Lesson 6.4
Midpoint Formula & Partitions

Concept: Partitions

EQ: How do we partition a line segment in the coordinate plane? (G.GPE.6)

Vocabulary: Midpoint, Partition, Ratio, Proportion

Introduction

- A **line segment** is a part of a line that is noted by two endpoints, \((x_1, y_1)\) and \((x_2, y_2)\).
- You can **partition** or divide a line segment in lots of different ways.
- A popular partition is dividing a line segment into two equal parts. The point on the segment where this division occurs is called the **midpoint**.
### Steps to Finding the Midpoint of a Line Segment

1. Determine the **endpoints** of the line segment, 
   \((x_1, y_1)\) and \((x_2, y_2)\).
2. Write the Midpoint Formula. \[
\left( \frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)
\]
3. **Substitute** the values of \((x_1, y_1)\) and \((x_2, y_2)\) into the midpoint formula:
4. **Simplify**.
**Guided Practice - Example 1**

Calculate the midpoint of the line segment with endpoints \((-2, 1)\) and \((4, 10)\).

<table>
<thead>
<tr>
<th>1. Write and label the endpoints of the line segment.</th>
<th>3. Substitute your endpoints into the Midpoint Formula.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Write the Midpoint Formula.</td>
<td>4. Simplify.</td>
</tr>
</tbody>
</table>
Guided Practice - Example 2
Calculate the midpoint of the line segment with endpoints (–8, –4) and (2, 0).

<table>
<thead>
<tr>
<th>Step</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Write and label the endpoints of the line segment.</td>
</tr>
<tr>
<td>2.</td>
<td>Write the Midpoint Formula.</td>
</tr>
<tr>
<td>3.</td>
<td>Substitute your endpoints into the Midpoint Formula.</td>
</tr>
<tr>
<td>4.</td>
<td>Simplify.</td>
</tr>
</tbody>
</table>

6.2.1: Midpoints and Other Points on Line Segments
Individual Practice – You Try 1
Calculate the midpoint of the line segment with endpoints (1, 3) and (4, 5).

1. Write and label the endpoints of the line segment.

2. Write the Midpoint Formula.

3. Substitute your endpoints into the Midpoint Formula.

4. Simplify.
Guided Practice - Example 3

A line segment has an endpoint at (6, 0) and a midpoint at (3, 1). Determine the coordinates of the other endpoint.

1. Draw the line segment and label it with the points provided.
\[(6, 0) \quad (3, 1)\]

2. Compare the x-values of the endpoint to the midpoint. State the translation from the endpoint to the midpoint.
\[6 - 3 = 3\]
\textit{Subtract 3}

3. Compare the y-values of the endpoint to the midpoint. State the translation from the endpoint to the midpoint.
\[0 + 1 = 1\]
\textit{Add 1}

4. Using your answers from steps 2 and 3, write the ordered pair of the other endpoint from the midpoint.
\[(3, 1) \rightarrow (3 - 3, 1 + 1) = (0, 2)\]
Individual Practice – You Try 2

A line segment has an endpoint at (2, -2) and a midpoint at (3, 0). Determine the coordinates of the other endpoint.

1. Draw the line segment and label it with the points provided.

2. Compare the x-values of the endpoint to the midpoint. State the translation from the endpoint to the midpoint.

3. Compare the y-values of the endpoint to the midpoint. State the translation from the endpoint to the midpoint.

4. Using your answers from steps 2 and 3, write the ordered pair of the other endpoint from the midpoint.
**Steps to Partitioning a Line Segment with any given fraction or ratio**

*If given a ratio, convert it to a fraction.

1. Draw the line segment on a coordinate plane.

2. Calculate the difference between the $x$-values: $|x_2 - x_1|$. Multiply your answer to the given fraction. Move this many units to the left or the right of your endpoint on your graph.

3. Calculate the difference between the $y$-values: $|y_2 - y_1|$. Multiply your answer to the given fraction. Move this many units up or down from where you left off at on the graph at the end of step 2.

4. State the point where the segment is partitioned.
Guided Practice - Example 4

Determine the point that is \(\frac{1}{4}\) the distance from the endpoint (-3, 7) of the segment with endpoints (-3, 7) and (5, -9).

1. Draw the segment on a coordinate plane.
Guided Practice - Example 4

2. Calculate the difference between the x-values $|x_2 - x_1|$. ______________

Multiply this answer by the fraction.

_________ $\cdot \frac{1}{4} = ______$

Move this many units to the left or right of your endpoint (-3, 7) on your graph.
Guided Practice - Example 4

3. Calculate the difference between the y-values $|y_2 - y_1|$. ______________

Multiply this answer by the fraction. 

____________ $\cdot \frac{1}{4} = ______$

Move this many units up or down from where you left off on the graph from step 2.

4. State the point that is $\frac{1}{4}$ the distance from the endpoint (-3, 7): __________
Guided Practice - Example 5
Given a line segment with endpoints (2, 9) and (-4, -6), what are the coordinates of the point that partitions the segment in the ratio 2:1?

*Before we can begin, we need to change the ratio to a fraction. The ratio 2:1 means 2 pieces to 1 piece. There are a total of 3 pieces that the segment will be partitioned into. So our fraction is $\frac{2}{3}$.
Guided Practice - Example 5

Given a line segment with endpoints (2, 9) and (-4, -6), what are the coordinates of the point that partitions the segment in the ratio 2:1?

1. Draw the segment on a coordinate plane.
Guided Practice - Example 5

2. Calculate the difference between the x-values $|x_2 - x_1|$. ______________

Multiply this answer by the fraction.

$\text{________} \cdot \frac{2}{3} = \text{_______}$

Move this many units to the left or right of your endpoint (2, 9) on your graph.

\[ (-4, -6) \]
Guided Practice - Example 5

3. Calculate the difference between the y-values $|y_2 - y_1|$. __________

Multiply this answer by the fraction.

_________ $\cdot \frac{2}{3} = ______$

Move this many units up or down from where you left off on the graph from step 2.

4. State the point that is $\frac{2}{3}$ the distance from the endpoint (2, 9): __________
Independent Practice – You Try 3

Determine the point that is \( \frac{1}{3} \) the distance from the endpoint \((4, 1)\) of the segment with endpoints \((4, 1)\) and \((10, 10)\).
Message to Absent Friend

Suppose a friend of yours in this class was absent today and missed this lesson…
They send you a text message later asking you what they missed and how do they do the homework.
Write or text me your response to them.

You must include at least 2 vocabulary words and 3 sentences in your response!

*If texting use this #37607 and I’ll give you the code*. 

6.2.1: Midpoints and Other Points on Line Segments