Section 1.2 Graphs of Equations

Objective: In this lesson you learned how to sketch the graph of an equation.

Important Vocabulary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equation in two variables</td>
<td>A way of expressing a relationship between two quantities.</td>
</tr>
<tr>
<td>Solution of equation in two variables</td>
<td>An ordered pair ((a, b)) is a solution of an equation in (x) and (y) if the equation is true when (a) is substituted for (x) and (b) is substituted for (y).</td>
</tr>
<tr>
<td>Graph of an equation</td>
<td>The set of all points that are solutions of the equation.</td>
</tr>
<tr>
<td>Intercepts</td>
<td>The points at which a graph intersects or touches the (x)- or (y)-axis.</td>
</tr>
<tr>
<td>Symmetry</td>
<td>If a graph is folded along a dividing line and the portion of the graph on one side of the dividing line coincides with the portion of the graph on the other side of the dividing line, then the graph is said to have symmetry.</td>
</tr>
<tr>
<td>Circle</td>
<td>The set of points that are equidistant from a fixed point, ((h, k)), called the center.</td>
</tr>
</tbody>
</table>

I. The Graph of an Equation (Pages 14–17)

To sketch the graph of an equation in two variables using the point-plotting method, . . . if possible, rewrite the equation so that one of the variables is isolated on one side of the equation. Then make a table of values showing several solution points. Plot these points on a rectangular coordinate system. Finally, connect the points with a smooth curve or line.

A shortcoming of the point-plotting method is . . . that with too few solution points, you can misrepresent the graph of an equation.

Example 1: Complete the table. Then use the resulting solution points to sketch the graph of the equation

\[ y = 3 - 0.5x. \]

<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>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
To graph an equation involving $x$ and $y$ on a graphing utility, . . . rewrite the equation so that $y$ is isolated on the left side. Enter the equation into the graphing utility. Determine a viewing window that shows all important features of the graph, and graph the equation.

II. Intercepts of a Graph (Page 17)

An $x$-intercept is written as the ordered pair $(x, 0)$, and a $y$-intercept is written as the ordered pair $(0, y)$.

To identify the $x$-intercepts of a graph, . . . examine the graph to find the points where $y$ is zero.

To identify the $y$-intercepts of a graph, . . . examine the graph to find the points where $x$ is zero.

III. Symmetry (Pages 18–20)

The three types of symmetry that a graph can exhibit are . . . $y$-axis symmetry, origin symmetry, or $x$-axis symmetry.

Knowing the symmetry of a graph before attempting to sketch it is helpful because . . . then you need only half as many solution points to sketch the graph.

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

The graph of an equation is symmetric with respect to the \(x\)-axis if . . . replacing \(y\) with \(-y\) yields an equivalent equation.

The graph of an equation is symmetric with respect to the \(y\)-axis if . . . replacing \(x\) with \(-x\) yields an equivalent equation.

The graph of an equation is symmetric with respect to the origin if . . . replacing \(x\) with \(-x\) and \(y\) with \(-y\) yields an equivalent equation.

Example 2: Use symmetry to sketch the graph of the equation \(y = 2x^2 + 2\).

IV. Circles (Page 20)

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

The standard form of the equation of a circle with radius \(r\) and its center at the origin is \(x^2 + y^2 = r^2\).

Example 3: For the equation \((x + 2)^2 + (y - 1)^2 = 4\), find the center and radius of the circle and then sketch the graph of the equation.

Center: \((-2, 1)\)
Radius: 2
V. Applications of Graphs of Equations  (Page 21)

List and describe three common approaches to solving a problem.
1) Numerical approach: construct and use a table
2) Graphical approach: draw and use a graph
3) Algebraic approach: use the rules of algebra

Describe a real-life situation in which a graphical solution approach would be helpful.

Answers will vary.

Additional notes

What you should learn
How to use graphs of equations in solving real-life problems

Homework Assignment
Page(s)
Exercises