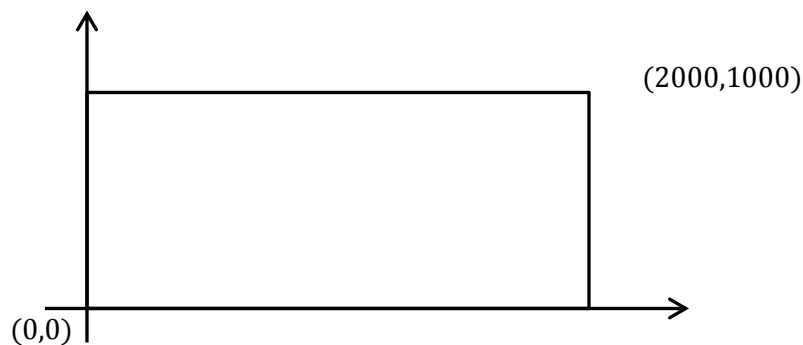


Lesson 1: Searching a Region in the Plane

Classwork

Exploratory Challenge

Students in a robotics class must program a robot to move about an empty rectangular warehouse. The program specifies location at a given time t seconds. The room is twice as long as it is wide. Locations are represented as points in a coordinate plane with the southwest corner of the room deemed the origin, $(0,0)$, and the northeast corner deemed the point $(2000,1000)$ in feet, as shown in the diagram below.



The first program written has the robot moving at a constant speed in a straight line. At time $t = 1$ second, the robot is at position $(30,45)$, and at $t = 3$ seconds, it is at position $(50,75)$. Complete the exercises, and answer the questions below to program the robot's motion.

- At what location will the robot hit the wall?
- At what speed will the robot hit the wall?
- At what time will the robot hit the wall?

Exercises

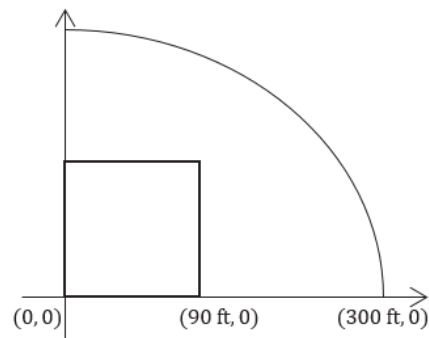
1. Plot the points on a coordinate plane.
2. Draw the segment connecting the points.
3. How much did the x -coordinate change in 2 seconds?
4. How much did the y -coordinate change in 2 seconds?
5. What is the ratio of change in y to the change in x ?
6. What is the equation of the line of motion?
7. What theorem could be used to find the distance between the points?
8. How far did the robot travel in 2 seconds?

Problem Set

1. A robot from the video now moves around an empty 100 ft. by 100 ft. storage room at a constant speed. If the robot crosses $(10,10)$ at 1 second and $(30,30)$ at 6 seconds:
 - a. Plot the points, and draw the segment connecting the points.
 - b. What was the change in the x -coordinate?
 - c. What was the change in the y -coordinate?
 - d. What is the ratio of the change in y to the change in x ?
 - e. How far did the robot travel between the two points?
 - f. What was the speed of the robot?
 - g. Where did the robot start?

2. Your mother received a robot vacuum cleaner as a gift and wants you to help her program it to clean a vacant 30 ft. by 30 ft. room. If the vacuum is at position $(12,9)$ at time $t = 2$ seconds and at position $(24,18)$ at $t = 5$ seconds, answer the following:
 - a. How far did the robot travel over 3 seconds?
 - b. What is the constant speed of the robot?
 - c. What is the ratio of the change in the x -coordinate to the change in the y -coordinate?
 - d. Where did the robot start?
 - e. Where will the robot be at $t = 3$ seconds? Explain how you know.
 - f. At what location will the robot hit the wall?
 - g. At what time will the robot hit the wall?

3. A baseball player hits a ball at home plate at position $(0,0)$. It travels at a constant speed across first base at position $(90,0)$ in 2 seconds.
 - a. What was the speed of the ball?
 - b. When will it cross the fence at position $(300,0)$? Explain how you know.



4. The tennis team has a robot that picks up tennis balls. The tennis court is 36 feet wide and 78 feet long. The robot starts at position $(8,10)$ and is at position $(16,20)$ at $t = 4$ seconds after moving at a constant speed. When will it pick up the ball located at position $(28,35)$?