power in the United States has experienced many dips as well as rises between 1975 and 1999? ________

3. What causes the graphs to differ in their appearance? __________________________

For Exercises 4–6, refer to the graphs below.

4. What was the world’s population in 1999? ____________________________

5. Which graph gives the impression that the world’s population skyrocketed between 1800 and 1925? Explain. ____________________________

6. Are the vertical axis and the horizontal axis in either graph misleading? Explain. ____________________________
EXTRA PRACTICE 3-1
POINTS, LINES, AND PLANES

Exercises

Use the figure at the right for Exercises 1–5. Which postulate justifies your answer?

1. Name two points that determine line \( k \).

2. Name three points that determine plane \( X \).

3. Name three points that determine plane \( Y \).

4. Name the intersection of planes \( X \) and \( Y \).

5. Name three lines that line in plane \( Y \).

Use the number line below for Exercises 6–13. Find each length.

6. \( AD \) _______  
7. \( CE \) _______  
8. \( DG \) _______  
9. \( FB \) _______

10. \( DC \) _______  
11. \( BE \) _______  
12. \( CF \) _______  
13. \( EA \) _______

14. In the figure at the right, \( RT = 52 \). Find \( RS \).

15. In the figure at the right, \( AC = 86 \). Find \( BC \).

16. On a number line, the coordinate of point \( Q \) is \(-6\). The length of \( PQ \) is 15. Give two possible coordinates for point \( P \).
**EXTRA PRACTICE 3-2**

**TYPES OF ANGLES**

**EXERCISES**

Refer to the figure at the right for Exercises 1–8. Use a protractor to find the measure of each angle. Then classify each angle as acute, right, or obtuse.

1. $\angle BFA$
2. $\angle CFA$
3. $\angle EFD$
4. $\angle DFB$
5. $\angle EFB$
6. $\angle DFC$
7. $\angle EFC$
8. $\angle CFB$

In the figure at the right, $m\angle PQN = (3x)°$ and $m\angle NQM = (4x + 5)°$. Find the measure of each angle.

9. $\angle PQN$
10. $\angle NQM$

In the figure at the right, $m\angle ADB = (7x + 2)°$ and $m\angle CDB = (3x - 2)°$. Find the measure of each angle.

11. $\angle ADB$
12. $\angle CDB$

13. The measure of $\angle XYZ$ is 46° more than the measure of its supplement. Find $m\angle XYZ$.

14. The measure of $\angle RST$ is 6° less than three times the measure of its complement. Find $m\angle RST$. 
EXTRA PRACTICE 3-3
SEGMENTS AND ANGLES

EXERCISES

For Exercises 1–7 refer to the figure below.

![Number line with points A to P and coordinates -7 to 7]

1. Name the midpoint of FN. ________________________________
2. Find the midpoint of DL. ________________________________
3. Find the midpoint of GM. ________________________________
4. Name all the segments whose midpoint is point M. ____________
5. Name all the segments whose midpoint is point D. ____________
6. Assume that point X is the midpoint of GL. What is its coordinate? ____________
7. Assume that point Y is the midpoint of CH. What is its coordinate? ____________

In the figure at the right, ML, NK, and PJ intersect at point H, HK bisects LHJ, KN bisects PHM, and \( m\angle PHL = 136^\circ \). Find the measure of each angle.

8. \( \angle LHJ \) ________________________________
9. \( \angle MHJ \) ________________________________
10. \( \angle PHM \) ________________________________
11. \( \angle LHK \) ________________________________
12. \( \angle PHN \) ________________________________
13. \( \angle NHM \) ________________________________

In the figure at the right, point N is the midpoint of PH. Find the length of each segment.

14. \( PN \) ________________________________
15. \( NH \) ________________________________
16. \( HJ \) ________________________________
17. \( PJ \) ________________________________
EXTRA PRACTICE 3-4
CONSTRUCTION AND LINES

EXERCISES

1. Trace $\overline{PM}$ onto a sheet of paper. Using a compass and straightedge, divide it into four segments of equal length. Use a ruler to check the accuracy of your construction.

2. Trace $\angle JKL$ onto a sheet of paper. Using a compass and a straightedge, divide $\angle JKL$ into four angles of equal measure. Use a protractor to check the accuracy of your construction.

In the figure at the right, $\overrightarrow{BE} \perp \overrightarrow{GD}$ and $m \angle CAD = 60^\circ$.

3. $\angle BAC$  
4. $\angle GAF$  
5. $\angle EAF$  
6. $\angle DAE$  
7. $\angle GAB$  
8. $\angle FAD$

Find the measure of each angle if $m \angle 2 = 68^\circ$.

9. $\angle 6$  
10. $\angle 8$  
11. $\angle 4$  
12. $\angle 1$  
13. $\angle 5$  
14. $\angle 3$  
15. $\angle 7$
EXTRA PRACTICE 3-5
INDUCTIVE REASONING IN MATHEMATICS

EXERCISES

Draw the next figure in each pattern on your own paper. Then describe the tenth figure in each pattern.

1. 

2. 

3. 

Create a geometric pattern for each number pattern. Use your own paper.

4. 2, 4, 6, 8, ...

5. 1, 5, 9, 13, ...

6. 2, 5, 9, 14, ...
EXTRA PRACTICE 3-6

CONDITIONAL STATEMENTS

EXERCISES

Sketch a counterexample that shows why each conditional is false. Use your own paper.

1. If point $A$ is the midpoint of $\overrightarrow{CD}$, then $\overrightarrow{CA} \perp \overrightarrow{DA}$.

2. If $\overrightarrow{XY}$ and $\overrightarrow{XZ}$ are opposite rays, then point $X$ is the midpoint of $\overrightarrow{YZ}$.

3. If $\angle RST$ and $\angle TSV$ are congruent, then $\overrightarrow{ST}$ bisects $\angle RSV$.

Write the converse of each statement. Then tell whether the given statement and its converse are true or false.

4. If points $A$, $B$, and $C$ are collinear, then $B$ is the midpoint of $\overline{AC}$. 

5. If point $X$ is the vertex of $\angle 1$ and $\angle 2$, then $\angle 1$ and $\angle 2$ are adjacent angles.

6. If two angles are complementary, then both of the angles are acute.

7. If two lines intersect, then they are parallel.

8. If an angle is obtuse, then its supplement is acute.

Write each definition as two conditionals and as a single biconditional.

9. Coplanar points are points that lie in the same plane.

10. A segment is a part of a line that begins at one endpoint and ends at another.
EXTRA PRACTICE 3-7
DEDUCTIVE REASONING AND PROOFS

EXERCISES

Complete each proof.

1. Given: $s \parallel t$
   Prove: $m \angle 1 = m \angle 7$

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. $s \parallel t$</td>
<td>1. __________________________</td>
</tr>
<tr>
<td>2. $m \angle 1 = m \angle 5$</td>
<td>2. __________________________</td>
</tr>
<tr>
<td>3. $m \angle 5 = m \angle 7$</td>
<td>3. __________________________</td>
</tr>
<tr>
<td>4. __________________________</td>
<td>4. Transitive Property of Equality</td>
</tr>
</tbody>
</table>

2. Given: $m \angle 1 = m \angle 2; m \angle 2 = 45^\circ$
   Prove: $\angle 1$ is complementary to $\angle 2$.

<table>
<thead>
<tr>
<th>Statements</th>
<th>Reasons</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. __________________________</td>
<td>1. given</td>
</tr>
<tr>
<td>2. $m \angle 1 = 45^\circ$</td>
<td>2. __________________________</td>
</tr>
<tr>
<td>3. $m \angle 1 + m \angle 2 = 45^\circ + 45^\circ$</td>
<td>3. __________________________</td>
</tr>
<tr>
<td>4. __________________________</td>
<td>4. addition</td>
</tr>
<tr>
<td>5. $\angle 1$ is complementary to $\angle 2$.</td>
<td>5. __________________________</td>
</tr>
</tbody>
</table>
EXTRA PRACTICE 3-8

LOGIC PROBLEMS

The following problems can be solved by eliminating possibilities. It may be helpful to use charts such as the one shown in the first problem. Mark an X in the chart to eliminate a possible answer.

EXERCISES

1. Nancy, Olivia, Mario, and Kenji each have one piece of fruit in their school lunch. They have a peach, an orange, a banana, and an apple. Mario does not have a peach or a banana. Olivia and Mario just came from class with the student who has an apple. Kenji and Nancy are sitting next to the student who has a banana. Nancy does not have a peach. Which student has each piece of fruit?

<table>
<thead>
<tr>
<th></th>
<th>Nancy</th>
<th>Olivia</th>
<th>Mario</th>
<th>Kenji</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peach</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Orange</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apple</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

3. Mr. Guthrie, Mrs. Hakoi, Mr. Mirza, and Mrs. Riva have jobs of doctor, accountant, teacher, and office manager. Mr. Mirza lives near the doctor and the teacher. Mrs. Riva is not the doctor or the office manager. Mrs. Hakoi is not the accountant or the office manager. Mr. Guthrie went to lunch with the doctor. Mrs. Riva’s son is a high school student and is only seven years younger than his algebra teacher. Which person has each occupation?

4. Yvette, Lana, Boris, and Scott each have a dog. The breeds are collie, beagle, poodle, and terrier. Yvette and Boris walked to the library with the student who has a collie. Boris does not have a poodle or terrier. Scott does not have a collie. Yvette is in math class with the student who has a terrier. Which student has each breed of dog?

2. Victor, Leon, Kasha, and Sheri each play one instrument. They play the viola, clarinet, trumpet, and flute. Sheri does not play the flute. Kasha lives near the student who plays flute and the one who plays trumpet. Leon does not play a brass or wind instrument. Which student plays each instrument?
EXTRA PRACTICE  4-1

TRIANGLES AND TRIANGLE THEOREM

EXERCISES

Find the value of $x$ in each figure.

1. 

2. 

3. 

4. In the figure at the right, $\overrightarrow{AB} \parallel \overrightarrow{CD}$.
   Find $m\angle ACD$. ________________

5. In the figure at the right, $\overrightarrow{NM} \perp \overrightarrow{PM}$.
   Find $m\angle MNP$. ________________

6. In $\triangle RST$, $m\angle R$ is 20° more than two times $m\angle S$, and $m\angle S = m\angle T$. Find the measure of each angle. ________________

7. The measure of the smallest angle of a triangle is 34° less than the measure of the largest angle of the triangle. The measure of the third angle is 14° more than the measure of the smallest angle. Find all three measures. ________________

8. $A(-2, -2), B(0, 4), C(2, -2)$

9. $R(-5, 1), S(-2, 3), T(6, 0)$
EXTRA PRACTICE 4-2
CONGRUENT TRIANGLES

EXERCISES

Write a two-column proof.

1. Given: $MN \cong QP$, $\angle MNP \cong \angle QPN$
   Prove: $\triangle MNP \cong \triangle QPN$

   \begin{tabular}{|l|l|}
   \hline
   STATEMENTS & REASONS \\
   \hline
   \hline
   \hline
   \hline
   \hline
   \end{tabular}

2. Given: $AB \perp BD$, $ED \perp BD$, $BA \cong DE$, $\angle A \cong \angle E$
   Prove: $\triangle ABC \cong \triangle EDC$

   \begin{tabular}{|l|l|}
   \hline
   STATEMENTS & REASONS \\
   \hline
   \hline
   \hline
   \hline
   \hline
   \end{tabular}

3. Given: $YX \cong WZ$, $XW \cong ZY$
   Prove: $\triangle YXW \cong \triangle WZY$

   \begin{tabular}{|l|l|}
   \hline
   STATEMENTS & REASONS \\
   \hline
   \hline
   \hline
   \hline
   \hline
   \end{tabular}
EXTRA PRACTICE 4-3
CONGRUENT TRIANGLES AND PROOFS

EXERCISES

Find the value of \( x \) in each figure.

1. \[
\begin{align*}
\triangle & \quad 6 \text{ ft} \quad x^\circ \quad 6 \text{ ft} \\
& \quad 6 \text{ ft}
\end{align*}
\]

2. \[
\begin{align*}
\triangle & \quad x \text{ m} \quad 13 \text{ m} \quad 50^\circ \quad 50^\circ \\
& \quad 17 \text{ m}
\end{align*}
\]

3. \[
\begin{align*}
\triangle & \quad x \text{ in.} \quad 8 \text{ in.} \quad 45^\circ \quad 45^\circ \\
\end{align*}
\]

Complete each proof.

4. Given: \( \overline{RS} \parallel \overline{UT}, \overline{RU} \parallel \overline{ST} \)
Prove: \( \overline{RS} \cong \overline{TU} \)

<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>REASONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \overline{SRT} \cong \overline{UTR}; \overline{STR} \cong \overline{URT} )</td>
<td>1. ( \overline{SRT} \cong \overline{UTR}; \overline{STR} \cong \overline{URT} )</td>
</tr>
<tr>
<td>2. ( \overline{RT} \cong \overline{TR} )</td>
<td>2. ( \overline{RT} \cong \overline{TR} )</td>
</tr>
<tr>
<td>3. ( \overline{S} \equiv \overline{T} )</td>
<td>3. ASA Postulate</td>
</tr>
<tr>
<td>4. ( \overline{RS} \equiv \overline{TU} )</td>
<td>4. ( \overline{RS} \equiv \overline{TU} )</td>
</tr>
</tbody>
</table>

5. Given: \( \overline{XZ} \perp \overline{WY} \); Point \( Z \) is the midpoint of \( \overline{WY} \).
Prove: \( \angle W \equiv \angle Y \)

<table>
<thead>
<tr>
<th>STATEMENTS</th>
<th>REASONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ( \overline{XZ} \perp \overline{WY} ) ( Z ) is the midpoint of ( \overline{WY} )</td>
<td>1. ( \overline{XZ} \perp \overline{WY} ) ( Z ) is the midpoint of ( \overline{WY} )</td>
</tr>
<tr>
<td>( \overline{WZ} \equiv \overline{YZ} )</td>
<td>2. definition of perpendicular</td>
</tr>
<tr>
<td>3. ( \overline{WZ} \equiv \overline{YZ} )</td>
<td>3. Reflexive Property</td>
</tr>
<tr>
<td>4. ( \triangle XZW \cong \triangle XZY )</td>
<td>4. Reflexive Property</td>
</tr>
<tr>
<td>5. ( \angle W \equiv \angle Y )</td>
<td>5. ( \angle W \equiv \angle Y )</td>
</tr>
<tr>
<td>6. ( \angle W \equiv \angle Y )</td>
<td>6. ( \angle W \equiv \angle Y )</td>
</tr>
</tbody>
</table>
EXTRA PRACTICE 4-4
ALTITUDES, MEDIANS, AND PERPENDICULAR BISECTORS

1. Sketch all the altitudes.
2. Sketch all the medians.

Exercises 3–9 refer to \( \triangle ACD \), at the right.
If you know that \( \overline{DB} \) is the perpendicular bisector of \( \overline{AC} \), tell whether each statement is true or false.

3. \( \overline{AD} \equiv \overline{CD} \)
4. \( \angle A \equiv \angle C \)
5. \( \angle ABD \equiv \angle CBD \)
6. \( \overline{AB} \equiv \overline{CB} \)
7. \( \overline{DB} \) is an altitude of \( \triangle ACD \).
8. \( \overline{AC} \) is a median of \( \triangle ACD \).
9. \( \triangle ABD \equiv \triangle CBD \)

Exercises 10–18 refer to \( \triangle LNP \), at the right.
If you know that \( M \) is the midpoint of \( \overline{LN} \) tell whether each statement is true or false.

10. \( \overline{LM} \equiv \overline{NM} \)
11. \( \angle L \equiv \angle N \)
12. \( \angle LMP \equiv \angle NMP \)
13. \( \overline{LP} \equiv \overline{NP} \)
14. \( \overline{PM} \perp \overline{LN} \)
15. \( \angle MLP \equiv \angle MNP \)
16. \( \overline{MP} \) is an altitude of \( \triangle LNP \).
17. \( \overline{MP} \) is a median of \( \triangle LNP \).
18. \( \triangle LMP \equiv \triangle NMP \)
EXTRA PRACTICE  4-5

INDIRECT PROOF

EXERCISES

Write the assumption you would make to start an indirect proof of each statement.

1. **BD** bisects **∠ABC**.

2. **RT = TS**

PROOF  Write an indirect proof.

3. **Given:** \(-4x + 2 < -10\)
   **Prove:** \(x > 3\)

4. **Given:** \(m\angle 2 + m\angle 3 \neq 180\)
   **Prove:** \(a \parallel b\)

5. **PHYSICS**  Sound travels through air at about 344 meters per second when the temperature is 20°C. If Enrique lives 2 kilometers from the fire station and it takes 5 seconds for the sound of the fire station siren to reach him, how can you prove indirectly that it is not 20°C when Enrique hears the siren?
EXTRA PRACTICE 4-6
INEQUALITIES IN TRIANGLES

EXERCISES

Can the given measures be the lengths of the sides of a triangle?

1. 4 cm, 5 cm, 6 cm
2. 9.1 m, 5.6 m, 7.5 m
3. 15 in., 24 in., 19 in.
4. 8 cm, 12 mm, 4 cm
5. $\frac{5}{4}$ in., 9 in., $12\frac{1}{8}$ in.
6. 3.5 yd, 3.5 yd, 3.5 yd
7. 4 ft, 3 yd, 6 ft
8. 5 m, 0.5 km, 3 m

Which is the longest side of each triangle? the shortest?

9.

10.

11.

In each figure, give the range of possible values for $x$.

12.

13.

14.

List all the segments in each figure in order from longest to shortest.

15.

16.
EXTRA PRACTICE 4-7
POLYGONS AND ANGLES

EXERCISES

Find the unknown angle measure in each figure.

1. \[ \begin{array}{c}
\text{85°} \\
\text{129°} \\
\text{112°}
\end{array} \]

2. \[ \begin{array}{c}
\text{z°} \\
\text{z°} \\
\text{z°} \]

3. \[ \begin{array}{c}
\text{136°} \\
\text{136°} \\
\text{(m – 16)°} \\
\text{(m – 16)°} \\
\text{m°} \\
\text{m°}
\end{array} \]

4. \[ \begin{array}{c}
\text{61°} \\
\text{48°}
\end{array} \]

5. Find the measure of each interior angle of a regular decagon. ________________

6. Find the sum of the measures of the interior angles of a regular polygon with 20 sides. ________________

7. Find the sum of the measures of the exterior angles of a regular heptagon. ________

8. Find the measure of each exterior angle of a regular polygon with 30 sides. ________

9. Find the measure of each interior angle of a regular polygon with 24 sides. ________

10. Find the sum of the measures of the interior angles of a regular polygon with 30 sides. ________________

Find the number of sides of each regular polygon.

11. The measure of each exterior angle is 4°. ____________________________

12. The sum of the measures of the interior angles is 6120°. __________________

13. The measure of each interior angle is 160°. ____________________________

14. The sum of the measures of the interior angles is 2520°. __________________

15. The measure of each interior angle is 170°. ____________________________

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EXTRA PRACTICE 4-8
SPECIAL QUADRILATERALS: PARALLELOGRAMS

EXERCISES

In Exercises 1–4, \(ABCD\) is a parallelogram. Find the values of \(x\), \(y\), \(z\), and \(w\).

1. \hspace{1cm}

2. \hspace{1cm}

3. \hspace{1cm}

4. \hspace{1cm}

Tell whether each statement is true or false.

5. All parallelograms are rectangles. ______________________________

6. No rectangles are squares. ______________________________

Do you think that the given figure is a parallelogram? Write yes or no. Explain.

7. ______________________________

8. ______________________________
EXTRA PRACTICE  4-9
SPECIAL QUADRILATERALS: TRAPEZIODES

EXERCISES

A trapezoid and its median are shown. Find the value of $x$.

1. \[ \text{12 cm} \quad \text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{\text{x cm}} \quad \text{10.6 cm}}}}}}}}}}}}}}}}}} \]

2. \[ \text{x in.} \quad \text{8 in.} \quad \text{13 in.} \]

3. \[ \text{x ft} \quad \text{70 ft} \quad \text{42 ft} \]

4. \[ \text{x m} \quad \text{9.6 m} \quad \text{2x m} \]

The given figure is a trapezoid. Find all the unknown angle measures.

5. \[ \text{X} \quad \text{Y} \quad \text{W} \quad \text{Z} \quad \text{80°} \]

6. \[ \text{M} \quad \text{N} \quad \text{(5x + 5)°} \quad \text{(6x - 15)°} \]
EXTRA PRACTICE 5-1
RATIO AND UNITS OF MEASURE

EXERCISES

Complete.
1. 5 qt = ______________________ c
2. 38 in. = _____ ft _____ in.
3. 5 kg = ______________________ g
4. 2.5 T = ______________________ lb
5. 40 m = ______________________ mm
6. 8 gal = ______________________ oz
7. 0.005 mL = ______________________ kL
8. 15 yd = ______________________ ft
9. 70 oz = ________ c ________ oz
10. 1300 cm = ______________________ km

Name the best customary unit for expressing the measure of each.
11. height of a flag pole ____________
12. capacity of a large bucket ____________

Name the best metric unit for expressing the measure of each.
13. mass of a pen ________________
14. length of a driveway ________________

Write each ratio in lowest terms.
15. 16 mg : 48 mg ______________________
16. 16 in. to 3 ft ______________________
17. \( \frac{4 \text{ h}}{45 \text{ min}} \) ______________________
18. 8 km to 500 m ______________________

Find each unit rate.
19. $52 for 8 hours of work ______________________
20. 32 minutes to run 4 miles ______________________
21. $10.71 for 9 gallons of gas ______________________

Solve.
22. Which is a better buy, 5 apples for $2.10, or 7 apples for $3.01? ________________
23. Which is a better buy, 8 oz of bottled water for $0.72, or 12 oz of bottled water for $0.96? ________________

Choose the best estimate for each.
24. weight of a dog a. 15 oz b. 15 lb c. 15 T ________________
25. height of a door a. 8 in. b. 8 ft c. 8 mi ________________
EXTRA PRACTICE 5-2
PERIMETER, CIRCUMFERENCE, AND AREA

EXERCISES

Find the perimeter or circumference of each. Then find the area of each. If necessary, round answers to the nearest whole number.

1. Find the area of the shaded region of each figure.

3. 3.8 m 4.7 ft
   3.8 m
   3.8 m

2. 4.7 ft 3.2 ft
   2.5 ft
   2.5 ft

3. 9 in.

4. 15 ft

5. What is the perimeter of a regular pentagon with 8-ft sides? ________________

6. What is the perimeter of a regular hexagon with 3.5-cm sides? ________________

7. What is the circumference to the nearest in. of a circle with a diameter of 9.5 in.? ________________

8. Find the height of a triangle if area = 54 ft² and base = 9 ft. ________________

9. Find the base of a triangle if area = 97.5 m² and height = 13 m. ________________
EXTRA PRACTICE 5-3
PROBABILITY AND AREA

EXERCISES

A standard deck of playing cards has 52 cards. A card is drawn at random from a shuffled deck. Find each probability.

1. \( P(\text{ace}) \)  
2. \( P(\text{club}) \)

3. \( P(\text{red 2}) \)  
4. \( P(\text{face card}) \)

Find the probability that a point selected at random in each figure is in the shaded region.

5. 

6. 

7. 

8. 

9. 

10.
EXTRA PRACTICE 5-4
AREAS OF IRREGULAR FIGURES

EXERCISES

Find the area of each figure. Round to the nearest tenth if necessary.

1. 

2. 

3. 

4. 

5. 

6. 

LANDSCAPING For Exercises 7 and 8, use the following information.
One of the displays at a botanical garden is a koi pond with a walkway around it. The figure shows the dimensions of the pond and the walkway.

7. Find the area of the pond to the nearest tenth.

8. Find the area of the walkway to the nearest tenth.
EXTRA PRACTICE  5-5
THREE-DIMENSIONAL FIGURES AND LOCI

EXERCISES

Name the polyhedra shown below. Then state the number of faces, vertices, and edges each has.

1. cube

2. right rectangular prism

3. triangular prism

4. triangular pyramid

5. square pyramid

6. pentagonal prism

7. sphere

8. oblique cylinder

9. hexagonal pyramid

10. oblique rectangular prism

Draw the figure.

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EXTRA PRACTICE 5-6
SURFACE AREA OF THREE-DIMENSIONAL FIGURES

EXERCISES
Find the surface area of each figure. Assume that all pyramids are regular pyramids. Use \( \pi = 3.14 \). Round answers to the nearest whole number.

1. 
   \[ \begin{array}{c}
   \text{8 in.} \\
   \text{4 in.} \\
   \text{6 in.}
   \end{array} \]

2. 
   \[ \begin{array}{c}
   \text{19 m} \\
   \text{6 m}
   \end{array} \]

3. 
   \[ \begin{array}{c}
   \text{14 ft} \\
   \text{18 ft}
   \end{array} \]

4. 
   \[ \begin{array}{c}
   \text{5 m} \\
   \text{3.5 m}
   \end{array} \]

5. 
   \[ \begin{array}{c}
   \text{5 in.} \\
   \text{5 in.}
   \end{array} \]

6. 
   \[ \begin{array}{c}
   \text{8 cm} \\
   \text{16 cm} \\
   \text{6 cm}
   \end{array} \]

7. What is the surface area of a ball with a diameter of about 15 cm? ______________

8. What is the surface area of a square pyramid whose base length is 8 ft and whose faces have heights of 12 ft? ________________________________

9. What is the surface area of a box with a height of 5 in., a length of 8 in. and a width of 4 in.? ________________________________

10. What is the surface area of a cube if each edge has length 3.5 ft? ______________

11. Can you find the surface area of a cylinder if all you know is its radius? Explain.
EXTRA PRACTICE 5-7
VOLUME OF THREE-DIMENSIONAL FIGURES

EXERCISES

Find the volume to the nearest whole number. Use 3.14 for \( \pi \).

1. \( \text{Volume of a cube: } a^3 = 5^3 = 125 \) cubic ft

2. \( \text{Volume of a cylinder: } \pi r^2 h = 3.14 \times (6^2 \times 12) = 1130.4 \) cubic in.

3. \( \text{Volume of a cone: } \frac{1}{3} \pi r^2 h = \frac{1}{3} \times 3.14 \times (5^2 \times 15) = 392.5 \) cubic cm

4. \( \text{Volume of a pyramid: } \frac{1}{3} \times (12 \times 16) \times 14 = 1120 \) cubic m

5. How many cubic meters of water can a water tank hold, if the tank is a cylinder 10 m high and 12 m in diameter?

6. A rectangular prism has a volume of 382.5 in.\(^3\) and a base area of 45 in.\(^2\). What is the height of the prism?

7. A sphere has a radius of 4 m. What is the volume of the sphere?

8. A cylinder with a diameter of 8 in. and a height of 5 in. fits completely inside a rectangular box with a height of 5 in., a length of 10 in., and a width of 8 in. What is the volume of the box outside of the cylinder?

9. What happens to the volume of a rectangular prism if its height is doubled?

10. A container is made by placing a triangular pyramid with a base area of 12 cm\(^2\) and a height of 8 cm on top of a rectangular prism with a height of 6 cm, a length of 8 cm, and a width of 4 cm. What is the volume of the container?
EXTRA PRACTICE 6-1
SLOPE OF A LINE AND SLOPE-INTERCEPT FORM

EXERCISES

Find the slope of each line.

1. 

2. 

3. 

4. 

Find the slope of the line containing the given points.

5. A(−2, 2) and B(0, 4) 

6. R(5, −1) and S(2, 3) 

7. M(4, −8) and N(6, −1) 

8. F(−5, 5) and G(−1, 6) 

Find the slope and y-intercept for each line.

9. y = 2x + 1 

10. −4x + y = 2 

11. y = −1 

12. 3x − 3y = 6 

Write an equation of the line with the given slope and y-intercept.

13. m = −1, b = 3 

14. m = 4, b = −2 

Graph each equation on your own paper.

15. −x + y = 1 

16. y = −2x − 5 

17. 4x − 2y = −4
EXTRA PRACTICE 6-2
PARALLEL AND PERPENDICULAR LINES

EXERCISES
Find the slope of a line parallel to the given line and a line perpendicular to the given line.

1. The line containing (2, −4) and (5, 1).

2. The line containing (0, 3) and (−2, −6).

3. $5x − 5y = 10$

4. $−2x + y = 2$

5. $y = \frac{3}{4}x − 2$

Determine whether each pair of lines is parallel, perpendicular or neither.

6. The line containing points $X(8, −3)$ and $Y(−4, −6)$.

   The line containing points $R(1, 4)$ and $S(3, −3)$.

7. The line containing points $A(2, −1)$ and $B(3, −4)$.

   The line containing points $C(1, 6)$ and $D(3, 0)$.

8. $y = 2x + 1$

   $2y = −x − 1$

9. $4x − y = 2$

   $8x − 2y = −6$

10. Plot and connect the points $X(−2, 1)$, $Y(−1, −1)$ and $Z(3, 1)$ on your own paper.

    Determine if $XYZ$ is a right triangle.

11. Plot and connect the points $A(−4, 3)$, $B(1, 4)$, $C(2, 0)$ and $D(−3, −1)$ on your own paper.

    Determine if $ABCD$ is a rectangle.

Determine the value of $x$ so that the line containing the given points is parallel to another line whose slope is also given.

12. $A(x, 5)$ and $B(−4, 3)$

    slope = $−1$

13. $R(3, −5)$ and $S(1, x)$

    slope = $−\frac{1}{2}$

Determine the value of $y$ so that the line containing the given points is perpendicular to another line whose slope is also given.

14. $A(4, y)$ and $B(−2, 6)$

    slope = $2$

15. $R(2, −4)$ and $S(y, 8)$

    slope = $1$
EXTRA PRACTICE  6-3
WRITE EQUATIONS FOR LINES

EXERCISES

Write an equation of the line with the given slope and y-intercept.
1. \(m = -2, b = 4\) 
2. \(m = -\frac{2}{5}, b = 1\) 
3. \(m = -5, b = -2\) 
4. \(m = 1, b = \frac{3}{4}\)

Write an equation of the line with the given information.
5. \(m = 0, C(-1, 4)\) 
6. \(m = \frac{1}{3}, W\left(\frac{1}{2}, 2\right)\) 
7. \(m\) is undefined, \(T(5, -6)\) 
8. \(m = -4, S\left(\frac{3}{5}, -\frac{1}{5}\right)\) 
9. \(A(3, -1) \text{ and } B(2, 4)\) 
10. \(M(-6, 4) \text{ and } N(0, -5)\) 
11. \(R(6, -1) \text{ and } S(-3, 0)\) 
12. \(F(1, -8) \text{ and } G(3, 2)\)

Write an equation of the line with the given information.
13. \(y = \frac{3}{2}x + 1\) 
14. \(y = \frac{1}{2}x + 2\)

15. Parallel to \(x + y = 4\) and passes through \(M(3, 2)\).
16. Parallel to \(5x - 2y = -3\) and passes through \(Q(-4, 0)\).
17. Perpendicular to \(3x - y = 1\) and passes through \(R(-1, 1)\).
18. Perpendicular to \(4y = 2x + 3\) and has \(y\)-intercept \(-4\).
19. Parallel to the line through points \(J(4, -2) \text{ and } K(0, 1)\) and has \(y\)-intercept 2.
20. Perpendicular to the line \(2y = 6 - 2x\) and has \(x\)-intercept \(-1\).
EXTRA PRACTICE 6-4
SYSTEMS OF EQUATIONS

EXERCISES

Determine the solution of each system of equations.

1.

\[ \begin{align*}
4x - y &= 5 \\
2x + y &= 7
\end{align*} \]

Solve each system of equations by graphing. Use your own paper.

3. \[ \begin{align*}
4x - y &= 5 \\
2x + y &= 7
\end{align*} \]

4. \[ \begin{align*}
x + y &= -2 \\
x &= y - 2
\end{align*} \]

5. \[ \begin{align*}
y &= 5x + 2 \\
x &= 6 - 3y
\end{align*} \]

6. \[ \begin{align*}
\frac{x}{2} + \frac{y}{3} &= 1 \\
y &= \frac{x}{4} - 4
\end{align*} \]

7. \[ \begin{align*}
3x + 2y &= 4 \\
y &= 2x + 9
\end{align*} \]

8. \[ \begin{align*}
x &= y - 6 \\
\frac{x}{2} + \frac{y}{2} &= -3
\end{align*} \]

9. The sum of two numbers is 2. Their difference is 10. Find the numbers.

10. One number is three times another number. The difference of the two numbers is 2. Find the numbers.

Determine the number of solutions for each system. Do not graph.

11. \[ \begin{align*}
2x - y &= -4 \\
3x - y &= 1
\end{align*} \]

12. \[ \begin{align*}
3x + 6y &= 12 \\
x + 2y &= 10
\end{align*} \]

13. \[ \begin{align*}
8x + 6y &= 10 \\
3y &= 5 - 4x
\end{align*} \]

14. \[ \begin{align*}
12x + 4y &= 1 \\
3x + y &= 0
\end{align*} \]
EXTRA PRACTICE 6-5
SOLVE SYSTEMS BY SUBSTITUTION

**EXERCISES**

Solve and check each system of equations by the substitution method.

1. \[
\begin{align*}
4x + y &= -2 \\
2x &= -y
\end{align*}
\]

2. \[
\begin{align*}
2x - y &= 3 \\
2y &= x - 3
\end{align*}
\]

3. \[
\begin{align*}
4x + y &= 0 \\
x - y &= 10
\end{align*}
\]

4. \[
\begin{align*}
4x &= 2y \\
x + 2 &= y
\end{align*}
\]

5. \[
\begin{align*}
2x - 3y &= -2 \\
4x + y &= 3
\end{align*}
\]

6. \[
\begin{align*}
y + 4 &= 2x \\
\frac{x}{2} + \frac{y}{2} &= -2
\end{align*}
\]

7. \[
\begin{align*}
x - 2y &= -2 \\
3x - 5y &= -7
\end{align*}
\]

8. \[
\begin{align*}
3x + 8y &= 3 \\
x + 4y &= 2
\end{align*}
\]

9. \[
\begin{align*}
3x - 2y &= -2 \\
5x + y &= -12
\end{align*}
\]

10. \[
\begin{align*}
-2y - 6x &= 6 \\
x + y &= 3
\end{align*}
\]

11. \[
\begin{align*}
x + y &= -1 \\
3x + 2y &= 2
\end{align*}
\]

12. \[
\begin{align*}
2x + y &= 7 \\
x - 2y &= -14
\end{align*}
\]

13. \[
\begin{align*}
x &= y - 2 \\
3x - 4y &= -13
\end{align*}
\]

14. \[
\begin{align*}
2x + 5y &= -3 \\
x + 8y &= 4
\end{align*}
\]

15. Ryan has 10 coins consisting of dimes and nickels worth $0.70. How many dimes and how many nickels does he have?

16. Brooke spent $94.92 at the music store. She bought some cassette tapes for $9.99 each and some CDs for $12.99 each. How many cassette tapes and how many CDs did she buy if she bought 8 all together?

17. Hannah jogs and walks for 48 minutes everyday. She spends 3 times as many minutes jogging as she does walking. How many minutes does she jog each day, and how many minutes does she walk?

18. Trevor spent $48.50 on 13 pounds of steaks and ground beef for his cookout. The steaks cost $6.50 a pound and the ground beef cost $2.50 a pound. How much steak and how much ground beef did Trevor buy?
EXTRA PRACTICE 6-6

SOLVE SYSTEMS BY ADDING, SUBTRACTING, AND MULTIPLYING

EXERCISES

Solve each system of equations. Check the solutions.

1. \[ \begin{aligned} -x + 5y &= 8 \\
               x - y &= 4 \end{aligned} \]

2. \[ \begin{aligned} x + 2y &= -2 \\
               3x - 2y &= -14 \end{aligned} \]

3. \[ \begin{aligned} 2x - 3y &= -1 \\
               -2x + 4y &= 4 \end{aligned} \]

4. \[ \begin{aligned} 3x + 2y &= -4 \\
               x - 2y &= 4 \end{aligned} \]

5. \[ \begin{aligned} x - 3y &= -3 \\
               y &= 3x - 1 \end{aligned} \]

6. \[ \begin{aligned} 3y + 2 &= 2x \\
               x + y &= 1 \end{aligned} \]

7. \[ \begin{aligned} 4x + y &= -1 \\
               x - 2y &= 3 \end{aligned} \]

8. \[ \begin{aligned} 5x + 2y &= 1 \\
               x - 4y &= 2 \end{aligned} \]

9. \[ \begin{aligned} 4x - y &= -10 \\
               x + 2y &= 20 \end{aligned} \]

10. \[ \begin{aligned} 3x - 5y &= 2 \\
               2y &= x - 3 \end{aligned} \]

11. \[ \begin{aligned} x + y &= 7 \\
               2x + 3y &= 22 \end{aligned} \]

12. \[ \begin{aligned} 2y &= 1 - x \\
               2x - y &= 4 \end{aligned} \]

13. \[ \begin{aligned} 3x &= 3y + 1 \\
               2x - 6y &= 4 \end{aligned} \]

14. \[ \begin{aligned} 2x + 5y &= 2 \\
               4x + y &= 4 \end{aligned} \]

15. \[ \begin{aligned} \frac{x}{2} - \frac{y}{2} &= -3 \\
               -x + 2y &= 8 \end{aligned} \]

16. \[ \begin{aligned} 4x + 2 &= 3y + 5 \\
               2y - 1 &= x + 2 \end{aligned} \]

17. \[ \begin{aligned} -\frac{x}{3} - \frac{3}{4}y &= 4 \\
               \frac{2}{3}x + \frac{y}{8} &= 3 \end{aligned} \]

18. \[ \begin{aligned} \frac{2}{5}x + \frac{5}{6}y &= 6 \\
               \frac{y}{3} &= x + 9 \end{aligned} \]

19. Mika paid $68 for 14 movie tickets. Some of the tickets were adult tickets, and some were student tickets. Each adult ticket cost $6 and each student ticket cost $4. How many adult tickets and how many student tickets did she buy?
EXTRA PRACTICE  6-7

DETERMINANTS

EXERCISES

Find the value of each determinant.

1. \[
\begin{vmatrix}
1 & 6 \\
2 & 7
\end{vmatrix}
\]

2. \[
\begin{vmatrix}
9 & 6 \\
3 & 2
\end{vmatrix}
\]

3. \[
\begin{vmatrix}
-2 & -5 \\
-4 & 1
\end{vmatrix}
\]

4. \[
\begin{vmatrix}
-14 & -3 \\
2 & -2
\end{vmatrix}
\]

5. \[
\begin{vmatrix}
-12 & 4 \\
-3 & 4
\end{vmatrix}
\]

6. \[
\begin{vmatrix}
2 & -5 \\
\frac{3}{5} & -11
\end{vmatrix}
\]

7. \[
\begin{vmatrix}
4 & 0 \\
-2 & 9
\end{vmatrix}
\]

8. \[
\begin{vmatrix}
3 & -4 \\
7 & 9
\end{vmatrix}
\]

9. \[
\begin{vmatrix}
-1 & -11 \\
10 & -2
\end{vmatrix}
\]

10. \[
\begin{vmatrix}
3.75 & -4 \\
5 & 2
\end{vmatrix}
\]

11. \[
\begin{vmatrix}
2 & -1 \\
3 & -9.5
\end{vmatrix}
\]

12. \[
\begin{vmatrix}
0.5 & -0.7 \\
0.4 & -0.3
\end{vmatrix}
\]

Evaluate each determinant using expansion by minors.

13. \[
\begin{vmatrix}
-2 & 3 & -1 \\
0 & 4 & -3 \\
2 & 5 & -1
\end{vmatrix}
\]

14. \[
\begin{vmatrix}
2 & -4 & 1 \\
3 & 0 & 9 \\
-1 & 5 & 7
\end{vmatrix}
\]

15. \[
\begin{vmatrix}
2 & 1 & -1 \\
1 & -1 & -2
\end{vmatrix}
\]

16. \[
\begin{vmatrix}
0 & -4 & 0 \\
2 & -1 & 1 \\
3 & -2 & 5
\end{vmatrix}
\]

17. \[
\begin{vmatrix}
2 & 7 & -6 \\
8 & 4 & 0 \\
1 & 1 & 3
\end{vmatrix}
\]

18. \[
\begin{vmatrix}
-12 & 0 & 3 \\
7 & 5 & -1 \\
4 & 2 & -6
\end{vmatrix}
\]

Evaluate each determinant using diagonals.

19. \[
\begin{vmatrix}
-4 & 3 & -1 \\
2 & 1 & -2 \\
4 & 1 & -4
\end{vmatrix}
\]

20. \[
\begin{vmatrix}
2 & 2 & 3 \\
1 & 1 & 1 \\
3 & 1 & 1
\end{vmatrix}
\]

21. \[
\begin{vmatrix}
1 & -4 & -1 \\
1 & 6 & -2 \\
2 & 3 & 1
\end{vmatrix}
\]

22. \[
\begin{vmatrix}
1 & 2 & -4 \\
4 & -6 & 3 \\
2 & 3 & 3
\end{vmatrix}
\]

23. \[
\begin{vmatrix}
2 & -1 & -2 \\
4 & 0 & -2 \\
0 & 3 & 2
\end{vmatrix}
\]

24. \[
\begin{vmatrix}
2 & 1 & 3 \\
1 & 8 & 0 \\
0 & 5 & -1
\end{vmatrix}
\]

25. GEOMETRY  Find the area of a triangle whose vertices have coordinates (3, 5), (6, -5), and (-4, 10).

26. LAND MANAGEMENT  A fish and wildlife management organization uses a GIS (geographic information system) to store and analyze data for the parcels of land it manages. All of the parcels are mapped on a grid in which 1 unit represents 1 acre. If the coordinates of the corners of a parcel are (-8, 10), (6, 17), and (2, -4), how many acres is the parcel?
EXTRA PRACTICE 6-8
SYSTEMS OF INEQUALITIES

EXERCISES
Determine whether the given ordered pair is a solution to the given system of inequalities.

1. \((1, 2); \begin{cases} x + y \leq 1 \\ x - y > 2 \end{cases} \quad 2x + 2y \leq 2\)

3. \((-3, -2); x + 4y \geq 4\)

Write a system of linear inequalities for the given graph.

5. \[
\begin{array}{c}
\text{Graph 1} \\
\text{Graph 2}
\end{array}
\]

6. \[
\begin{array}{c}
\text{Graph 3} \\
\text{Graph 4}
\end{array}
\]

Graph the solution set of the system of linear inequalities. Use your own paper.

7. \[
\begin{cases} y > 1 \\ x \leq 3 \\
x + y > 1 \\ x \leq 0 \\
x + y \leq 0 \\ 4x - y > 0 \\
x + 4 \leq 2 \\ x - 2y > 4 \\ y \geq 0 \\ x > 2 \\ y \geq x - 3
\end{cases}
\]

8. \[
\begin{cases} x + y > 2 \\ x - y < 1 \\
x > y \\ x - 2y < 2 \\
x - 3y > 6 \\ x + y \leq 4 \\
x - 3 > y \\ y \leq 4 \\
x \geq y \\ x < 2 \\ y \geq 0
\end{cases}
\]
EXTRA PRACTICE 6-9
LINEAR PROGRAMMING

EXERCISES

Graph the solution set of the system of inequalities. Use your own paper. Determine the maximum or minimum value of $P$.

1. \[
\begin{align*}
    x + y &\leq 3 \\
    y &\leq 3 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
maximum $P = 3x + y$ 

2. \[
\begin{align*}
    2x + y &\leq 4 \\
    x + 2y &\geq 2 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
maximum $P = 4x - y$ 

3. \[
\begin{align*}
    x + 2y &\geq 8 \\
    y &\leq 1 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
minimum $P = x + 2y$ 

4. \[
\begin{align*}
    x + 3y &\geq 6 \\
    4x + 3y &\leq 12 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
minimum $P = x + 3y$ 

5. \[
\begin{align*}
    2x + 2y &\leq 6 \\
    x + y &\geq 2 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
maximum $P = 4x + y$ 

6. \[
\begin{align*}
    x - y &\leq 4 \\
    x + y &\leq 4 \\
    y &\geq 0
\end{align*}
\]
maximum $P = 4x + y$ 

7. \[
\begin{align*}
    x + y &\leq 6 \\
    y &\leq 4 \\
    x &\leq 3 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
minimum $P = 2x + 2y$ 

8. \[
\begin{align*}
    -x - y &\geq -10 \\
    y &\leq 8 \\
    x &\leq 6 \\
    x &\geq 0 \\
    y &\geq 0
\end{align*}
\]
maximum $P = 6x + y$ 

9. \[
\begin{align*}
    2x + y &\leq 4 \\
    x + y &\geq 2 \\
    y &\geq 0 \\
    x &\geq 0
\end{align*}
\]
maximum $P = 2x - 2y$ 

10. \[
\begin{align*}
    4x - 2y &\geq 8 \\
    x - y &\leq 4 \\
    x &\leq 5 \\
    y &\geq 0
\end{align*}
\]
minimum $P = 3x + 2y$
EXTRA PRACTICE 7-1
RATIOS AND PROPORTIONS

EXERCISES

Is each pair of ratios equivalent? Write yes or no.

1. 2 : 8, 5 : 10  ____________________________
2. 14 to 28, 16 to 30  ____________________________
3. 8/12, 12/18  ____________________________
4. 1/2 : 3/4, 24 : 36  ____________________________

Solve each proportion.

5. \( \frac{9}{15} = \frac{x}{10} \)  ____________________________
6. \( \frac{c}{14} = \frac{6}{21} \)  ____________________________
7. \( \frac{16}{r} = \frac{10}{20} \)  ____________________________
8. \( \frac{0.2}{1.5} = \frac{2}{d} \)  ____________________________
9. \( \frac{24}{32} = \frac{v}{3} \)  ____________________________
10. \( \frac{14}{m} = \frac{28}{48} \)  ____________________________
11. \( \frac{2x}{6} = \frac{4x + 8}{15} \)  ____________________________
12. \( \frac{x + 1}{10} = \frac{x - 3}{2} \)  ____________________________
13. \( \frac{4x}{18} = \frac{x + 6}{36} \)  ____________________________

Use a calculator to solve these proportions.

14. \( \frac{180}{450} = \frac{x}{440} \)  ____________________________
15. \( \frac{204}{272} = \frac{225}{x} \)  ____________________________
16. \( \frac{159}{x} = \frac{183}{427} \)  ____________________________

17. A recipe for muffins calls for 2 cups of flour for each 1.5 cups of sugar. How much sugar should be used if 8 cups of flour are used?  ________________

18. Maria is holding a garage sale. She is selling her old cassette tapes for $2 for 8 tapes. How much will 20 tapes cost?  ________________

19. Franco uses 2 teaspoons of fertilizer for each gallon of water. How many gallons can he make with 15 teaspoons of fertilizer?  ________________

20. The areas of two rectangles are in the proportion 3 : 4. If the area of the larger rectangle is 64 in.\(^2\), what is the area of the smaller rectangle?  ________________

Arrange the given terms to form a proportion. Supply the missing term.

21. 3, 5, 8  ________________
22. 81, 3, 9  ________________
23. 6, 15, 4  ________________
24. 42, 24, 36  ________________
EXTRA PRACTICE  7-2
SIMILAR POLYGONS

**EXERCISES**

Determine if the polygons are similar.

1.  
   \[
   \begin{array}{c}
   \text{4 in.} \\
   \text{8 in.} \quad \text{113°} \\
   \text{5 in.} \quad \text{30°}
   \end{array}
   \quad
   \begin{array}{c}
   \text{6 in.} \\
   \text{12 in.} \\
   \text{7.5 in.} \quad \text{113°}
   \end{array}
   

2.  
   \[
   \begin{array}{c}
   \text{8 cm} \\
   \text{6 cm}
   \end{array}
   \quad
   \begin{array}{c}
   \text{5 cm} \quad \text{7 cm}
   \end{array}
   

Find the measure of \(x\) in each pair of similar figures.

3.  
   \[
   \begin{array}{c}
   \text{8 cm} \quad \text{10 cm} \\
   \text{12 cm} \quad x \text{ cm}
   \end{array}
   

4.  
   \[
   \begin{array}{c}
   \text{80°} \\
   \text{76°}
   \end{array}
   \quad
   \begin{array}{c}
   \text{76°} \\
   x°
   \end{array}
   

5.  
   \[
   \begin{array}{c}
   \text{106°} \\
   \text{25°}
   \end{array}
   

6.  
   \[
   \begin{array}{c}
   \text{9 m} \quad x \text{ m} \\
   \text{12 m} \quad 14 \text{ m}
   \end{array}
   

Identify the similar figures.

7.  
   \[
   \begin{array}{c}
   \text{9 cm} \\
   \text{11 cm} \quad \text{11 cm}
   \end{array}
   \quad
   \begin{array}{c}
   \text{7.5 cm} \\
   \text{15 cm} \quad \text{11 cm}
   \end{array}
   

8.  
   \[
   \begin{array}{c}
   \text{2} \\
   \text{3}
   \end{array}
   \quad
   \begin{array}{c}
   \text{2} \\
   \text{3}
   \end{array}
   

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EXTRA PRACTICE  7-3

SCALE DRAWINGS

EXERCISES

Find the actual length of each of the following.

1. scale length is 5 cm
   scale is 2.5 cm : 4 m

2. scale distance is 3.5 cm
   scale is 1 cm : 100 km

3. scale length is 10 in.
   scale is 1: 50

4. scale distance is 4.5 in.
   scale is 2 in. : 25 ft

5. scale length is 4.6 cm
   scale is 1 : 600

6. scale distance is 6.8 cm
   scale is 1 cm : 50 km

Find the scale length of each of the following.

7. actual length is 20 km
   scale is 2 cm : 10 km

8. actual distance is 60 m
   scale is 2 cm : 15 m

9. actual length is 36 ft
   scale is 3 in. : 24 ft

10. actual distance is 64 mi
    scale is 1 in. : 10 mi

11. actual length is 25 in.
    scale is 1 : 50

12. actual distance is 150 cm
    scale is 1 : 100

13. Laren has a map with a scale of 2 in. : 25 mi. There are 16 inches on the map between Laren’s home and her aunt’s home. If she can drive an average of 50 miles per hour, how long will it take Laren to get from her home to her aunt’s home? __________

14. The floorplan of a house is drawn to a scale of 1 in. : 5 ft. The actual dimensions of the family room are 20 feet by 24 feet. What are the dimensions of the family room on the floorplan? __________

15. The distance from the front to the back of a model bicycle is 3 centimeters. What is the actual distance on the bicycle if the scale is 1 : 100? __________

16. The distance between two cities on a map is 5 cm. What is the actual distance between the cities if the scale is 1 cm : 50 km? __________
EXTRA PRACTICE  7-4
POSTULATES FOR SIMILAR TRIANGLES

EXERCISES

Determine whether each pair of triangles is similar. If the triangles are similar, give a reason: write AA, SSS, or SAS.

1. 2.

3. 4.

5. In $\triangle ACB$, $\overline{CD} \perp AB$. Can you prove that $\triangle ADC \sim \triangle CDB$? Explain.

6. Suppose $\angle X \cong \angle W$. Can you prove that $\triangle XYZ \sim \triangle WVZ$? Explain.

Tell whether each statement is always true, sometimes true or never true. Write always, sometimes, or never.

7. Two right triangles are similar. _____________________________

8. An obtuse triangle and an acute triangles are similar. _____________________________
**EXTRA PRACTICE 7-5**

**TRIANGLES AND PROPORTIONAL SEGMENTS**

**EXERCISES**

Find $x$ in each pair of similar triangles to the nearest tenth.

1. \[ \triangle S \]

\[
\begin{array}{c}
8
\end{array}
\]

\[
\begin{array}{c}
4.5
\end{array}
\]

\[
\begin{array}{c}
6
\end{array}
\]

\[
\begin{array}{c}
x
\end{array}
\]

2. \[ \triangle V \]

\[
\begin{array}{c}
7
\end{array}
\]

\[
\begin{array}{c}
10
\end{array}
\]

\[
\begin{array}{c}
x
\end{array}
\]

3. \[ \triangle R \]

\[
\begin{array}{c}
14
\end{array}
\]

\[
\begin{array}{c}
8
\end{array}
\]

\[
\begin{array}{c}
x
\end{array}
\]

4. \[ \triangle T \]

\[
\begin{array}{c}
6
\end{array}
\]

\[
\begin{array}{c}
5
\end{array}
\]

\[
\begin{array}{c}
x
\end{array}
\]

In Exercises 5–7, \( \triangle ABC \) is a right triangle with right angle \( C \) and altitude \( \overline{CD} \).

5. If \( AD = 4 \) and \( DB = 9 \), find \( CD \). 

6. If \( CA = 12 \), \( BC = 15 \), and \( AD = 8 \), find \( CD \).

7. If \( CD = 16 \) and \( BD = 32 \), find \( AD \).

8. If two parallelograms are similar, do you think their diagonals are proportional to corresponding sides? Explain your thinking.

9. If two squares are similar, do you think their diagonals are proportional to corresponding sides? Explain your thinking.
**EXTRA PRACTICE  7-6**
**PARALLEL LINES AND PROPORTIONAL SEGMENTS**

**EXERCISES**
In each figure, \( \overline{BC} \parallel \overline{DE} \). Find the value of \( x \) to the nearest tenth.

1. 
   \[ \begin{array}{c}
   A \hline
   B & 6 \\
   C & 9 \\
   D & 3 \\
   E & x \end{array} \]

2. 
   \[ \begin{array}{c}
   R \hline
   B & 3 \\
   C & x \\
   D & 4 \\
   E & 8 \end{array} \]

3. 
   \[ \begin{array}{c}
   B & 9.5 \\
   C & 4.5 \\
   D & x \\
   F & 15.5 \\
   G & \end{array} \]

4. 
   \[ \begin{array}{c}
   B & 5.5 \\
   D & 5.5 \\
   E & 9 \\
   F & 5 \\
   G & \end{array} \]

5. 
   \[ \begin{array}{c}
   B & x \\
   D & 18 \\
   H & 8 \\
   E & 12 \\
   C & \end{array} \]

6. 
   \[ \begin{array}{c}
   N \hline
   B & 7 \\
   C & 10 \\
   D & x \\
   E & \end{array} \]

7. 
   \[ \begin{array}{c}
   A \hline
   B & 5.5 \\
   C & \hline
   D & 5.5 \\
   E & \end{array} \]

8. 
   \[ \begin{array}{c}
   C & 5 \\
   E & 10 \\
   G & x \end{array} \]
EXTRA PRACTICE 7-7
INDIRECT MEASUREMENT

EXERCISES

1. HEIGHT Paco is 6 feet tall and casts a 12-foot shadow. At the same time, Diane casts an 11-foot shadow. How tall is Diane?

2. LIGHTING If a 25-foot-tall house casts a 75-foot shadow at the same time that a streetlight casts a 60-foot shadow, how tall is the streetlight?

3. FLAGPOLE Lena is $\frac{5}{2}$ feet tall and casts an 8-foot shadow. At the same time, a flagpole casts a 48-foot shadow. How tall is the flagpole?

4. LANDMARKS A woman who is 5 feet 5 inches tall is standing near the Space Needle in Seattle, Washington; she casts a 13-inch shadow at the same time that the Space Needle casts a 121-foot shadow. How tall is the Space Needle?

5. NATIONAL MONUMENTS A 42-foot flagpole near the Washington Monument casts a shadow that is 14 feet long. At the same time, the Washington Monument casts a shadow that is 185 feet long. How tall is the Washington Monument?

6. ACCESSIBILITY A ramp slopes upward from the sidewalk to the entrance of a building at a constant incline. If the ramp is 2 feet high when it is 5 feet from the sidewalk, how high is the ramp when it is 7 feet from the sidewalk?
EXTRA PRACTICE 8-1

TRANSLATIONS AND REFLECTIONS

EXERCISES

On a coordinate grid, graph parallelogram \(ABCD\) with vertices \(A(2, 4), B(6, 4), C(5, 2)\) and \(D(1, 2)\). Then graph its image under each transformation from the original position. Use your own paper.

1. 5 units left
2. 3 units right
3. reflected across the \(x\)-axis
4. reflected across the \(y\)-axis

5. Compare the slopes of the non-horizontal sides of parallelogram \(ABCD\) in all five positions above.

6. Graph the image of \(\triangle MNP\) with vertices \(M(3, 1), N(4, 4)\) and \(P(6, 2)\) under a reflection across the line with equation \(y = x\). Use your own paper. Compare the slopes of the sides of \(\triangle MNP\) and \(\triangle M'N'P'\).

7. Triangle \(A'B'C'\) is the image of a figure that was translated under the rule \((x, y) \rightarrow (x - 4, y + 1)\). What are the vertices of the preimage of \(\triangle A'B'C'\)? What are the slopes of the sides \(A'B', B'C'\) and \(A'C'\)? Are the slopes of the preimage the same?
EXTRA PRACTICE  8-2

ROTATIONS IN THE COORDINATE PLANE

EXERCISES

For each figure, draw the image after the given rotation about the origin. Use your own paper.

1. Use the rule \( (x, -y) \rightarrow (y, x) \) for a 90° clockwise rotation.

![Triangle XYZ rotated 90° clockwise](image)

3. Use the rule \( (x, y) \rightarrow (-y, x) \) for a 90° counter clockwise rotation.

![Triangle XYZ rotated 90° counter-clockwise](image)

5. Triangle XYZ is rotated twice about the origin, as shown in the table below. Compare the slope to determine how much of a rotation was completed each time.

<table>
<thead>
<tr>
<th>ORIGINAL POSITION</th>
<th>AFTER ROTATION 1</th>
<th>AFTER ROTATION 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>side</td>
<td>side</td>
<td>side</td>
</tr>
<tr>
<td>( XY )</td>
<td>3</td>
<td>( X'Y' )</td>
</tr>
<tr>
<td></td>
<td>( 1/3 )</td>
<td>( -1/3 )</td>
</tr>
<tr>
<td>( YZ )</td>
<td>( 1/2 )</td>
<td>( Y'Z' )</td>
</tr>
<tr>
<td></td>
<td>( -2 )</td>
<td>( -2 )</td>
</tr>
<tr>
<td>( XZ )</td>
<td>( -2 )</td>
<td>( X'Z' )</td>
</tr>
<tr>
<td></td>
<td>( 1/2 )</td>
<td>( 1/2 )</td>
</tr>
</tbody>
</table>

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MathMatters 3
EXTRA PRACTICE  8-3
DILATIONS IN THE COORDINATE PLANE

EXERCISES

Draw each dilation image.

1. The center of dilation is the origin and the scale factor is 2. Use the rule \((x, y) \rightarrow (2x, 2y)\).

   ![Dilation image for Exercise 1](image1)

2. The center of dilation is the origin and the scale factor is \(\frac{1}{2}\).

   ![Dilation image for Exercise 2](image2)

3. The center of dilation is point \(M\) and the scale factor is \(\frac{1}{2}\).

   ![Dilation image for Exercise 3](image3)

4. The center of dilation is point \(A\) and the scale factor is 3.

   ![Dilation image for Exercise 4](image4)

The following sets of points are the vertices of figures and their dilation images. For each two sets of points, give the scale factor.

5. \(A(1, 1), B(2, 6), C(6, 2)\)
   \(A'(4, 4), B'(8, 24), C'(24, 8)\)

6. \(R(-3, -9), S(-6, 3), T(-3, 3)\)
   \(R'(-1, -3), S'(-2, 1), T'(-1, 1)\)
EXTRA PRACTICE 8-4
MULTIPLE TRANSFORMATIONS

EXERCISES

For each exercise, copy the given figure onto your own grid paper. Then draw the result of the first transformation as a dashed figure and the result of the second transformation in red.

1. a translation 4 units to the left, followed by a translation 5 units down

2. a translation 6 units down, followed by a reflection over the y-axis

3. a reflection over the x-axis, followed by a dilation with center at the origin and a scale factor of 2

4. a clockwise rotation of 90° around the origin, followed by a clockwise rotation of 180° around the origin

In Exercises 5 and 6, describe two transformations that would create figure 2 as the image of figure 1. There may be more than one possible answer.

5. 

6. 

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EXTRA PRACTICE 8-5
ADDICTION AND MULTIPLICATION WITH MATRICES

EXERCISES

Find the dimensions of each matrix.

1. \[
\begin{bmatrix}
-1 & 2 & 5 & 0 \\
3 & -3 & 4 & 1
\end{bmatrix}
\]

2. \[
\begin{bmatrix}
2 & 10 & 6 \\
-5 & 3 & 5
\end{bmatrix}
\]

3. \[
\begin{bmatrix}
4 & 1 \\
\frac{1}{3} & 0 \\
5 & \frac{3}{4}
\end{bmatrix}
\]

4. \[
\begin{bmatrix}
0 & 2 & -2 \\
6 & 6 & -7 \\
1 & 0 & 0.5 \\
0.8 & 7.5 & 6
\end{bmatrix}
\]

Use the following matrices in Exercises 5–16.

\[
A = \begin{bmatrix}
2 & 5 & 1 \\
6 & -1 & 8
\end{bmatrix}
\quad B = \begin{bmatrix}
-10 & 6 & 4 \\
-16 & -4 & 2
\end{bmatrix}
\quad C = \begin{bmatrix}
8 & 8 & 4 \\
-4 & 20 & 12
\end{bmatrix}
\]

Find each of the following.

5. \(-3A\)

6. \(\frac{1}{4}C\)

7. \(B + C\)

8. \(C - A\)

9. \(B + -2A\)

10. \(\frac{1}{2}B - C\)

11. \(2B + 3C\)

12. \(4A - 2C\)

13. \(B - 4C\)

14. \(A + \frac{1}{4}C\)

15. \(-B - C\)

16. \(0.5A + C\)
MORE OPERATIONS ON MATRICES

EXERCISES

Refer to the matrices below. Find the dimensions of each product, if possible. Do not multiply. If not possible to multiply, write NP.

\[ R = \begin{bmatrix} 5 & 2 \\ -2 & 4 \end{bmatrix} \quad S = \begin{bmatrix} -1 \\ 2 \end{bmatrix} \quad T = \begin{bmatrix} -1 & 3 & 5 \\ 6 & 2 & 0 \end{bmatrix} \quad V = [4 \quad -5] \]

1. RS ________________  
2. TV ________________  
3. SV ________________  
4. SR ________________  
5. ST ________________  
6. VT ________________  
7. TS ________________  
8. TR ________________  
9. RT ________________

Find each product. If not possible, write NP.

10. \[ \begin{bmatrix} 1 \\ 4 \end{bmatrix} \begin{bmatrix} 3 & -1 & 2 \end{bmatrix} \]  
11. \[ \begin{bmatrix} 2 & 4 \\ 1 & 2 \end{bmatrix} \begin{bmatrix} -1 & 5 \end{bmatrix} \]

12. \[ \begin{bmatrix} -1 & 0 & 2 \\ 3 & 4 & 0 \end{bmatrix} \begin{bmatrix} 4 \\ 1 \\ 2 \end{bmatrix} \]

13. \[ \begin{bmatrix} 4 & -1 & 2 \\ 2 & 1 & 6 \end{bmatrix} \]

14. \[ \begin{bmatrix} -4 & 4 \\ 2 & -2 \\ 3 & -1 \end{bmatrix} \begin{bmatrix} 6 & 1 \\ 2 & 5 \end{bmatrix} \]

15. \[ \begin{bmatrix} -8 & 1 & 1 & -1 \\ 0 & 0 & 2 & 0 \end{bmatrix} \begin{bmatrix} 6 & -1 \\ 2 & -1 \end{bmatrix} \]

16. \[ \begin{bmatrix} 10 & 0 \\ 9 & 1 \end{bmatrix} \begin{bmatrix} -1 \\ 2 \end{bmatrix} \]

17. \[ \begin{bmatrix} 6 & 7 \\ 1 & 2 \\ 4 & -1 \\ 3 & 0 \end{bmatrix} \begin{bmatrix} -1 \\ 0 \end{bmatrix} \]

18. For \( X = \begin{bmatrix} 3 & 4 \\ 1 & 2 \end{bmatrix} \), \( Y = \begin{bmatrix} -1 & 2 \\ 1 & 1 \end{bmatrix} \), and \( Z = \begin{bmatrix} 1 & 1 \\ -2 & -2 \end{bmatrix} \), show that \( (XY)Z = X(YZ) \).
EXTRA PRACTICE 8-7
TRANSFORMATIONS AND MATRICES

EXERCISES

Represent each geometric figure with a matrix.

1. 

2. 

Find the reflection images of the quadrilateral represented by \[
\begin{bmatrix}
-3 & 2 & 1 & -2 \\
3 & 4 & 1 & 1 
\end{bmatrix}
\]

3. over the line \(y = x\).

4. over the \(y\)-axis.

5. over the line \(y = -x\).

6. over the \(x\)-axis.

Interpret each equation as indicating: The reflection image of point \(\ldots\)? over \(\ldots\)? is the point \(\ldots\)?.

7. \[
\begin{bmatrix}
0 & 1 \\
1 & 0 
\end{bmatrix}
\begin{bmatrix}
2 \\
-2 
\end{bmatrix}
= \begin{bmatrix}
-2 \\
2 
\end{bmatrix}
\]

8. \[
\begin{bmatrix}
-1 & 0 \\
0 & 1 
\end{bmatrix}
\begin{bmatrix}
1 \\
4 
\end{bmatrix}
= \begin{bmatrix}
-1 \\
4 
\end{bmatrix}
\]

9. \[
\begin{bmatrix}
0 & -1 \\
-1 & 0 
\end{bmatrix}
\begin{bmatrix}
-2 \\
5 
\end{bmatrix}
= \begin{bmatrix}
-5 \\
2 
\end{bmatrix}
\]
EXTRA PRACTICE  8-8
MATRICES

EXERCISES

CITIES  For Exercises 1 and 2, use the following information.

<table>
<thead>
<tr>
<th>City</th>
<th>Diners</th>
<th>Gas Stations</th>
<th>Theaters</th>
<th>Hotels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oak Hill</td>
<td>19</td>
<td>30</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Elm Grove</td>
<td>11</td>
<td>24</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Cedar Fork</td>
<td>12</td>
<td>22</td>
<td>4</td>
<td>3</td>
</tr>
</tbody>
</table>

1. Make a matrix for the information in the table.

2. Explain what is meant by the dimensions of the matrix. What are the dimensions of the matrix?

FOOTBALL  For Exercises 3–6, use the following information.

<table>
<thead>
<tr>
<th>2002 NFL Season, Week 1</th>
<th>2002 NFL Season, Week 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team</td>
<td>Points</td>
</tr>
<tr>
<td>49ers</td>
<td>16</td>
</tr>
<tr>
<td>Giants</td>
<td>13</td>
</tr>
<tr>
<td>Vikings</td>
<td>23</td>
</tr>
<tr>
<td>Bears</td>
<td>27</td>
</tr>
</tbody>
</table>

3. Make a matrix for the information for the first game of the 2002 season.

4. Make a matrix for the information for the second game of the 2002 season.

5. Explain the conditions necessary to be able to add two matrices.

6. Use the addition of matrices to find the totals in each category for each team in the two games. Write as a matrix.
EXTRA PRACTICE 9-1

REVIEW PERCENTS AND PROBABILITY

EXERCISES

A die is rolled 50 times with the following results.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
</tr>
</tbody>
</table>

What is the experimental probability of rolling each of the following?

1. a 4
2. a 1
3. a number greater than 3
4. an even number
5. a number less than 5
6. an odd number

List all the elements of the sample space for each of the following experiments.

7. You roll a die and toss a penny.
8. You spin a spinner with four equal sections labeled 1, 2, 3, and 4 and toss a dime.

Find the probability of each of the following.

9. Drawing a red card from a standard deck of cards.
10. Tossing 3 coins and getting 2 heads and 1 tail.
11. Rolling a die and getting a 1 or a 2
12. Reaching into a box without looking and taking out one red pencil, when the box contains 6 green pencils, 8 red pencils, and 5 blue pencils.
13. Out of 450 people watching a parade, 200 were children. What is the probability that a person chosen at random out of this group will not be a child?
EXTRA PRACTICE 9-2

PROBABILITY SIMULATIONS

EXERCISES
For Exercises 1–3, place 5 red, 4 yellow, and 7 green marbles in a box. Randomly draw two marbles from the box, record each color, and then return the marbles to the box. Repeat this procedure 50 times.

1. Based on your results, what is the experimental probability of selecting two yellow marbles? 

2. Based on your results, what is the experimental probability of selecting a green marble and a yellow marble? 

3. Compare your results to the theoretical probabilities. 

4. Color blindness occurs in 4% of the male population. What could you use to simulate this situation? 

SCHOOL CURRICULUM For Exercises 5–8, use the following information.
Laurel Woods High randomly selected students for a survey to determine the most important school issues among the student body. The school wants to develop a curriculum that addresses these issues. The survey results are shown in the table.

5. Find the experimental probability distribution of the importance of each issue.

6. Based on the survey, what is the experimental probability that a student chosen at random thinks the most important issue is grades or school standards?

7. The enrollment in the 9th and 10th grades at Laurel Woods High is 168. If their opinions are reflective of those of the school as a whole, how many of them would you expect to have chosen popularity as the most important issue?

8. Suppose the school develops a curriculum incorporating the top three issues. What is the probability that a student selected at random will think the curriculum addresses the most important issue at school?
EXTRA PRACTICE 9-3
COMPOUND EVENTS

EXERCISES

Four coins are tossed.

1. Find the probability that two of the coins show heads and two show tails. ________

2. Find the probability that only one coin shows a tail. ____________________________

3. Find the probability that all four coins show heads. _____________________________

4. Find \( P(\text{all tails}) \). ________________ 5. Find \( P(\text{1 head, 3 tails or all tails}) \). ____

You spin the spinner at the right.
Find each probability.

6. spinning a 3 or an even number ________________

7. spinning a prime number ________________

8. spinning a number greater than 1 ________________

9. spinning a number less than 4 ________________

A card is drawn at random from a standard deck of playing cards. For each event, estimate whether the probability is closer to 1, \( \frac{1}{2} \), or 0.

10. \( P(\text{a diamond or a spade}) \) ________________ 11. \( P(\text{black and a 3}) \)

12. \( P(\text{red and a number card}) \) ________________ 13. \( P(\text{face card or an ace}) \)

14. \( P(\text{red, club, or a face card}) \) ________________ 15. \( P(\text{black and a face card}) \) ________________
EXTRA PRACTICE 9-4
INDEPENDENT AND DEPENDENT EVENTS

EXERCISES

A bag contains 4 blue marbles, 6 red marbles, 8 green marbles and 2 yellow marbles. Marbles are taken at random from the bag, one at a time, and then replaced. Find each probability.

1. \( P(\text{blue, then green}) \)  
2. \( P(\text{red, then red}) \)

3. \( P(\text{yellow, then not green}) \)  
4. \( P(\text{not blue, then not red}) \)

5. \( P(\text{blue, then not blue}) \)  
6. \( P(\text{green, then green}) \)

7. \( P(\text{blue, then red, then green}) \)  
8. \( P(\text{red, then yellow, then red}) \)

A drawer contains 3 pairs of white socks, 4 pairs of black socks, a pair of blue socks and 5 pairs of brown socks. One sock at a time is taken at random from the drawer and not replaced. Find each probability.

9. \( P(\text{white, then white}) \)  
10. \( P(\text{blue, then black}) \)

11. \( P(\text{brown, then blue}) \)  
12. \( P(\text{white, then black}) \)

13. \( P(\text{blue, then blue}) \)  
14. \( P(\text{brown, then brown}) \)

15. \( P(\text{blue, then white}) \)  
16. \( P(\text{black, then white}) \)

Both spinners at the right are spun. Find each probability.

17. \( P(A, 1) \)  
18. \( P(B, 2) \)

19. \( P(\text{a consonant, an even number}) \)  
20. \( P(\text{a vowel, 3}) \)
EXTRA PRACTICE  9-5
PERMUTATIONS AND COMBINATIONS

EXERCISES

For each situation, tell whether order does or does not matter.

1. You are writing the digits of your social security number. _________________
2. Four students are selected to be on a committee. _________________
3. You are choosing toppings for a pizza. _________________
4. You are recording the digits of your e-mail password. _________________
5. You are listing the types of sandwiches available for lunch. _________________

Solve.

6. A golfer has 5 balls in her bag. In how many different orders can she use these balls during the course of a game? _________________
7. Three of the twenty-five semi-finalists for a contest will make the final round. How many choices of three finalists are there? _________________
8. In how many ways can three books be chosen from a box of ten books? _________________
9. Mark is on vacation. He has six places he wants to visit on Tuesday, but he knows he can only make it to four in one day. In how many ways can he choose the four places to visit? _________________
10. In how many different ways can you arrange the digits 0 through 9, if 0 cannot be the first or the last digit? _________________
11. In how many different ways can two team captains be chosen from a team of 15 players? _________________
12. Find the number of permutations of the letters in the word computer. _________________
13. Ten teams enter a tournament. How many different arrangements of first-, second-, and third-place winners are possible? _________________
14. In how many different ways can you arrange eight videos in a row on a shelf? _________________
15. How many different outfits can be made from five pairs of jeans, three T-shirts and three pairs of shoes? _________________
SCATTER PLOTS AND LINES OF BEST FIT

EXERCISES

The table at the right shows the scoring averages for the players on the Lady Tigers basketball team scored during last season.

Use this information for Exercises 1–4.

1. Make a scatter plot on your own paper.

2. What is the range of the Lady Tiger’s scoring averages?

3. Does your scatter plot show a positive correlation, a negative correlation, or no correlation?

4. Can you use this data to make a prediction of a possible scoring average for an 20-year-old player? Why or why not?

5. Make a boxplot for the following data. Use your own paper.

   FINAL EXAM GRADES FOR MR. TRENT’S CLASS
   75, 88, 90, 94, 60, 78, 90, 99, 75, 62, 55, 80

   a. Are the data clustered more closely above or below the median?

   b. What does the plot tell you about the scores?
EXTRA PRACTICE 9-7

STANDARD DEVIATION

EXERCISES

Compute the variance and standard deviation for each set of data.

1. 8, 8, 8, 8, 8, 8, 8, 8
   2. 6, 2, 4, 8, 6, 9, 5
   3. 2.5, 3.5, 7.2, 4.8, 5.4, 3.3
   4. 6, 7.3, 5, 7.5, 6, 2
   5. 2, 1, 5, 12, 5, 15, 9
   6. 86, 69, 90, 79, 88
   7. 90, 65, 78, 92, 84
   8. 15, 16, 19, 20, 24, 28
   9. 12, 20, 13, 14, 18, 15
   10. 10, 4, 7, 9, 15, 18, 6

11. The variance for a set of scores is 16. On the average, how much does a score deviate from the mean score? ____________

12. The standard deviation for the scores of the students in a certain class is increasing with each test given. What is happening to the scores? ________________

13. On a math test taken by 23 students, the mean score was 86. The standard deviation for the scores was 8.2. What was the sum of all the scores? _____________

14. Mikal scored an 82 on a test for which the mean score was 72 and the standard deviation was 10. He scored a 78 on a second test for which the mean score was 70 and the standard deviation was 5. On which test did he score better, compared with others in his class? ____________________

15. Mary had a z-score of –2 on her last test. If the mean score of the last test was 78, what was Mary’s score? ________________

16. Will scored an 89 on a test for which the mean was 72. What was his z-score for the test? ______________

17. Lina scored a 68 on a test for which the mean was 75. What was her z-score for the test? ______________

18. Explain the difference between a positive z-score and a negative z-score.
EXTRA PRACTICE 10-1

IRRATIONAL NUMBERS

EXERCISES

Find the value to the nearest hundredth.

1. $\sqrt{5}$  
2. $\sqrt{45}$  
3. $\sqrt{86}$  
4. $\sqrt{31}$  
5. $\sqrt{132}$  
6. $\sqrt{543}$  
7. $\sqrt{256}$  
8. $\sqrt{984}$  
9. $\sqrt{1235}$

Write each in simplest radical form.

10. $\sqrt{40}$  
11. $\sqrt{600}$  
12. $\sqrt{147}$  
13. $\sqrt{320}$  
14. $\sqrt{216}$  
15. $\sqrt{448}$  
16. $(4\sqrt{2})(3\sqrt{6})$  
17. $(12\sqrt{5})(2\sqrt{10})$  
18. $(3\sqrt{8})(7\sqrt{2})$  
19. $(-\sqrt{12})(4\sqrt{6})$  
20. $(-3\sqrt{15})(4\sqrt{6})$  
21. $(-5\sqrt{5})(-2\sqrt{50})$  
22. $(6\sqrt{7})^2$  
23. $(-9\sqrt{6})^2$  
24. $\frac{\sqrt{3}}{\sqrt{2}}$  
25. $\frac{\sqrt{72}}{\sqrt{6}}$  
26. $\frac{\sqrt{14}}{\sqrt{7}}$  
27. $\frac{\sqrt{5}}{\sqrt{10}}$  
28. $\frac{9}{\sqrt{3}}$  
29. $\frac{11}{\sqrt{7}}$  
30. $\frac{4}{\sqrt{6}}$  
31. $\frac{5}{\sqrt{3}}$  
32. $\sqrt{\frac{14}{3}}$  
33. $\sqrt{\frac{8}{12}}$  
34. $\sqrt{\frac{18}{5}}$  
35. $\sqrt{\frac{3}{10}}$
EXTRA PRACTICE 10-2
THE PYTHAGOREAN THEOREM

EXERCISES

Use the Pythagorean Theorem to find the unknown length. Round your answers to the nearest tenth.

1. \(4 \text{ m}\) \(8 \text{ m}\)

2. \(20 \text{ in.}\) \(12 \text{ in.}\)

3. \(5 \text{ cm}\) \(5 \text{ cm}\)

4. \(7 \text{ ft}\) \(10 \text{ ft}\)

5. \(5 \text{ in.}\) \(9 \text{ in.}\)

6. \(18 \text{ m}\) \(20 \text{ m}\)

Determine if the triangle is a right triangle. Write yes or no.

7. \(9 \text{ in.}\) \(10 \text{ in.}\) \(7 \text{ in.}\)

8. \(13 \text{ m}\) \(12 \text{ m}\) \(5 \text{ m}\)

9. \(6 \text{ ft}\) \(7 \text{ ft}\) \(9 \text{ ft}\)

Solve. Round your answers to the nearest tenth.

10. Find the length of the diagonal of a rectangle with a length of 6 in. and a width of 4 in. ________________

11. A ramp 8 meters long reaches from a deck to a point on the ground 6 meters from the base of the deck. How high above the ground is the deck? ________________

12. A 12-foot ladder is placed against a building. The top of the ladder rests on the building 10 feet from the base of the building. How far from the base of the building is the base of the ladder? ________________
**EXTRA PRACTICE 10-3**

**SPECIAL RIGHT TRIANGLES**

**EXERCISES**

Find the missing measures. Express your answer in simplest radical form and then round to the nearest tenth.

1. \[\text{9 m} \quad 60^\circ\]
2. \[\text{4 in.} \quad 30^\circ\]
3. \[\text{8 yd} \quad 45^\circ\]
4. \[\text{10 cm} \quad 60^\circ\]
5. \[\text{16 ft} \quad 60^\circ\]
6. \[\text{12 m} \quad 60^\circ\]

Solve.

7. The diagonal of a square measures 10 cm. Find the length of a side of the square to the nearest tenth. ________________

8. The perimeter of a square is 20 ft. Find the length of the diagonal of the square to the nearest tenth. ________________

9. Find the measure of a side of an equilateral triangle with an altitude that measures 12 in. ________________
EXTRA PRACTICE 10-4
CIRCLES, ANGLES, AND ARCS

EXERCISES

Find $x$.

1. 

2. 

3. 

4. 

5. 

6. 

Solve.

7. An inscribed angle measures $114^\circ$. What is the measure of the minor arc it intercepts? 

8. A central angle intercepts a minor arc that measures $68^\circ$. What is the measure of the central angle?
For Exercises 1 and 2, use the table that shows the number of people that speak the five languages that are spoken by the most people in the world.

<table>
<thead>
<tr>
<th>Language</th>
<th>Speakers (millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese, Mandarin</td>
<td>874</td>
</tr>
<tr>
<td>Hindi</td>
<td>366</td>
</tr>
<tr>
<td>English</td>
<td>341</td>
</tr>
<tr>
<td>Spanish</td>
<td>322</td>
</tr>
<tr>
<td>Bengali</td>
<td>207</td>
</tr>
</tbody>
</table>

1. Find the degrees for each part of a circle graph that shows the data.

2. Make a circle graph of the data. Which three languages account for 41% of the total?

For Exercises 3 and 4, use the table that shows the number of people active in the United States military in 2002.

<table>
<thead>
<tr>
<th>Branch</th>
<th>Personnel (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Army</td>
<td>486</td>
</tr>
<tr>
<td>Navy</td>
<td>385</td>
</tr>
<tr>
<td>Marine Corps</td>
<td>174</td>
</tr>
<tr>
<td>Air Force</td>
<td>368</td>
</tr>
<tr>
<td>Coast Guard</td>
<td>38</td>
</tr>
</tbody>
</table>

3. Make a circle graph of the data.

4. Which two branches taken together account for almost half of the total?
EXTRA PRACTICE 10-6
CIRCLES AND SEGMENTS

EXERCISES

Find $x$.

1. \[ \begin{array}{c}
    7 \\
   6 \\
   x
\end{array} \]

2. \[ \begin{array}{c}
    14 \\
   10 \\
   x
\end{array} \]

3. \[ \begin{array}{c}
    4 \\
   5 \\
   15 \\
   x
\end{array} \]

4. \[ \begin{array}{c}
    4 \\
   3 \\
   3 \\
   x
\end{array} \]

5. \[ \begin{array}{c}
    8 \\
   6 \\
   x
\end{array} \]

6. \[ \begin{array}{c}
   12 \\
   4 \\
   x
\end{array} \]

Find $x$ and $y$.

7. \[ \begin{array}{c}
   x \\
   8 \\
   y \\
   15
\end{array} \]

8. \[ \begin{array}{c}
   4 \\
   x \\
   3 \\
   1 \\
   y
\end{array} \]
EXTRA PRACTICE 10-7
CONSTRUCTIONS WITH CIRCLES

EXERCISES

1. Copy this square onto your own paper. Inscribe the square in a circle.

2. Copy this regular hexagon onto your own paper. Circumscribe the hexagon around a circle.

3. Copy this equilateral triangle onto your own paper. Inscribe this triangle in a circle.

4. Copy this regular pentagon onto your own paper. Circumscribe the pentagon around a circle.

5. Construct a regular hexagon on your own paper.

6. Construct an equilateral triangle on your own paper.
EXTRA PRACTICE 11-1
ADDING AND SUBTRACTING POLYNOMIALS

EXERCISES

Simplify.

1. \((4z + 2) + (5z - 3)\) 

2. \((5x + y) + (2x + 6y)\) 

3. \((6 - 5m) - (8 + m)\) 

4. \((5z^2 + 4x) + (5x - 4z^2)\) 

5. \((9m + 7m^2) - (2m - 5m^2)\) 

6. \((x^2 + 2xy - y^2) + (4x^2 - xy + 5y^2)\) 

7. \((4z^2 - 3z + 5w^3) - (2z^2 + 4z - 4w^3)\) 

8. \((6a^2 - 5b^2) - (-b^2 + 5a^2 - 12)\) 

9. \((8r^2 - 6t^2) - (9r^2 - 4rt + 7t^2)\) 

10. \((-5a^3 + 5a^2 + 6a - 1) + (3a^3 - 7a - 5)\) 

11. \((z^5 - 2z^4 + 5z - 16) - (4z^2 - z + 6)\) 

12. \((8b^2 - 4b + 3) - (-5b + 3b^2)\) 

13. \((-6r^3 + 2r^2 - 6r - 4) - (r^3 + r^2 + 6)\) 

14. \((m^2 + 3m - 4) + (2m - 6) - (4m^2 - 5m)\) 

15. \((7w + 2w^2 - 5) - (6w - 4) + (w^3 + w^2 + 6)\) 

16. \((3.5c^2 - 4.5c + 1.2) + (4.6c^2 + 3.2c - 2.5)\) 

17. \(3(4x^2 + 4x - 3) + (9x^2 - 2x + 9)\) 

18. \((6r^2 + 7r - 8) - 2(r^2 + r + 1)\) 

19. \(-(50 + y - y^2) + (46 - 16y + y^2)\) 

20. \([r - (-6s)] - (r^2 + 3r + 4s)\)
EXTRA PRACTICE 11-2
MULTIPLY BY A MONOMIAL

EXERCISES

Simplify.

1. \((5x)(3y)\)

2. \((z^3)(4wxz)\)

3. \((5h^2)(6h^3k)\)

4. \((8x^2y)(-2xy^2)\)

5. \((2a^2)^3\)

6. \((4mn)(3m^2n)^2\)

7. \(5w(2w^4 + 4x)\)

8. \(2y^3(y^2 - 7)\)

9. \(8ab(2a^3 - b^4)\)

10.\(-2xy^3(3x^2z - 2xy^4)\)

11. \(3abc(a^2 + b^2 + 8c^2)\)

12. \(b^2c^3(4bc - 5b^3 + 8c^4)\)

13. \((x^3y)(2xy)(x^3y^4)\)

14. \((3r^2s^3)(rs)^3 - (4r^3s^4)^2\)

15. \(4mn(m^2 + m^3n^4) + m^3n(4m^4 + mn^3)\)

Write and simplify an expression for the area of each rectangle.

16. \(z^2 \times 2x^2y\)

17. \(3a \times 4a - b + c\)
EXTRA PRACTICE 11-3
DIVIDE AND FIND FACTORS

EXERCISES

Find the GCF and its paired factor for the following.

1. \(8x + 4y\) ________________
2. \(24c - 30d^2\) ________________
3. \(5xz - z^2\) ________________
4. \(n^2p + 6n\) ________________
5. \(8x^2 - 12xy\) ________________
6. \(r^2s + 4r\) ________________
7. \(15r - 10s\) ________________
8. \(12a^2 - 10a\) ________________
9. \(h^3k - 3hk^3\) ________________
10. \(4n^2m^2 + 6n^4m\) ________________
11. \(2r^2s^2 - r^2s\) ________________
12. \(12a^2 + 8a^2b\) ________________
13. \(3x^2y - 3x^2 + 3xy\) ________________
14. \(2a^3b^2 + 3a^3b - 4a^2b^3\) ________________
15. \(20d^5 - 10cd^3 + 15c^2d^4\) ________________

Write, simplify, and factor an expression for each perimeter below.

16. \(a + 5\)
\(a - 1\)
17. \(xy + xz\)
\(3xz\)
\(4xy\)
18. \(3n\)
\(4m\)
\(2n + 3m\)
\(3m\)
19. \(5r (r + 4t)\)
\(2r (r + 4t)\)
\(3r (2r + t)\)
\(4r (r + t)\)
EXTRA PRACTICE 11-4
MULTIPLY TWO BINOMIALS

EXERCISES

Simplify.
1. \((2r + 2)(3r - 1)\)
2. \((5w - 2)(2w + 3)\)
3. \((2x - y)(3x - 2y)\)
4. \((4m - 3n)(2m + 5n)\)
5. \((a + 2b)(c - d)\)
6. \((x - 3)(x - 3)\)
7. \((h - 4k)(3h + k)\)
8. \((4b - 3c)(2b + c)\)
9. \((7m + 2n)(7m - 2n)\)
10. \((5r - s)(5r + s)\)
11. \((3m - 5n)(2m + n)\)
12. \((3s + 4r)(5s - r)\)
13. \((2f - g)(2h + k)\)
14. \((3m - n)(2m + 3n)\)

Expand and simplify.
15. \((3k - 1)(k + 3) + 4k^2\)
16. \((4x - 2)(x^2 + 3x - 1)\)
17. \((m + 2n)(m - 3n)(m + n)\)

Express, expand, and simplify the volumes of the two rectangular prisms shown below.

18. \(3m + n \times 2m + 2n \times m\)
19. \(4x - 2 \times 2x \times 4x + 1\)
EXTRA PRACTICE 11-5

FIND BINOMIAL FACTORS IN A POLYNOMIAL

EXERCISES

Find factors for the following.

1. \(16ab - 20ad + 12bc - 15cd\)
2. \(6x^2 + 2xz - 3xy - yz\)
3. \(m^2 + mp - 4mn - 4np\)
4. \(12r^2 + 18rt - 2rs - 3st\)
5. \(35hj + 14hm - 5jk - 2km\)
6. \(12w^2 - 18wz - 2wx + 3xz\)
7. \(4x^2y + 3x^2z + 20y + 15z\)
8. \(6fh - 16fk + 3hg - 8gk\)
9. \(2rs + 2rt + 8rv - s - t - 4v\)
10. \(3x^3 + 2x^2z - x^2w + 3xy + 2yz - wy\)
11. \(ab^2 - ad + 4af + b^2c - cd + 4cf\)
12. \(8mp^2 + 4mq - 8m - 2n^2p^2 - n^2q + 2n^2\)
13. \(24a - 8ac - 12b + 4bc\)
14. \(24fdg + 18df - 8fg - 6f\)
15. The area of the figure at the right is expressed as a polynomial. Find the binomial expressions of the two sides.

\[
\text{Area: } 3xy + 6x - 4y - 8
\]

16. Find the binomial expression for the base and height of this right triangle.

\[
\text{Area: } 4mp - 16m + 10np - 40n
\]
EXTRA PRACTICE 11-6
SPECIAL FACTORING PATTERNS

EXERCISES

Find binomial factors for the following, if possible.

1. \( p^2 + 2p + 1 \) 
2. \( 25x^2 - 10x + 1 \) 
3. \( w^2 - 9 \) 
4. \( 5s^2 - r^2 \) 
5. \( 4m^2 - 4mn + n^2 \) 
6. \( 4 - 36r + 81r^2 \) 
7. \( m^2 + 4m - 9 \) 
8. \( 4m^2 - 25n^2 \) 
9. \( 16r^2 + 24rs + 9s^2 \) 
10. \( 16x^2 + 8xy + y^2 \) 
11. \( 25r^2 - t^2 \) 
12. \( x^2 - 49y^2 \) 
13. \( 16a^2 - 12 \) 
14. \( 9w^2 - 4 \) 
15. \( 36c^2 - 60c + 25 \) 
16. \( 4t^2 - 12tr + 9r^2 \)

Find a monomial factor and two binomial factors for each of the following.

17. \( 2x^2 - 4x - 2 \) 
18. \( 12x^2 - 3 \) 
19. \( 2x^3 + 16x^2 + 32x \) 
20. \( 10m^2 - 40n^2 \) 
21. \( 8r^3 - 8rt^2 \) 
22. \( 5w^4 - 20w^2z^2 \)

Find a binomial expression for the length of each side of each square shown below.

23. Area: \( x^2 + 8x + 16 \)
24. Area: \( x^2 - 10x + 25 \)

Find two binomial expressions for the dimensions of each rectangle shown below.

25. Area: \( x^2 - 4 \)
26. Area: \( x^2 - 36 \)
EXTRA PRACTICE 11-7
FACTOR TRINOMIALS

EXERCISES

Identify binomial second-term factors for the following.

1. \(w^2 + 4w + 3\)  
2. \(x^2 - 5x - 6\)  
3. \(d^2 + 3d - 4\)  
4. \(y^2 + 6y + 8\)  
5. \(m^2 + mn - 2n^2\)  
6. \(r^2 + rt - 12t^2\)  
7. \(x^2 - 9xy + 18y^2\)  
8. \(p^2 - 3pq - 10q^2\)

Identify binomial second-term signs for the following.

9. \(w^2 + 3w + 2\)  
10. \(x^2 - 8x + 12\)  
11. \(r^2 + 4r - 5\)  
12. \(q^2 - 6q - 8\)  
13. \(n^2 + n - 2\)  
14. \(t^2 + 3t - 18\)  
15. \(x^2 - 5xy + 4y^2\)  
16. \(c^2 - 8cd + 7d^2\)

Factor the following trinomials.

17. \(x^2 + 2x - 8\)  
18. \(y^2 + 7y + 12\)  
19. \(d^2 + d - 20\)  
20. \(z^2 - 5z - 6\)  
21. \(r^2 + 2rt - 3t^2\)  
22. \(j^2 + 2jk - 8k^2\)  
23. \(x^2 + 5xy + 6y^2\)  
24. \(p^2 + 2pq - 3q^2\)  
25. \(8 - 6x + x^2\)  
26. \(10 + 3a - a^2\)

Find two binomial expressions for the dimensions of each rectangle shown below.

27. Area: \(x^2 + 5x + 6\)  
28. Area: \(x^2 - 5x + 4\)  
29. Area: \(x^2 + 3x - 10\)  
30. Area: \(x^2 - x - 6\)
**EXTRA PRACTICE 11-8**

**FACTORING TRINOMIALS: \( ax^2 + bx + c \)**

Factor each trinomial, if possible. If the trinomial cannot be factored using integers, write prime.

1. \(2b^2 + 10b + 12\)  
2. \(3g^2 + 8g + 4\)  
3. \(4x^2 + 4x - 3\)

4. \(8b^2 - 5b - 10\)  
5. \(6m^2 + 7m - 3\)  
6. \(10d^2 + 17d - 20\)

7. \(6a^2 - 17a + 12\)  
8. \(8w^2 - 18w + 9\)  
9. \(10x^2 - 9x + 6\)

10. \(15n^2 - n - 28\)  
11. \(10x^2 + 21x - 10\)  
12. \(9r^2 + 15r + 6\)

13. \(12y^2 - 4y - 5\)  
14. \(14k^2 - 9k - 18\)  
15. \(8z^2 + 20z - 48\)

16. \(12q^2 + 34q - 28\)  
17. \(18h^2 + 15h - 18\)  
18. \(12p^2 - 22p - 20\)

**Solve each equation. Check your solutions.**

19. \(3h^2 + 2h - 16 = 0\)  
20. \(15n^2 - n = 2\)  
21. \(8q^2 - 10q + 3 = 0\)

22. \(6b^2 - 5b = 4\)  
23. \(10c^2 - 21c = -4c + 6\)  
24. \(10g^2 + 10 = 29g\)

25. \(6y^2 = -7y - 2\)  
26. \(9z^2 = -6z + 15\)  
27. \(12k^2 + 15k = 16k + 20\)

28. \(12x^2 - 1 = -x\)  
29. \(8a^2 - 16a = 6a - 12\)  
30. \(18a^2 + 10a = -11a + 4\)

31. **DIVING** Lauren dove into a swimming pool from a 15-foot-high diving board with an initial upward velocity of 8 feet per second. Find the time \(t\) in seconds it took Lauren to enter the water. Use the model for vertical motion given by the equation \(h = -16t^2 + vt + s\), where \(h\) is height in feet, \(t\) is time in seconds, \(v\) is the initial upward velocity in feet per second, and \(s\) is the initial height in feet. \(\text{Hint: Let } h = 0\) represent the surface of the pool.

32. **BASEBALL** Brad tossed a baseball in the air from a height of 6 feet with an initial upward velocity of 14 feet per second. Enrique caught the ball on its way down at a point 4 feet above the ground. How long was the ball in the air before Enrique caught it? Use the model of vertical motion from Exercise 31.
MORE ON FACTORING TRINOMIALS

EXERCISES

Find FOIL coefficients for the following trinomials.

1. \(6p^2 + p - 2\)  
2. \(2x^2 - x - 6\)  
3. \(9r^2 - 12r - 5\)  
4. \(10y^2 + 9y + 2\)  
5. \(8z^2 + 10z - 3\)  
6. \(6s^2 - 5s + 6\)  
7. \(14y^2 + 5y - 1\)  
8. \(12m^2 - 2m - 10\)

Place appropriate signs in these unsigned binomials.

9. \(12q^2 - 17q - 5 = (3q \quad 5)(4q \quad 1)\)  
10. \(10a^2 + 19a + 6 = (5a \quad 2)(2a \quad 3)\)  
11. \(2x^2 - 11x + 14 = (2x \quad 7)(x \quad 2)\)  
12. \(6d^2 - d - 2 = (2d \quad 1)(3d \quad 2)\)  
13. \(4r^2 - 35r + 24 = (4r \quad 3)(r \quad 8)\)  
14. \(15t^2 - 4t - 4 = (5t \quad 2)(3t \quad 2)\)

Find binomial factors for the following trinomials.

15. \(6x^2 - x - 2\)  
16. \(4y^2 - 13y - 12\)  
17. \(10t^2 + t - 2\)  
18. \(2d^2 + d - 21\)  
19. \(9h^2 - 6h - 8\)  
20. \(8m^2 - 34m - 9\)  
21. \(6r^2 + 7r - 10\)  
22. \(12f^2 + 35f + 8\)  
23. \(5a^2 - 7ab - 6b^2\)  
24. \(8x^2 - 10xy - 25y^2\)  
25. \(14m^2 + 19mn - 3n^2\)  
26. \(18w^2 - wz - 5z^2\)  
27. \(16h^2 + 8hk - 15k^2\)  
28. \(10x^2 - 25x - 60\)  
29. \(16p^2 - 4pq - 30q^2\)  
30. \(42r^2 - 3rt - 9t^2\)  
31. \(6c^3 + 11c^2 - 10c\)
EXTRA PRACTICE  12-1
GRAPHING PARABOLAS

EXERCISES

Complete each table. Then draw the graph on your own paper.

1. \( y = x^2 + 2 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. \( y = -x^2 + 3 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-4</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3. \( y = 4x^2 - 4 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4. \( y = -2x^2 + 1 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5. \( y = 2x^2 + 1 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-4</th>
<th>-2</th>
<th>0</th>
<th>2</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6. \( y = -4x^2 + 5 \)
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-2</th>
<th>-1</th>
<th>0</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>( y )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Graph each function for the domain of real numbers. Use your own paper. For each graph, give the coordinates of the vertex.

7. \( y = 2x^2 \)
   
8. \( y = 3x^2 + 2 \)
   
9. \( y = -x^2 + 4 \)
   
10. \( y = -2x^2 - 2 \)
   
11. \( y = 10x^2 - 6 \)
   
12. \( y = -6x^2 + 7 \)
   
Determine if the graph of each equation below opens upward or downward.

13. \( y = 4x^2 + 5 \)
   
14. \( y = -9x^2 - 12 \)
   
15. \( y = -x^2 + 1 \)
   
16. \( y = 3x^2 - 9 \)
   
17. Suppose that when a ball is thrown upward, the arc it makes can be represented by the equation \( y = -x^2 + 16 \). Find the vertex or highest point on the arc.
Estimate the coordinates of the vertex for each parabola by graphing the equation on a graphing calculator. Then use \( x = -\frac{b}{2a} \) to find the coordinates.

1. \( y = x^2 + 4x + 2 \)  
2. \( y = 4x^2 + 8x + 4 \)

3. \( y - 1 = x^2 + 10x \)  
4. \( 6 - y = -2x + 8x^2 \)

5. \( y = x^2 + 6 \)  
6. \( -10x + 4 = -4x^2 + y \)

7. \( -5x + 1 = -x^2 + y \)  
8. \( 4x^2 + 20x + 10 = y \)

Find the vertex and axis of symmetry. Then graph each equation on your own paper.

9. \( y = 2x^2 + 4x + 1 \)  
10. \( y = x^2 + x - 2 \)

11. \( y = -x^2 + 4 \)  
12. \( y = 4x^2 + 5x + 1 \)

13. \( y = x^2 - 4 \)  
14. \( y = 6x^2 + 5x - 2 \)

15. \( y = -4x^2 + x - 4 \)  
16. \( y = -3x^2 + 6x + 1 \)

17. \( -x^2 + y = 4 + x \)  
18. \( y = 6x^2 + 6x \)

19. \( x^2 + 3x - 4 = y \)  
20. \( y = 4x^2 + x + 2 \)

21. Find a quadratic equation in the form \( y = ax^2 + bx + c \) for which \( c = 2 \) and the axis of symmetry is \( x = \frac{2}{3} \).
EXTRA PRACTICE 12-3
FACTOR AND GRAPH

EXERCISES

Use a graphing calculator to determine the number of solutions for each equation. For equations with one or two solutions, find the exact solutions by factoring.

1. \( y = x^2 - 25 \)  
2. \( y = x^2 + 6x \)  
3. \( y = x^2 + 16 \)  
4. \( y = x^2 + 7x + 6 \)  
5. \( y = x^2 - 7x + 12 \)  
6. \( y - x^2 = 20 + 5x \)  
7. \( y - 49 = x^2 + 14x \)  
8. \( y + 8x = x^2 + 16 \)  
9. \( y = x^2 + 9x + 20 \)  
10. \( y = x^2 - 14x + 40 \)  
11. \( y = x^2 + 4x - 12 \)  
12. \( y + 5 = x^2 - 4x \)  
13. \( y = x^2 + 11x + 10 \)  
14. \( y = x^2 - 9x + 8 \)  

Write an equation for each problem. Then factor to solve.

15. The square of a positive integer is 4 more than 3 times the integer. Find the integer. 

16. The square of a number exceeds the number by 6. Find the number. 

17. The square of an integer is 27 more than 6 times the integer. Find the integer. 

18. Six times an integer minus 5 equals the square of the integer. Find the integer. 

For Exercises 19–21, use the equation \( vt - 16t^2 = 0 \), where \( v \) = velocity in feet per second and \( t \) = time in seconds.

19. The initial velocity of a projectile is 112 feet per second. In how many seconds will it return to the ground? 

20. How long will a football kicked with an initial velocity of 88 feet per second remain in the air? 

21. A projectile is launched with the initial velocity of 576 feet per second. How many seconds will it remain in the air?
EXTRA PRACTICE 12-4
COMPLETE THE SQUARE

EXERCISES

1. \( x^2 + 12x \) 
2. \( x^2 + 10x \) 
3. \( x^2 - 8x \) 
4. \( x^2 - 2x \) 
5. \( x^2 - 40x \) 
6. \( x^2 + 18x \) 
7. \( x^2 - 24x \) 
8. \( x^2 + 5x \) 
9. \( x^2 + 9x \) 
10. \( x^2 - 3x \) 
11. \( x^2 - 7x \) 
12. \( x^2 + 15x \) 

Solve by completing the square. Check your solutions.

13. \( x^2 - 5x + 6 = 0 \) 
14. \( 2x^2 - 7x - 4 = 0 \) 
15. \( x^2 - x - 30 = 0 \) 
16. \( x^2 + 5x = 0 \) 
17. \( 3x^2 + x = 2 \) 
18. \( 3x^2 - 6x = 0 \) 
19. \( x^2 - 9x + 20 = 0 \) 
20. \( x^2 = 5x \) 

Find values for \( c \) and \( h \) to complete each perfect square.

21. \( x^2 + 10x + c = (x + h)^2 \) 
22. \( x^2 + 6x + c = (x + h)^2 \) 
23. \( x^2 + 8x + c = (x + h)^2 \) 
24. \( x^2 + 24x + c = (x + h)^2 \) 
25. \( x^2 + 36x + c = (x + h)^2 \) 
26. \( x^2 + 5x + c = (x + h)^2 \)
EXTRA PRACTICE 12-5
THE QUADRATIC FORMULA

EXERCISES

Use the quadratic formula to solve each equation.

1. \( x^2 - 3x = -2 \)  
2. \( 4x^2 + 4x + 1 = 0 \)

3. \( 2x^2 + x - 4 = 0 \)  
4. \( 3x^2 + 2x - 3 = 0 \)

5. \( x^2 - 6x = 9 \)  
6. \( 12x = 5x^2 \)

7. \( x^2 = 40 \)  
8. \( 2x^2 + 6x - 5 = 0 \)

9. \( x^2 - 18 = 0 \)  
10. \( 16 = 4x^2 + 4x \)

11. \( x^2 + 7x - 8 = 0 \)  
12. \( 4x^2 - 6x - 1 = 0 \)

13. \( 5x^2 + 2x = 10 \)  
14. \( x^2 - 7x + 2 = 0 \)

Choose factoring or the quadratic formula to solve each equation.

15. \( x^2 + 4x + 3 = 0 \)  
16. \( 2x^2 - 7x - 15 = 0 \)

17. \( x^2 - 5x + 4 = 0 \)  
18. \( 5x^2 + 3x - 6 = 0 \)

19. \( x^2 = 9 \)  
20. \( 10x + 4 = 5x^2 \)

21. \( x^2 = -4x \)  
22. \( 7x^2 - 16x - 2 = 0 \)

23. \( x^2 - 12 = 0 \)  
24. \( 12 = x^2 + x \)

25. \( x^2 + 6x - 5 = 0 \)  
26. \( 3x^2 - 2x - 1 = 0 \)
EXTRA PRACTICE 12-6
DISTANCE FORMULA

EXERCISES

Calculate the distance between each pair of points.

1. \(M(2, 5), N(4, 2)\)  
2. \(A(6, 1), B(-4, -5)\)  
3. \(J(-8, 2), K(0, -5)\)  
4. \(X(4, 4), Y(-6, 3)\)  
5. \(P(-7, 3), Q(-3, -4)\)  
6. \(W(0, 3), Z(-4, -6)\)  
7. \(L(-7, -2), M(-4, 2)\)  
8. \(F(12, 3), G(-3, -7)\)  
9. \(A(12, 3), B(-3, 5)\)  
10. \(T(4, 3), V(2, -5)\)  
11. \(C(8, -1), D(-5, 3)\)  
12. \(R(3, -8), S(5, -1)\)

Calculate the midpoint between each pair of points.

13. \(M(2, 5), N(4, 2)\)  
14. \(A(6, 1), B(-4, -5)\)  
15. \(J(-8, 2), K(0, -5)\)  
16. \(X(4, 4), Y(-6, 3)\)  
17. \(P(-7, 3), Q(-3, -4)\)  
18. \(W(0, 3), Z(-4, 6)\)  
19. \(L(-7, -2), M(-4, -2)\)  
20. \(F(12, 3), G(-3, -7)\)  
21. \(A(12, 3), B(-3, 6)\)  
22. \(T(4, 3), V(2, -5)\)  
23. \(C(8, -1), D(-5, 3)\)  
24. \(R(3, -8), S(5, -1)\)

25. The vertices of triangle \(MNP\) are \(M(5, 6), N(0, 3),\) and \(P(4, -2)\). What is the coordinate of the midpoint of the line connecting the midpoints of sides \(MN\) and \(MP\)?

26. What type of triangle is formed by connecting the midpoints of line segments formed by \(R(5, 2), S(-1, -3),\) and \(T(2, -4)\)?

27. Use the distance formula to find the equation for a circle with radius 4 and center at point \((0, 0)\).

28. Use the distance formula to find the equation for a circle with radius 3 and center at point \((2, 3)\).
EXTRA PRACTICE 12-7

GRAPHS TO EQUATIONS

EXERCISES

Find equations for each parabola.

1. 

2. 

3. 

4. 

5. 

6. 

NUMBER THEORY For Exercises 7 and 8, use the following information.

Two numbers have a sum of 2 and a product of −8. The quadratic equation \(-n^2 + 2n + 8 = 0\) can be used to determine the two numbers.

7. Graph the related function \(f(n) = −n^2 + 2n + 8\) and determine its \(x\)-intercepts. 

8. What are the two numbers?

DESIGN For Exercises 9 and 10, use the following information.

A footbridge is suspended from a parabolic support. The function \(h(x) = −\frac{1}{25}x^2 + 9\) represents the height in feet of the support above the walkway, where \(x = 0\) represents the midpoint of the bridge.

9. Graph the function and determine its \(x\)-intercepts.

10. What is the length of the walkway between the two supports?
EXTRA PRACTICE 13-1
THE STANDARD EQUATION OF A CIRCLE

EXERCISES

Write an equation for each circle.
1. radius 3, center (0, 0) ____________________________
2. radius 5, center (0, −5) ____________________________
3. radius 10, center (2, 1) ____________________________
4. radius 7, center (−4, 3) ____________________________
5. radius 15, center (−1, −2) ____________________________
6. radius 1, center (5, −6) ____________________________

Find the radius and center for each circle.
7. $x^2 + y^2 = 36$ ____________________________
8. $x^2 + y^2 = 12$ ____________________________
9. $(x − 3)^2 + (y − 2)^2 = 16$ ____________________________
10. $(x + 10)^2 + (y − 4)^2 = 100$ ____________________________
11. $(x − 15)^2 + (y + 2)^2 = 196$ ____________________________
12. $(x + 8)^2 + (y + 18)^2 = 75$ ____________________________
13. $(x − 6)^2 + (y + 12)^2 = 80$ ____________________________
14. $(x + 18)^2 + (y − 14)^2 = 24$ ____________________________

Write two equations for each circle. The endpoints of the radius are given.
15. $(0, 0), (4, 0)$ ____________________________
16. $(3, 5), (5, −3)$ ____________________________
EXTRA PRACTICE 13-2
MORE ON PARABOLAS

EXERCISES

Find the focus and directrix of each equation.

1. \(x^2 = 25y\)  
2. \(x^2 = -4y\)

3. \(x^2 = 15y\)  
4. \(x^2 = -8y\)

5. \(x^2 - 12y = 0\)  
6. \(x^2 + 9y = 0\)

7. \(50y + 2x^2 = 0\)  
8. \(-3x^2 = -27y\)

Find the simple equation for each parabola with vertex located at the origin.

9. Focus \((0, -2)\)  
10. Focus \((0, 6)\)

11. Focus \((0, \frac{1}{3})\)  
12. Focus \((0, -\frac{1}{4})\)

Write the simple equation for each parabola with vertex at the origin and focus and directrix shown.

Find the equation of each parabola.

15. Focus \((3, 5)\), Vertex \((3, 2)\)

16. Focus \((2, 1)\), Vertex \((4, 1)\)

17. Focus \((3, 3)\), Vertex \((2, 3)\)

18. Focus \((1, 5)\), Directrix \(y = -1\)
Write each equation in standard form. State whether the graph of the equation is a parabola, circle, ellipse, or hyperbola. Then graph the equation.

1. \(y^2 = -3x\)
2. \(x^2 + y^2 + 6x = 7\)
3. \(5x^2 - 6y^2 - 30x - 12y = -9\)
4. \(196y^2 = 1225 - 100x^2\)
5. \(3x^2 = 9 - 3y^2 - 6y\)
6. \(9x^2 + y^2 + 54x - 6y = -81\)

Without writing the equation in standard form, state whether the graph of each equation is a parabola, circle, ellipse, or hyperbola.

7. \(6x^2 + 6y^2 = 36\)
8. \(4x^2 - y^2 = 16\)
9. \(9x^2 + 16y^2 - 64y - 80 = 0\)
10. \(5x^2 + 5y^2 - 45 = 0\)
11. \(x^2 + 2x = y\)
12. \(4y^2 - 36x^2 + 4x - 144 = 0\)

13. ASTRONOMY A satellite travels in a hyperbolic orbit. It reaches the vertex of its orbit at (5, 0) and then travels along a path that gets closer and closer to the line \(y = \frac{2}{5}x\).

Write an equation that describes the path of the satellite if the center of its hyperbolic orbit is at (0, 0).
EXTRA PRACTICE 13-4
ELLIPSES AND HYPERBOLAS

EXERCISES

Graph each equation. Use your own paper.

1. $4x^2 + 16y^2 = 25$
2. $16x^2 + 25y^2 = 81$
3. $4x^2 - 16y^2 = 64$
4. $x^2 - 9y^2 = 16$

5. Find the equation of the ellipse with foci (6, 0) and (-6, 0) and x-intercepts (8, 0) and (-8, 0).

6. Find the equation of the ellipse with foci (10, 0) and (-10, 0) and x-intercepts (15, 0) and (-15, 0).

7. Find the equation of the ellipse with foci (5, 0) and (-5, 0) and x-intercepts (6, 0) and (-6, 0).

8. Find the equation of the ellipse with foci (7, 0) and (-7, 0) and x-intercepts (9, 0) and (-9, 0).

9. Find the equation of the hyperbola with center (0, 0) and foci on the x-axis if $a = \pm 6$ and $b = \pm 8$.

10. Find the equation of the hyperbola with center (0, 0) and foci on the x-axis if $a = \pm 1$ and $b = \pm 2$.

11. Find the equation of the hyperbola with center (0, 0) and foci on the x-axis if $a = \pm 5$ and $b = \pm 2$.

12. Find the equation of the hyperbola with center (0, 0) and foci on the x-axis if $a = \pm 4$ and $b = \pm 7$.

Graph each hyperbola. Use your own paper.

13. $16x^2 - 4y^2 = 64$
14. $x^2 - y^2 = 121$
15. $8x^2 - 2y^2 = 32$
16. $4x^2 - y^2 = 100$

Graph each ellipse. Use your own paper.

17. $x^2 + 36y^2 = 9$
18. $4x^2 + 9y^2 = 36$
19. $6x^2 + 24y^2 = 6$
20. $2x^2 + 8y^2 = 8$
EXTRA PRACTICE 13-5
DIRECT VARIATION

EXERCISES

1. What is the equation of direct variation when one pair of values is $x = 60$ and $y = 15$?

2. What is the equation of direct variation when one pair of values is $x = 49$ and $y = 98$?

3. What is the equation of direct variation when one pair of values is $x = 72$ and $y = 54$?

4. If $y$ varies directly as $x$ and $y = 24$ when $x = 20$, find $y$ when $x = 10$.

5. If $y$ varies directly as $x$ and $y = 16$ when $x = 4$, find $y$ when $x = 5$.

6. If $y$ varies directly as $x^2$ and $y = 300$ when $x = 25$, find $y$ when $x = 20$.

7. If $y$ varies directly as $x^2$ and $y = 400$ when $x = 16$, find $y$ when $x = 4$.

8. The distance ($d$) a vehicle travels at a given speed is directly proportional to the time ($t$) it travels. If a vehicle travels 40 miles in 60 minutes, how far can it travel in 90 minutes?

9. The distance ($d$) a vehicle travels at a given speed is directly proportional to the time ($t$) it travels. If a vehicle travels 60 miles in 50 minutes, how far can it travel in 2 hours?

10. The expected increase ($I$) of a population of organisms is directly proportional to the current population ($n$). If a sample of 240 organisms increases by 20, by how many will a population of 600 increase?

12. The expected increase ($I$) of a population of organisms is directly proportional to the current population ($n$). If a sample of 500 organisms increases by 35, by how many will a population of 6000 increase?

13. The distance ($d$) an object falls is directly proportional to the square of time ($t$) it falls. If an object falls 144 feet in 4 seconds, how far will it fall in 6 seconds?

14. The distance ($d$) an object falls is directly proportional to the square of time ($t$) it falls. If an object falls 225 feet in 9 seconds, how far will it fall in 12 seconds?
EXTRA PRACTICE  13-6
INVERSE VARIATION

EXERCISES

1. Write an equation in which \( y \) varies inversely as \( x \) if one pair of values is \( x = 15 \) and \( y = 10 \). ________________

2. Write an equation in which \( y \) varies inversely as \( x \) if one pair of values is \( x = 24 \) and \( y = 0.2 \). ________________

3. If \( y \) varies inversely as \( x \) and one pair of values is \( y = 64 \) and \( x = 8 \), find \( y \) when \( x = 12 \). ________________

4. If \( y \) varies inversely as \( x \) and one pair of values is \( y = 52 \) and \( x = 14 \), find \( y \) when \( x = 28 \). ________________

5. If \( y \) varies inversely as the square of \( x \) and \( y = 144 \) when \( x = 4 \), find \( y \) when \( x = 12 \). ___

6. If \( y \) varies inversely as the square of \( x \) and \( y = 64 \) when \( x = 8 \), find \( y \) when \( x = 16 \). ___

7. The brightness of a light bulb varies inversely as the square of the distance from the source. If a light bulb has a brightness of 625 lumens at 5 feet, what will be its brightness at 25 feet? ________________

8. The force of attraction between two magnets varies inversely as the square of the distance between them. When two magnets are 9 centimeters apart, the force is 81 newtons. What will be the force when they are 15 centimeters apart? ________________

Write an equation of joint variation for each.

9. \( r \) varies jointly as \( a \) and \( b \). ________________

10. \( q \) varies jointly as \( r, s, \) and \( t \). ________________

Write an equation of combined variation for each.

11. \( x \) varies directly as \( y \) and inversely as \( z \). ________________

12. \( b \) varies directly as \( f \) and inversely as the square \( g \). ________________


EXTRA PRACTICE  13-7

QUADRATIC INEQUALITIES

EXERCISES

Graph each inequality. Use your own paper.

1. \( 9x^2 + 25y^2 \leq 225 \)
2. \( (x - 2)^2 + (y - 1)^2 > 9 \)
3. \( y < x^2 + 4x + 4 \)
4. \( 16x^2 - 4y^2 \geq 64 \)
5. \( x^2 + 4y^2 > 16 \)
6. \( (x + 3)^2 + (y - 4)^2 - 16 \)
7. \( y \geq x^2 - 2x - 8 \)
8. \( 8x^2 - 2y^2 \leq 32 \)
9. \( y > x^2 + 8x + 15 \)
10. \( (x + 2)^2 + (y + 4)^2 - 25 \)
11. \( x^2 + y^2 > 144 \)
12. \( y \leq x^2 - 13x - 12 \)

Graph each system of inequalities. Use your own paper.

13. \( x^2 - y^2 < 36 \)
   \( x^2 + y^2 \geq 25 \)
14. \( y > x^2 - 3x \)
   \( y \leq x - 1 \)
15. \( (x + 2)^2 + (y - 1)^2 \geq 4 \)
   \( y > x^2 \geq 4x + 3 \)
16. \( 12x^2 + 27y^2 \leq 108 \)
   \( x^2 + y^2 \geq 100 \)
17. \( x^2 - y^2 > 16 \)
   \( x^2 + y^2 < 9 \)
18. \( y < x^2 - 2x + 1 \)
   \( y > x + 3 \)
19. \( (x - 2)^2 + (y + 1)^2 \geq 25 \)
   \( y \leq x^2 - 9x + 20 \)
20. \( x^2 + y^2 \leq 9 \)
   \( x^2 - y^2 \geq 16 \)
21. \( x^2 + y^2 \geq 16 \)
   \( y < x - 5 \)
22. \( 4x^2 + 8y^2 \leq 64 \)
   \( x^2 + y^2 > 64 \)

Complete each statement. Use <, >, or =.

23. If \( x^2 + y^2 \) is _____ \( r^2 \), the outside of the circle is in the solution set.

24. If \( \frac{x^2}{a^2} + \frac{y^2}{b^2} \) is _____ 1, the inside of the ellipse is in the solution set.

25. If \( \frac{x^2}{a^2} - \frac{y^2}{b^2} \) is _____ 1, the outside of the hyperbola is in the solution set.

26. If \( ax^2 + bx^2 + c \) is _____ \( y \), for \( a > 0 \), the section outside the parabola is in the solution set.
EXTRA PRACTICE 13-8

EXPONENTIAL FUNCTIONS

Sketch the graph of each function. Then state the function's domain and range.

1. \( y = 1.5(2)^x \)
2. \( y = 4(3)^x \)
3. \( y = 3(0.5)^x \)

Determine whether each function represents exponential growth or decay.

4. \( y = 5(0.6)^x \)
5. \( y = 0.1(2)^x \)
6. \( y = 5 \cdot 4^{-x} \)

Write an exponential function whose graph passes through the given points.

7. \((0, 1)\) and \((-1, 4)\)
8. \((0, 2)\) and \((1, 10)\)
9. \((0, -3)\) and \((1, -1.5)\)

10. \((0, 0.8)\) and \((1, 1.6)\)
11. \((0, -0.4)\) and \((2, -10)\)
12. \((0, \pi)\) and \((3, 8\pi)\)

Simplify each expression.

13. \((2^{\sqrt{2}})^{\sqrt{8}}\)
14. \((n^{\sqrt{3}})^{\sqrt{75}}\)
15. \(y^{\sqrt{6}} \cdot y^{5\sqrt{6}}\)
16. \(13^{\sqrt{6}} \cdot 13^{\frac{1}{24}}\)
17. \(n^3 \div n^{\pi}\)
18. \(125^{\frac{1}{11}} \div 5^{\frac{1}{11}}\)

Solve each equation or inequality. Check your solution.

19. \(3^{3x - 5} > 81\)
20. \(7^{6x} = 7^{2x - 20}\)
21. \(3^{6n - 5} < 9^{4n - 3}\)

22. \(9^{2x - 1} = 27^x + 4\)
23. \(2^{3n - 1} \geq \left(\frac{1}{8}\right)^n\)
24. \(16^{4n - 1} = 128^{2n + 1}\)

BIOLOGY For Exercises 25 and 26, use the following information.
The initial number of bacteria in a culture is 12,000. The number after 3 days is 96,000.

25. Write an exponential function to model the population \(y\) of bacteria after \(x\) days.

26. How many bacteria are there after 6 days?

27. EDUCATION A college with a graduating class of 4000 students in the year 2002 predicts that it will have a graduating class of 4862 in 4 years. Write an exponential function to model the number of students \(y\) in the graduating class \(t\) years after 2002.
EXTRA PRACTICE 13-9
LOGARITHMIC FUNCTIONS
Write each equation in logarithmic form.

1. \(5^3 = 125\)  
2. \(7^0 = 1\)  
3. \(3^4 = 81\)  

4. \(3^{-4} = \frac{1}{81}\)
5. \((\frac{1}{4})^3 = \frac{1}{64}\)
6. \(7776^{\frac{1}{3}} = 6\)

Write each equation in exponential form.

7. \(\log_6 216 = 3\)  
8. \(\log_2 64 = 6\)  
9. \(\log_3 \frac{1}{81} = -4\)

10. \(\log_{10} 0.00001 = -5\)  
11. \(\log_{25} 5 = \frac{1}{2}\)  
12. \(\log_{32} 8 = \frac{3}{5}\)

Evaluate each expression.

13. \(\log_3 81\)  
14. \(\log_{10} 0.0001\)  
15. \(\log_2 \frac{1}{16}\)  
16. \(\log_5 27\)

17. \(\log_9 1\)  
18. \(\log_4 4\)  
19. \(\log_7 \frac{1}{49}\)  
20. \(\log_6 6^4\)

21. \(\log_3 \frac{1}{3}\)  
22. \(\log_4 \frac{1}{256}\)  
23. \(\log_9 9^{(n+1)}\)  
24. \(2^{\log_2 32}\)

Solve each equation or inequality. Check your solutions.

25. \(\log_{10} n = -3\)  
26. \(\log_4 x > 3\)  
27. \(\log_4 x = \frac{3}{2}\)

28. \(\log_5 x = -3\)  
29. \(\log_7 q < 0\)  
30. \(\log_6 (2y + 8) \geq 2\)
EXTRA PRACTICE 14-1
BASIC TRIGONOMETRY RATIOS

EXERCISES

Use the figure at the right to find each ratio.

1. \( \sin R \) 
2. \( \cos S \) 

3. \( \tan R \) 
4. \( \sin S \) 

5. \( \cos R \) 
6. \( \tan S \) 

Use the figure at the right to find each ratio.

7. \( \sin J \) 
8. \( \cos L \) 

9. \( \tan L \) 
10. \( \sin L \) 

11. \( \cos J \) 
12. \( \tan J \) 

13. In \( \triangle ABC \), \( \angle C \) is a right angle, \( AB = 14 \) and \( AC = 8 \). Find \( \sin A \) and \( \tan B \) to the nearest hundredth. 

14. In \( \triangle ABC \), \( \angle C \) is a right angle, \( BC = 7 \) and \( AB = 13 \). Find \( \cos B \) and \( \tan A \) to the nearest hundredth. 

15. In right triangle \( XYZ \), \( \angle Z \) is a right angle and \( \tan X = \frac{8}{15} \). Write \( \sin X \) and \( \tan Y \) as ratios. 

16. In right triangle \( XYZ \), \( \angle Z \) is a right angle and \( \tan Y = \frac{60}{11} \). Write \( \cos X \) and \( \tan X \) as ratios.
EXTRA PRACTICE 14-2

SOLVE RIGHT TRIANGLES

EXERCISES

For all exercises on this page, find the length of all line segments to the nearest tenth and all angles to the nearest degree.

Find the following in $\triangle ABC$.

1. $BC$ ________________________
2. $m\angle A$ ________________________
3. $m\angle B$ ________________________

Find the following in $\triangle XYZ$.

4. $m\angle X$ ________________________
5. $YZ$ ________________________
6. $ZX$ ________________________

Find the following in $\triangle MNP$.

7. $m\angle M$ ________________________
8. $MP$ ________________________
9. $NM$ ________________________

10. The two legs of a right triangle measure 24.2 and 36.4. Solve the triangle.

11. In a right triangle, a leg measures 9.6 and the hypotenuse measures 15.2. Solve the triangle.

12. In a right triangle, the leg adjacent to a $56^\circ$ angle has a length of 24. Solve the triangle.

13. In a right triangle, the leg opposite a $32^\circ$ angle has a length of 18. Solve the triangle.

14. From the top of a building, the angle of depression of a car is $5.2^\circ$. If the direct-line distance from the top of the building to the car is 1500 ft, how tall is the building?
EXTRA PRACTICE 14-3
GRAPH THE SINE FUNCTION

EXERCISES

Find each ratio by drawing a reference angle.

1. \( \sin 765^\circ \) ____________________________
2. \( \sin 600^\circ \) ____________________________
3. \( \sin 945^\circ \) ____________________________
4. \( \sin 840^\circ \) ____________________________
5. \( \sin 1050^\circ \) ____________________________
6. \( \sin 510^\circ \) ____________________________
7. \( \sin (-390)^\circ \) ____________________________
8. \( \sin (-675)^\circ \) ____________________________
9. \( \cos 405^\circ \) ____________________________
10. \( \tan 300^\circ \) ____________________________
11. \( \cos 480^\circ \) ____________________________
12. \( \cos 510^\circ \) ____________________________
13. \( \tan 600^\circ \) ____________________________
14. \( \cos (-675)^\circ \) ____________________________
15. \( \tan (-480)^\circ \) ____________________________
16. \( \tan 960^\circ \) ____________________________

17. Graph \( y = \cos x \) for \( 360^\circ \leq x \leq 720^\circ \). Use your own paper.

Solve for values of \( x \) with \( 0^\circ \leq x \leq 360^\circ \).

18. \( \sin x = \frac{\sqrt{3}}{2} \) ____________________________
19. \( \cos x = -\frac{1}{2} \) ____________________________
20. \( \tan x = 1 \) ____________________________
21. \( \tan x = -\sqrt{3} \) ____________________________
22. \( \sin x = \frac{1}{2} \) ____________________________
23. \( \cos x = \frac{\sqrt{3}}{2} \) ____________________________
EXTRA PRACTICE 14-4
EXPERIMENT WITH THE SINE FUNCTION

EXERCISES

1. Graph \( y = \sin 3x \). Use your own paper. State the period. ________________

2. Graph \( y = 2 \sin x \). Use your own paper. State the amplitude. ________________

State the period and amplitude of the graph of each equation and describe the position of the graph.

3. \( y = \sin x - 5 \) ________________

4. \( y = 3 \sin x + 1 \) ________________

5. \( y = 0.5 \sin 2x - 2 \) ________________

6. \( y = 2 \sin 4x + 3.5 \) ________________

Tell if the function is periodic. If it is, state the period.

7. ________________

8. ________________

Find the period of the graph of each equation.

9. \( y = \sin \frac{1}{4}x \) ________________

10. \( y = \sin \frac{2}{5}x \) ________________

11. \( y = \sin \frac{3}{2}x \) ________________

12. \( y = \sin \frac{4}{3}x \) ________________
EXTRA PRACTICE 14-5

GRAPHING TRIGONOMETRIC FUNCTIONS

EXERCISES

Find the amplitude, if it exists, and period of each function. Then graph each function.

1. \( y = -4 \sin \theta \)
2. \( y = \cot \frac{1}{2} \theta \)
3. \( y = \cos 5\theta \)

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<td>-4</td>
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4. \( y = \csc \frac{3}{4} \theta \)
5. \( y = 2 \tan \frac{1}{2} \theta \)
6. \( 2y = \sin \theta \)

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FORCE For Exercises 7 and 8, use the following information.

An anchoring cable exerts a force of 500 Newtons on a pole. The force has the horizontal and vertical components \( F_x \) and \( F_y \). (A force of one Newton (N), is the force that gives an acceleration of 1 m/sec\(^2\) to a mass of 1 kg.)

7. The function \( F_x = 500 \cos \theta \) describes the relationship between the angle \( \theta \) and the horizontal force. What are the amplitude and period of this function?

8. The function \( F_y = 500 \sin \theta \) describes the relationship between the angle \( \theta \) and the vertical force. What are the amplitude and period of this function?

WEATHER For Exercises 9 and 10, use the following information.

The function \( y = 60 + 25 \sin \frac{\pi}{6} t \), where \( t \) is in months and \( t = 0 \) corresponds to April 15, models the average high temperature in degrees Fahrenheit in Centerville.

9. Determine the period of this function. What does this period represent?

10. What is the maximum high temperature and when does this occur?