

Key Concepts



Integration: Geometry

Midpoint of a Line Segment

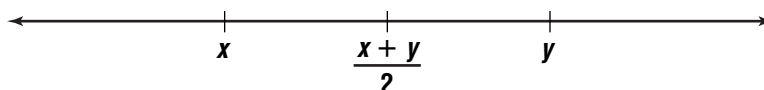
Objective Introduce students to the algebraic formula for the midpoint of a line segment, whose endpoints are given by ordered pairs of numbers.

Note to the Teacher *This is a relatively straightforward lesson, which shows that the x - and y -coordinates of the midpoint of a line segment can be obtained by taking the averages of the x - and y -coordinates, respectively. It can be introduced by showing the average of two numbers on the number line.*

Begin by reminding students of the formula for the average of two numbers x and y .

$$\text{average} = \frac{x + y}{2}$$

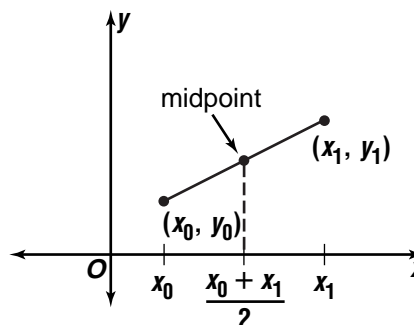
Show students this diagram.



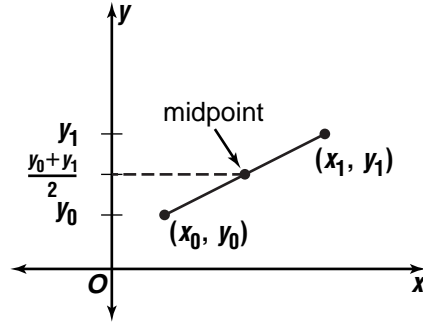
Explain that the average is the **midpoint** of the segment between the two points, or the halfway point between x and y . Ask the class to work out some specific examples, where they compute the average and draw it on the number line, to reinforce this idea.

Next, ask the following question. “Two points in a plane have coordinates (x_0, y_0) and (x_1, y_1) . How can we find the coordinates of the midpoint of the segment joining them?”

Make the point that, for two points in a plane, the halfway point between them should have an x -coordinate that is halfway between the x -coordinates of the two points. This is shown in the diagram at the right.



Explain that in the same way, the y -coordinate of the midpoint is the midpoint of the y -coordinates. The formula for the y -coordinate of the midpoint is $\frac{y_0 + y_1}{2}$. This is shown in the diagram at the right.



The formula for the coordinates of the midpoint of a line segment is given below.

Definition of Midpoint	The midpoint of the segment joining two points at (x_0, y_0) and (x_1, y_1) is given by $\left(\frac{x_0 + x_1}{2}, \frac{y_0 + y_1}{2}\right)$.
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Now have students practice using the formula to find midpoints of line segments. They could work on the following exercises in class.

Exercises

Find the coordinates of the midpoint of a segment with each pair of endpoints.

1. $A(9, 4), B(7, 6)$ **(8, 5)**
2. $L(8, -2), M(0, 10)$ **(4, 4)**
3. $X(2, 5), Y(-6, 3)$ **(-2, 4)**
4. $T(1, -9), U(4, 7)$ **(2.5, -1)**

