

Midpoints in the Coordinate Plane

ID: 8612

Time required
40 minutes

Activity Overview

In this activity, students will explore midpoints in the coordinate plane. Beginning with horizontal or vertical segments, students will show the coordinates of the endpoints and make a conjecture about the coordinates of the midpoint. This conclusion is extended to other segments in the coordinate plane.

Topic: Points, Lines & Planes

- Given the coordinates of the ends of a line segment, write the coordinates of its midpoint.

Teacher Preparation and Notes

- This activity is intended to be used in a middle school or high school geometry classroom.
- Depending on student skill level, you may wish to use points with integer coordinates, or only positive values.
- The Coordinate Midpoint formula for the midpoint of (x_1, y_1) and (x_2, y_2) is $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$. This can also be expressed as “The coordinates of the midpoint of a line segment are the averages of the coordinates of the endpoints.”
- Trisection Points is an optional extension, which can be used depending on time and student ability. The trisection points of a segment with endpoints (x_1, y_1) and (x_2, y_2) are $\left(\frac{x_1 + x_2}{3}, \frac{y_1 + y_2}{3}\right)$ and $\left(\frac{2(x_1 + x_2)}{3}, \frac{2(y_1 + y_2)}{3}\right)$.
- Notes for using the TI-Nspire™ Navigator™ System are included throughout the activity. The use of the Navigator System is not necessary for completion of this activity.
- To download the student TI-Nspire document (.tns file) and student worksheet, go to <http://education.ti.com/exchange> and enter “8612” in the keyword search box.**

Associated Materials

- MidptCoordPlane_Student.doc
- MidptCoordPlane.tns

Suggested Related Activities

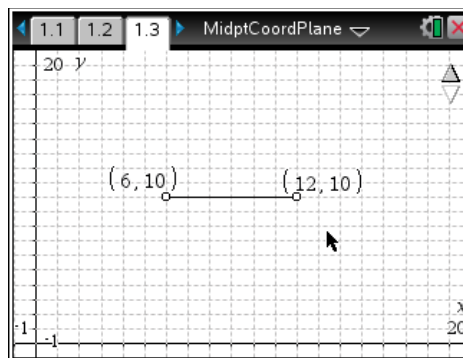
To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- Division of Integers (TI-84 Plus family) — 1433
- Multiplication of Integers (TI-84 Plus family) — 1434
- Integers (TI-84 Plus family, TI-Navigator Technology) — 4412

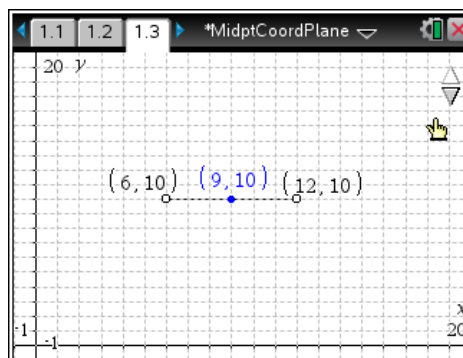
Problem 1 – Midpoints of Horizontal or Vertical Segments

Have students open the file and read the directions on page 1.2.

On page 1.3, students will see a line segment and the coordinates of the endpoints displayed.

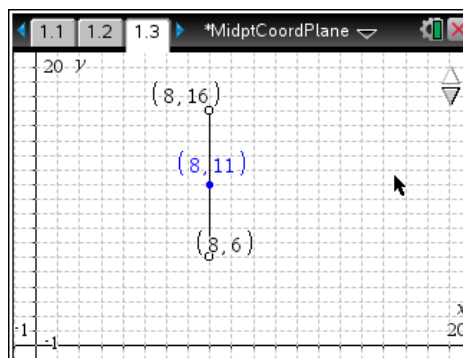


Students should make a prediction about the coordinates for the midpoint of the segment. Have students plot a point on the segment where they think the midpoint will be. To check their predictions, have students press the up arrow to display the actual midpoint and compare.



Tell students to hide the midpoint and coordinates of the midpoint by pressing the down arrow before moving the segment.

Students can now drag the endpoints to create a vertical segment and then make a prediction for the new coordinates of the midpoint by using their previous prediction point. They can verify their prediction by pressing the up arrow again.

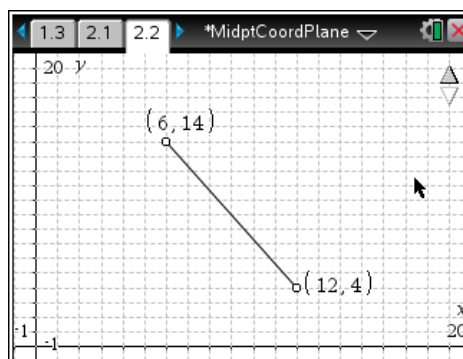


Note: If desired, have students explore the midpoint of a segment whose endpoints do not have integer coordinates by selecting **MENU > Window/Zoom > Window Settings** and dividing each value by 10. They can also explore what happens when one or both endpoints are not in Quadrant 1.

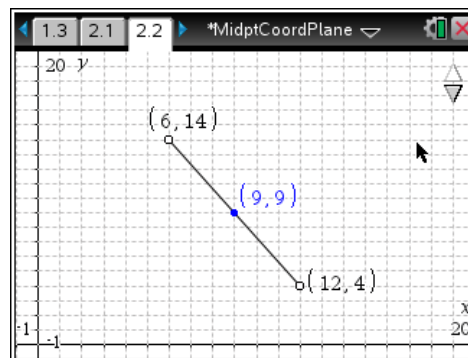
Problem 2 – Midpoints of Diagonal Segments

Direct students to advance to page 2.1 and read the directions.

On page 2.2, students will see a diagonal segment and the coordinates of the endpoints.

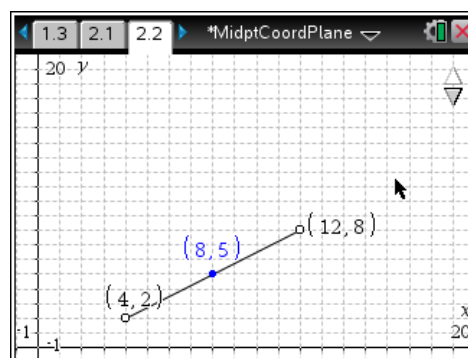


They should use the endpoint coordinates to make a prediction about the coordinates of the midpoint. Again, have students plot a point where they think the midpoint should be.



To check their prediction, students can press the up arrow to display the actual midpoint and its coordinates.

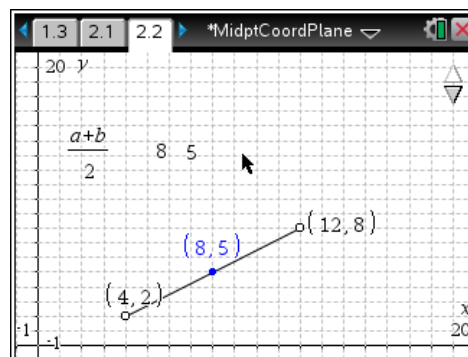
Tell students to hide the midpoint and its coordinates by pressing the down arrow.



Students can drag the endpoints to create a different diagonal segment and then make a prediction for the new coordinates of the midpoint. Students can confirm their prediction by pressing the up arrow again.

Discuss how to calculate the coordinates of the midpoint of a segment if the coordinates of the endpoints are known. Then, challenge students to write a formula or a rule for calculating midpoints.

To observe how the midpoint is related to the endpoints, students should press **MENU > Actions > Text** and enter the expression $(a+b)/2$ in a text box.



Then select **MENU > Actions > Calculate**, click on the expression, and click on the x-values of the coordinates for the endpoints for a and b . Tell students to repeat the calculation with the y -values of the coordinates for the endpoints.

If desired, students can press the up arrow to display the actual midpoint and its coordinates and compare it to their calculations.

Now they can drag the segment endpoints and observe the calculation results as they update.

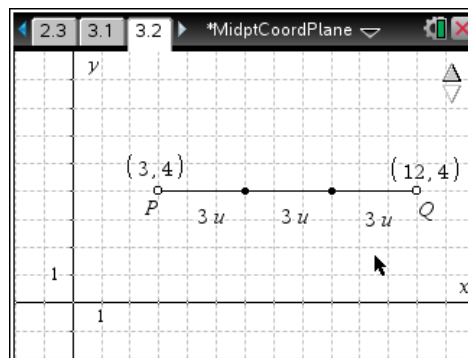
Discuss how these calculation results relate to the coordinates of the midpoint.

TI-Nspire Navigator Opportunity: Quick Poll
See Note 1 at the end of this lesson.

Extension – Trisection Points

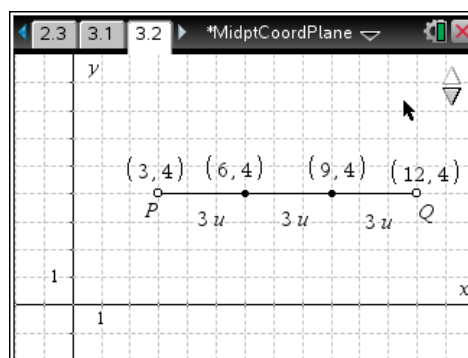
Students will read the directions on page 3.1 and then advance to page 3.2. There is a segment displayed with its two *trisection points*, which divide the segment into three equal sections.

If needed, they can select **MENU > Geometry > Measurement > Length** and measure the lengths of each section to confirm that the segment is trisected.



Students should make a prediction about the coordinates of the trisection points. To confirm their prediction, students can show the coordinates of the trisection points by pressing the up arrow.

Have students explore the relationship between the coordinates of the segment endpoints and the trisection points by dragging points P or Q to adjust the location of the segment. Challenge them to write a formula for the trisection points.



TI-Nspire Navigator Opportunities

Note 1

Problems 1–2, *Quick Poll*

You may choose to use *Quick Poll* to assess student understanding. The worksheet questions can be used as a guide for possible questions to ask.