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,, 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, , and the northeast corner deemed the point , as shown in the diagram below.

The first program written has the robot moving at a constant speed in a straight line. At time second, the robot is at position , and at seconds, it is at position . Complete the exercises and answer the questions below to program the robot’s motion.

* 1. Where is the location of impact?
  2. At what speed will the robot hit the wall?
  3. At what time will the robot hit the wall?

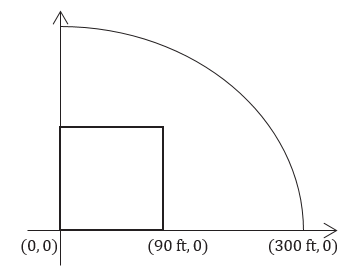
Exercises 1–8

1. Plot the points on a coordinate plane.
2. Draw the line connecting the segments.
3. How much did the -coordinate change in seconds?
4. How much did the -coordinate change in seconds?
5. What is the ratio of change in to change in ?

1. What is the equation of the line of motion?

1. What theorem could be used to find the distance between the points?
2. How far did the robot travel in seconds?

Problem Set

1. The robot in the video is moving around an empty ft. by ft. storage room at a constant speed. If the robot crosses at second and at seconds:
   1. Plot the points and draw the segment connecting the points.
   2. What was the change in the -coordinate?
   3. What was the change in the -coordinate?
   4. What is the ratio of the change in to the change in ?
   5. How far did the robot travel between the two points?
   6. What was the speed of the robot?
   7. 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 ft. by ft. room. If the vacuum is at position at time seconds and at position at seconds, answer the following:
   1. How far did the robot travel over seconds?
   2. What is the speed?
   3. What is the ratio of the change in the -coordinate to the change in the -coordinate?
   4. Where did the robot start?
   5. Where will the robot be at seconds? Explain how you know.
   6. What is the location of impact?
   7. At what time will the robot hit the wall?
3. A baseball player hits a ball at home plate at position . It travels at a constant speed across first base at position in seconds.
   1. What was the speed of the ball?
   2. When will it cross the fence at position ? Explain how you know.
4. The tennis team has a robot that picks up tennis balls. The tennis court is feet wide and feet long. The robot starts at position and is at position at seconds. When will it pick up the ball located at position ?