4.4 Matching Equations and Graphs

**FOCUS** Match equations and graphs of linear relations.

### Example 1

**Matching Equations with Graphs**

Match each graph on the grid with its equation.

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

#### Solution

Substitute \( x = -1, \ 0, \ 1 \) in each equation.

\[
\begin{array}{|c|c|}
\hline
x & y \\
\hline
-1 & -1 \\
0 & 0 \\
1 & 1 \\
\hline
\end{array}
\]

*We chose to use x-values of \(-1, 0, \ 1\) because they're often easy to substitute.*

Points \((-1, \ -1), \ (0, \ 0), \ \text{and} \ (1, \ 1)\) lie on Graph B.

So, \(y = x\) matches Graph B.

\[
\begin{array}{|c|c|}
\hline
x & y \\
\hline
-1 & 1 \\
0 & 0 \\
1 & -1 \\
\hline
\end{array}
\]

Points \((-1, \ 1), \ (0, \ 0), \ \text{and} \ (1, \ -1)\) lie on Graph A.

So, \(y = -x\) matches Graph A.

### Check

1. Which equation describes the graph at the right?

\[
\begin{array}{|c|c|}
\hline
x & y = x + 2 \\
\hline
0 & y = 0 + 2 = \_
\hline
1 & y = \_
+ 2 = \_
\hline
2 & y = \_
+ 2 = \_
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
x & y = x - 2 \\
\hline
0 & y = \_
- 2 = \_
\hline
1 & y = \_
= \_
\hline
2 & y = \_
= \_
\hline
\end{array}
\]

Points \(\_
, \ 
, \ \) do not lie on the graph.

Points \(\_
, \ 
, \ \) lie on the graph.

So, the equation \(y = \_
\) describes the graph.
Example 2  Identifying a Graph Given Its Equation

Which graph on this grid has the equation \( y = x - 1 \)?

Solution

Pick 2 points on each graph and check if their coordinates satisfy the equation.

For Graph A, use: \( C(-1, 0) \) and \( D(0, 1) \)
Check if \( C(-1, 0) \) satisfies the equation \( y = x - 1 \).
Substitute \( x = -1 \) and \( y = 0 \) in \( y = x - 1 \)
Left side: \( y = 0 \)    Right side: \( x - 1 = (-1) - 1 \)
\[ = -2 \]

The left side does not equal the right side.
So, Graph A does not have equation \( y = x - 1 \).

Verify that the other graph does match the equation.
For Graph B, use: \( E(0, -1) \) and \( F(1, 0) \)
Check if \( E(0, -1) \) satisfies the equation \( y = x - 1 \).
Substitute \( x = 0 \) and \( y = -1 \) in \( y = x - 1 \)
Left side: \( y = -1 \)    Right side: \( x - 1 = 0 - 1 \)
\[ = -1 \]

The left side does equal the right side.
So, \( E(0, -1) \) lies on the line represented by \( y = x - 1 \).

Check if \( F(1, 0) \) satisfies the equation \( y = x - 1 \).
Substitute \( x = 1 \) and \( y = 0 \) in \( y = x - 1 \)
Left side: \( y = 0 \)    Right side: \( x - 1 = 1 - 1 \)
\[ = 0 \]

The left side does equal the right side.
So, \( F(1, 0) \) lies on the line represented by \( y = x - 1 \).
So, Graph B has equation \( y = x - 1 \).
1. Show that this graph has equation \( y = 2x + 1 \).
   Use the points labelled on the graph.
   For A(0, 1): Substitute \( x = 0 \) and \( y = 1 \) in \( y = 2x + 1 \).
   Left side: \( y = \_\_\_\_\_\_\_\_ \) Right side: \( 2x + 1 = \_\_\_\_\_\_\_\_ \)
   \( = \_\_\_\_\_\_\_\_ \)
   \( = \_\_\_\_\_\_\_\_ \)
   For B(1, 3): Substitute \( x = \_\_\_\_\_\_\_\_ \) and \( y = \_\_\_\_\_\_\_\_ \) in \( y = 2x + 1 \).
   Left side: \( y = \_\_\_\_\_\_\_\_ \) Right side: \( 2x + 1 = \_\_\_\_\_\_\_\_ \)
   \( = \_\_\_\_\_\_\_\_ \)
   \( = \_\_\_\_\_\_\_\_ \)

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**Practice**

1. Show that the equation \( y = x + 2 \) matches the graph.
   Fill in the table of values.
   \[
   \begin{array}{c|c}
   x & y = x + 2 \\
   \hline
   -2 & \_\_\_\_\_\_\_\_ \\
   -1 & \_\_\_\_\_\_\_\_ \\
   0 & \_\_\_\_\_\_\_\_ \\
   \end{array}
   \]
   From the table:
   Points (______, ______), and (______) lie on the graph.
   So, \( y = x + 2 \) matches the graph.

2. Match each equation with a graph.
   \( y = 3x \) \quad \text{and} \quad \( y = -3x \)
   Fill in the tables of values.
   \[
   \begin{array}{c|c}
   x & y = 3x \\
   \hline
   -1 & \_\_\_\_\_\_\_\_ \\
   0 & \_\_\_\_\_\_\_\_ \\
   1 & \_\_\_\_\_\_\_\_ \\
   \end{array} \quad \begin{array}{c|c}
   x & y = -3x \\
   \hline
   -1 & \_\_\_\_\_\_\_\_ \\
   0 & \_\_\_\_\_\_\_\_ \\
   1 & \_\_\_\_\_\_\_\_ \\
   \end{array}
   \]
   From the tables:
   \( y = 3x \) has points (______, ______), and (______).
   These points lie on Graph ______.
   So, \( y = 3x \) matches Graph ______.

   \( y = -3x \) has points (______, ______), and (______).
   These points lie on Graph ______.
   So, \( y = -3x \) matches Graph ______.

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3. Match each equation with a graph.

\[ y = 1 - x \quad \text{and} \quad y = x - 1 \]

![Graph A](image1)

![Graph B](image2)

Fill in the tables of values.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( y = 1 - x )</th>
<th>( x )</th>
<th>( y = x - 1 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-1</td>
<td>( y = 1 - (__) = ___ )</td>
<td>-1</td>
<td>( y = ___ = ___ )</td>
</tr>
<tr>
<td>0</td>
<td>( y = 1 - ___ = ___ )</td>
<td>0</td>
<td>( y = ___ = ___ )</td>
</tr>
<tr>
<td>1</td>
<td>( y = 1 - ___ = ___ )</td>
<td>1</td>
<td>( y = ___ = ___ )</td>
</tr>
</tbody>
</table>

From the tables:

\( y = 1 - x \) has points (______), (______), and (______).
These points lie on Graph ______.
So, \( y = 1 - x \) matches Graph ______.

\( y = x - 1 \) has points (______), (______), and (______).
These points lie on Graph ______.
So, \( y = x - 1 \) matches Graph ______.

4. Which graph has equation \( y = x - 3 \)?

For C(3, 0):
Left side: \( y = \_\_\_\_ \) Right side: \( x - 3 = \_\_\_\_ \)
\( y = \_\_\_\_ \) = \_\_\_\_ \)
The left side ______ equal the right side.

For E(0, -3):
Left side: \( y = \_\_\_\_ \) Right side: \( x - 3 = \_\_\_\_ \)
\( y = \_\_\_\_ \) = \_\_\_\_ \)
The left side ______ the right side.
For F(3, 0):
Left side: \( y = \_\_\_\_ \) Right side: \( x - 3 = \_\_\_\_ \)
\( y = \_\_\_\_ \) = \_\_\_\_ \)

So, Graph _____ has equation \( y = x - 3 \).
Lesson 4.4: Matching Equations and Graphs

1. Match each equation with a graph on this grid.
   a) \( y = 2x - 1 \)
   b) \( y = -x + 4 \)
   c) \( y = 3x - 3 \)

2. Match each equation with a graph on this grid.
   a) \( y = -1 \)
   b) \( 0 = -x + 1 \)
   c) \( 2 = 2x - 3 \)

3. Match each equation with a graph on this grid. Justify your answers.
   a) \( x + y = 5 \)
   b) \( x - y = 5 \)
   c) \( x + y = -5 \)

4. Which equation describes this graph? Justify your answers.
   a) \( y = x + 2 \)
   b) \( y = -x + 2 \)
   c) \( y = x - 2 \)

5. Which equation describes this graph? Justify your answers.
   a) \( x - y = 4 \)
   b) \( x - 4y = 4 \)
   c) \( 4x - y = 1 \)