In mathematics, a **coordinate system** is used to locate points. The horizontal number line is called the **x-axis** and the vertical number line is called the **y-axis**. The point where the two axes intersect is the **origin** (0, 0). An **ordered pair** of numbers is used to locate points in the coordinate plane. The point (4, 3) has an **x-coordinate** of 4 and a **y-coordinate** of 3.

### Example 1
Graph A(4, 3) on the coordinate system.

**Step 1** Start at the origin.

**Step 2** Since the x-coordinate is 4, move 4 units to the right.

**Step 3** Since the y-coordinate is 3, move 3 units up. Draw a dot.

A set of ordered pairs is called a **relation**. The set of x-coordinates is called the **domain**. The set of y-coordinates is called the **range**.

### Example 2
Express the relation {(0, 0), (2, 1), (4, 2), (3, 5)} as a table and as a graph. Then determine the domain and range.

<table>
<thead>
<tr>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

The domain is {0, 2, 4, 3}, and the range is {0, 1, 2, 5}.

### Exercises
Graph each point on the coordinate system.

1. A(4,1)  2. B(2,0)
3. C(1,3)  4. D(5,2)
5. E(0,3)  6. F(6,4)
7. Express the relation {(4,6), (0,3), (1,4)} as a table and a graph. Then determine the domain and range.
Graph each point on the coordinate system.

1. \(A(2, 5)\)
2. \(M(6, 4)\)
3. \(Z(1, 1)\)
4. \(R(3, 0)\)
5. \(Q(7, 8)\)
6. \(W(0, 6)\)

Write the ordered pair that names each point.

7. \(N\)
8. \(K\)
9. \(A\)
10. \(V\)
11. \(Z\)
12. \(G\)
13. \(R\)
14. \(B\)

Express each relation as a table and as a graph. Then determine the domain and range.

15. \{ (3, 7), (1, 1), (6, 5), (2, 4) \}
16. \{ (0, 3), (5, 7), (1, 8) \}
17. \{ (2, 3), (3, 2), (1, 7), (7, 1) \}
18. \{ (5, 6), (0, 2), (4, 4), (8, 3) \}
17. GEOMETRY Graph (2, 1), (2, 4), and (5,1) on the coordinate system.
   a. Connect the points with line segments. What figure is formed?
   b. Multiply each number in the set of ordered pairs by 2. Graph and connect the new ordered pairs. What figure is formed?
   c. Compare the two figures you drew. Write a sentence that tells how the figures are the same and how they are different.
**Solution Sets**

Consider the following open sentence.

It is a robot that starred in STAR WARS.

You know that a replacement for the word *It* must be found in order to determine if the sentence is true or false. If *It* is replaced by either *R2D2* or *C3PO*, the sentence is true.

The set \{R2D2, C3PO\} can be thought of as the solution set of the open sentence given above. This set includes all replacements for the word that make the sentence true.

Write the solution set of each open sentence.

1. It is the name of a state beginning with the letter A. \{Alabama, Alaska, Arkansas, Arizona\}
2. It is a primary color. \{red, yellow, blue\}
3. Its capital is Harrisburg. \{Pennsylvania\}
4. It is a New England state. \{Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont\}
5. He was one of the Seven Dwarfs. \{Doc, Happy, Sleepy, Bashful, Grumpy, Sneezy, Dopey\}
6. It is a month that contains the letter q.
7. During the 1990s, she was the wife of a U.S. President. \{Barbara Bush, Hillary Clinton\}
8. It is an even number between 1 and 13. \{2, 4, 6, 8, 10, 12\}
9. \(x + 5 \leq 10\) \{6\}
10. \(31 \leq 72 - k\) \{41\}
11. It is the square of 2, 3, or 4. \{4, 9, 16\}

Write a description of each set.

12. \{A, E, I, O, U\} the vowels
13. \{1, 3, 5, 7, 9\} the odd numbers between 0 and 10
14. June, July, August the months between May and September
15. Atlantic, Pacific, Indian, Arctic the oceans
16. Gateway Arch, Statue of Liberty, Grand Canyon, Mount Rushmore the landmarks

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**Enrichment**

**Example 1**

Graph \(A(4, 3)\) on the coordinate system.

- **Step 1** Start at the origin.
- **Step 2** Since the \(x\)-coordinate is 4, move 4 units to the right.
- **Step 3** Since the \(y\)-coordinate is 3, move 3 units up. Draw a dot.

A set of ordered pairs is called a relation. The set of \(x\)-coordinates is called the domain. The set of \(y\)-coordinates is called the range.

**Graph each point on the coordinate system.**

1. \(A(4, 1)\)
2. \(B(2, 0)\)
3. \(C(1, 3)\)
4. \(D(5, 2)\)
5. \(E(0, 3)\)
6. \(F(6, 4)\)

7. Express the relation \{(4, 6), (0, 3), (1, 4)\} as a table and a graph. Then determine the domain and range.

   - **Domain:** \{4, 0, 1\}
   - **Range:** \{6, 3, 4\}

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**Study Guide and Intervention**

**Ordered Pairs and Relations**

In mathematics, a coordinate system is used to locate points. The horizontal number line is called the \(x\)-axis and the vertical number line is called the \(y\)-axis. The point where the two axes intersect is the origin \((0, 0)\). An ordered pair of numbers is used to locate points in the coordinate plane. The point \((4, 3)\) has an \(x\)-coordinate of 4 and a \(y\)-coordinate of 3.
17. **GEOMETRY** Graph (2, 1), (2, 4), and (5, 1) on the coordinate system.

a. Connect the points with line segments. What figure is formed? a right triangle

b. Multiply each number in the set of ordered pairs by 2. Graph and connect the new ordered pairs. What figure is formed? a right triangle
c. Compare the two figures you drew. Write a sentence that tells how the figures are the same and how they are different. Sample answer: Both figures are right triangles, but one is twice as large as the other.