Introduction to Mathematics

## Week 3

Formation of Equation

- **Unit 3.2**

Distance & Midpoint Formula

Rectangular Coordinate System

- In order to understand the midpoint and distance formulae, we first need to understand the rectangular coordinate system.

- Rectangular Coordinate System is based on a Cartesian Plane.

- These may look like difficult names but you're already familiar with this.

Axes
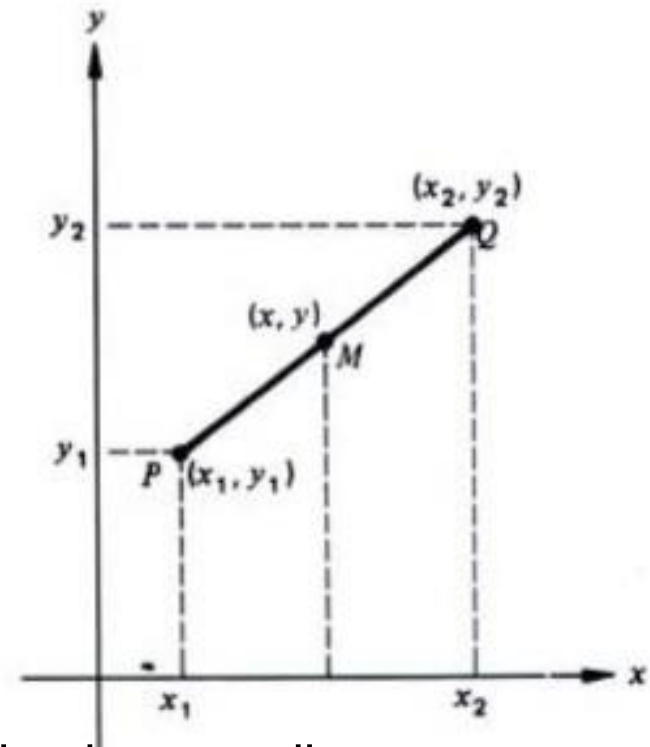**Origin**
Ordered Pair
Quadrants
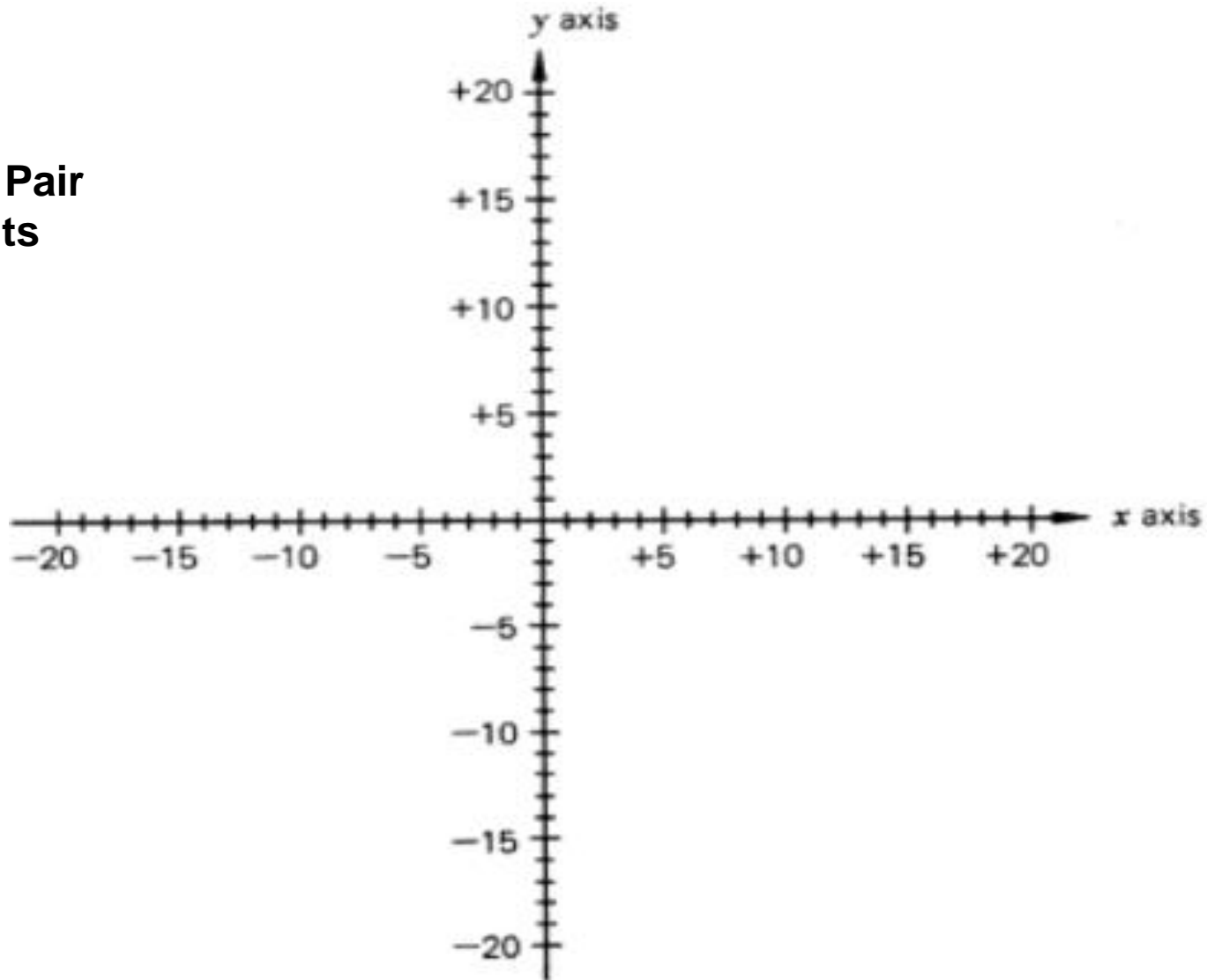
Midpoint Formula

Consider this line:

This is a line that is made by connecting two points.

What if we want to know the midpoint of this line?
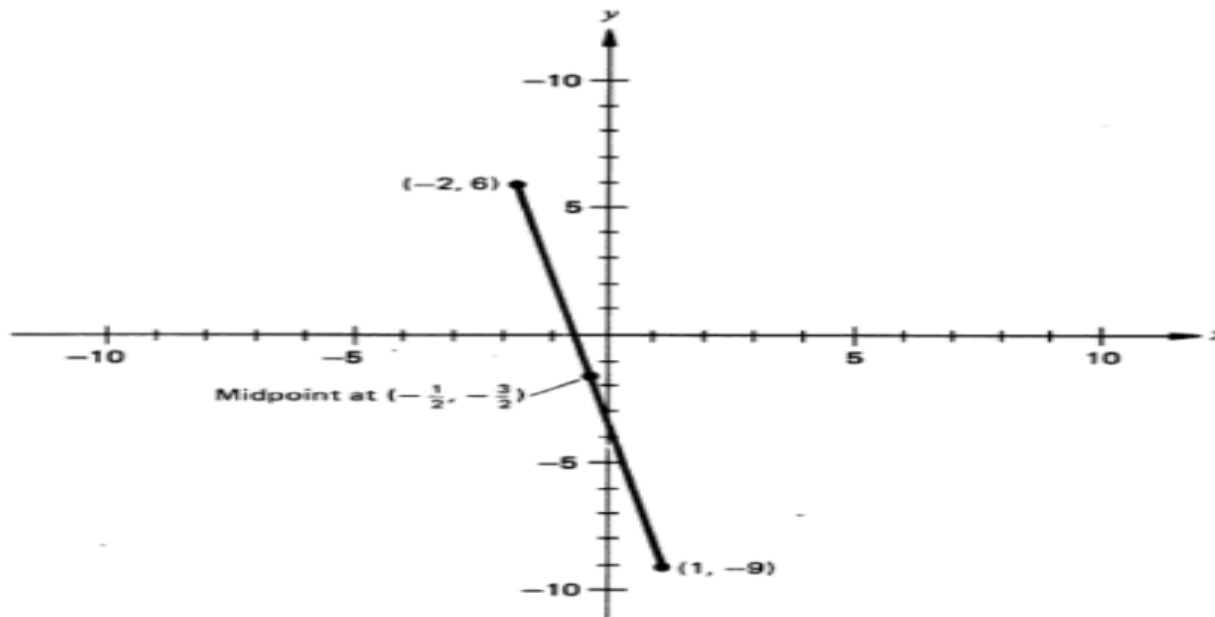
In such case, we use the midpoint formula.

The midpoint M of a line connecting two points having coordinates (x_1, y_1) and (x_2, y_2) is :

$$\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$$

Examples

To find the midpoint of the line segment connecting $(-2, 6)$ and $(1, -9)$, we apply

$$\left(\frac{-2+1}{2}, \frac{6+(-9)}{2}\right) = \left(\frac{-1}{2}, \frac{-3}{2}\right)$$

Distance Formula

- Given two points on a cartesian plane, the distance separating the two points can be found by using the distance formula.
- The distance between point A and B, denoted as d(A,B), can be calculated by the formula

$$d(A, B) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Example

Find the length of the line segment connecting points A and B located at $(-2, 5)$ and $(1, 1)$, respectively.

SOLUTION

Applying the distance formula gives

$$
\begin{aligned}
{}'d(A, B) &= \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2} \\
&= \sqrt{[1 - (-2)]^2 + (1 - 5)^2} \\
&= \sqrt{(3)^2 + (-4)^2} \\
&= \sqrt{25} \\
&= 5
\end{aligned}
$$

Practice

- Find the midpoint of the line segment connecting (4,12) and (-2,-18).
  Answer = (1, -3)

- Find the length of the line segment connecting (4, -2) and (-3, 6).
  Answer = 10.63

Helping Material

- https://www.khanacademy.org/math/algebra/x2f8bb11595b61c86:foundation-algebra/x2f8bb11595b61c86:algebra-overview-history/v/descartes-and-cartesian-coordinates

- https://www.khanacademy.org/math/geometry/hs-geo-analytic-geometry/hs-geo-distance-and-midpoints/v/midpoint-formula

- https://www.youtube.com/watch?v=Mvnt0BPzfL8

- https://www.youtube.com/watch?v=0IOEPcAHgi4

Thank you