1.2  EXERCISES

VOCABULARY: Fill in the blanks.

1. An ordered pair \((a, b)\) is a ________ of an equation in \(x\) and \(y\) if the equation is true when \(a\) is substituted for \(x\), and \(b\) is substituted for \(y\).

2. The set of all solution points of an equation is the ________ of the equation.

3. The points at which a graph intersects or touches an axis are called the ________ of the graph.

4. A graph is symmetric with respect to the ________ if, whenever \((x, y)\) is on the graph, \((-x, y)\) is also on the graph.

5. The equation \((x - h)^2 + (y - k)^2 = r^2\) is the standard form of the equation of a ________ with center ________ and radius ________.

6. When you construct and use a table to solve a problem, you are using a ________ approach.

SKILLS AND APPLICATIONS

In Exercises 7–14, determine whether each point lies on the graph of the equation.

<table>
<thead>
<tr>
<th>Equation</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. (y = \sqrt{x + 4})</td>
<td>(a) ((0, 2)) (b) ((5, 3))</td>
</tr>
<tr>
<td>8. (y = \sqrt{5 - x})</td>
<td>(a) ((1, 2)) (b) ((5, 0))</td>
</tr>
<tr>
<td>9. (y = x^2 - 3x + 2)</td>
<td>(a) ((2, 0)) (b) ((-2, 8))</td>
</tr>
<tr>
<td>10. (y = 4 -</td>
<td>x - 2</td>
</tr>
<tr>
<td>11. (y =</td>
<td>x - 1</td>
</tr>
<tr>
<td>12. (2x - y - 3 = 0)</td>
<td>(a) ((1, 2)) (b) ((1, -1))</td>
</tr>
<tr>
<td>13. (x^2 + y^2 = 20)</td>
<td>(a) ((3, -2)) (b) ((-4, 2))</td>
</tr>
<tr>
<td>14. (y = \frac{1}{3}x^3 - 2x^2)</td>
<td>(a) ((2, \frac{-16}{3})) (b) ((-3, 9))</td>
</tr>
</tbody>
</table>

In Exercises 15–18, complete the table. Use the resulting solution points to sketch the graph of the equation.

15. \(y = -2x + 5\)

<table>
<thead>
<tr>
<th>(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>(\frac{5}{2})</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(y)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

16. \(y = \frac{3}{4}x - 1\)

<table>
<thead>
<tr>
<th>(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>(\frac{4}{3})</td>
</tr>
<tr>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(y)</th>
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<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

17. \(y = x^2 - 3x\)

<table>
<thead>
<tr>
<th>(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
</tr>
<tr>
<td>0</td>
</tr>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(y)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

18. \(y = 5 - x^2\)

<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>

<table>
<thead>
<tr>
<th>((x, y))</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

In Exercises 19–22, graphically estimate the \(x\)- and \(y\)-intercepts of the graph. Verify your results algebraically.

19. \((x - 3)^2\)

20. \(y = 16 - 4x^2\)

21. \(y = |x + 2|\)

22. \(y^2 = 4 - x\)

In Exercises 23–32, find the \(x\)- and \(y\)-intercepts of the graph of the equation.

23. \(y = 5x - 6\)

24. \(y = 8 - 3x\)

25. \(y = \sqrt{x + 4}\)

26. \(y = \sqrt{2x - 1}\)

27. \(y = |3x - 7|\)

28. \(y = -|x + 10|\)

29. \(y = 2x^3 - 4x^2\)

30. \(y = x^4 - 25\)

31. \(y^2 = 6 - x\)

32. \(y^2 = x + 1\)
In Exercises 33–40, use the algebraic tests to check for symmetry with respect to both axes and the origin.

33. \( x^2 - y = 0 \)  
34. \( x - y^2 = 0 \)  
35. \( y = x^3 \)  
36. \( y = x^4 - x^2 + 3 \)  
37. \( y = \frac{x}{x^2 + 1} \)  
38. \( y = \frac{1}{x^2 + 1} \)  
39. \( xy^2 + 10 = 0 \)  
40. \( xy = 4 \)

In Exercises 41–44, assume that the graph has the indicated type of symmetry. Sketch the complete graph of the equation. To print an enlarged copy of the graph, go to the website www.mathgraphs.com.

41. 42.  
\[ y = -3x + 1 \]  
\[ y = 2x - 3 \]  
\[ y = x^2 - 2x \]  
\[ y = -x^2 - 2x \]  
43. 44.  
\[ y = x^3 + 3 \]  
\[ y = \sqrt{x - 3} \]  
\[ y = |x - 6| \]  
\[ y = 1 - |x| \]  
\[ x = y^2 - 1 \]  
\[ x = y^2 - 5 \]

In Exercises 45–56, identify any intercepts and test for symmetry. Then sketch the graph of the equation.

45. \( y = -3x + 1 \)  
46. \( y = 2x - 3 \)  
47. \( y = x^2 - 2x \)  
48. \( y = -x^2 - 2x \)  
49. \( y = x^3 + 3 \)  
50. \( y = x^3 - 1 \)  
51. \( y = \sqrt{x} - 3 \)  
52. \( y = \sqrt{1 - x} \)  
53. \( y = |x - 6| \)  
54. \( y = 1 - |x| \)  
55. \( x = y^2 - 1 \)  
56. \( x = y^2 - 5 \)

In Exercises 57–68, use a graphing utility to graph the equation. Use a standard setting. Approximate any intercepts.

57. \( y = 3 - \frac{1}{3}x \)  
58. \( y = \frac{2}{3}x - 1 \)  
59. \( y = x^2 - 4x + 3 \)  
60. \( y = x^2 + x - 2 \)  
61. \( y = \frac{2x}{x - 1} \)  
62. \( y = \frac{4}{x^2 + 1} \)  
63. \( y = \sqrt[3]{x} + 2 \)  
64. \( y = \sqrt[3]{x} + 1 \)

The symbol \( \text{\( \square \)} \) indicates an exercise or a part of an exercise in which you are instructed to use a graphing utility.

65. \( y = x\sqrt{x} + 6 \)  
66. \( y = (6 - x)^{\sqrt{x}} \)  
67. \( y = |x + 3| \)  
68. \( y = 2 - |x| \)

In Exercises 69–76, write the standard form of the equation of the circle with the given characteristics.

69. Center: \((0, 0)\); Radius: 4  
70. Center: \((0, 0)\); Radius: 5  
71. Center: \((2, -1)\); Radius: 4  
72. Center: \((-7, -4)\); Radius: 7  
73. Center: \((-1, 2)\); Solution point: \((0, 0)\)  
74. Center: \((3, -2)\); Solution point: \((-1, 1)\)  
75. Endpoints of a diameter: \((0, 0), (6, 8)\)  
76. Endpoints of a diameter: \((-4, -1), (4, 1)\)

In Exercises 77–82, find the center and radius of the circle, and sketch its graph.

77. \( x^2 + y^2 = 25 \)  
78. \( x^2 + y^2 = 16 \)  
79. \( (x - 1)^2 + (y + 3)^2 = 9 \)  
80. \( x^2 + (y - 1)^2 = 1 \)  
81. \( (x - \frac{1}{2})^2 + (y - \frac{3}{2}) = \frac{9}{4} \)  
82. \( (x - 2)^2 + (y + 3)^2 = \frac{16}{9} \)

83. DEPRECIATION A hospital purchases a new magnetic resonance imaging (MRI) machine for $500,000. The depreciated value \( y \) (reduced value) after \( t \) years is given by \( y = 500,000 - 40,000t, 0 \leq t \leq 8 \). Sketch the graph of the equation.

84. CONSUMERISM You purchase an all-terrain vehicle (ATV) for $8000. The depreciated value \( y \) after \( t \) years is given by \( y = 8000 - 900t, 0 \leq t \leq 6 \). Sketch the graph of the equation.

85. GEOMETRY A regulation NFL playing field (including the end zones) of length \( x \) and width \( y \) has a perimeter of \( 346\text{yd} \) or \( \frac{1060}{3} \) yards.

(a) Draw a rectangle that gives a visual representation of the problem. Use the specified variables to label the sides of the rectangle.

(b) Show that the width of the rectangle is \( y = \frac{520}{3} - x \) and its area is \( A = x\left(\frac{520}{3} - x\right) \).

(c) Use a graphing utility to graph the area equation. Be sure to adjust your window settings.

(d) From the graph in part (c), estimate the dimensions of the rectangle that yield a maximum area.

(e) Use your school’s library, the Internet, or some other reference source to find the actual dimensions and area of a regulation NFL playing field and compare your findings with the results of part (d).
86. GEOMETRY A soccer playing field of length \( x \) and width \( y \) has a perimeter of 360 meters.

(a) Draw a rectangle that gives a visual representation of the problem. Use the specified variables to label the sides of the rectangle.

(b) Show that the width of the rectangle is \( y = 180 - x \) and its area is \( A = x(180 - x) \).

(c) Use a graphing utility to graph the area equation. Be sure to adjust your window settings.

(d) From the graph in part (c), estimate the dimensions of the rectangle that yield a maximum area.

(e) Use your school’s library, the Internet, or some other reference source to find the actual dimensions and area of a regulation Major League Soccer field and compare your findings with the results of part (d).

87. POPULATION STATISTICS The table shows the life expectancies of a child (at birth) in the United States for selected years from 1920 to 2000. (Source: U.S. National Center for Health Statistics)

<table>
<thead>
<tr>
<th>Year</th>
<th>Life Expectancy, ( y )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>