# Lesson 14: Motion Along a Line—Search Robots Again 

## Classwork

## Opening Exercise

a. If $f(t)=(t, 2 t-1)$, find the values of $f(0), f(1)$, and $f(5)$, and plot them on a coordinate plane.
b. What is the image of $f(t)$ ?
c. At what time does the graph of the line pass through the $y$-axis?
d. When does it pass through the $x$-axis?
e. Can you write the equation of the line you graphed in slope $y$-intercept form?
f. How does this equation compare with the definition of $f(t)$ ?

## Example 1

Programmers want to program a robot so that it moves at a uniform speed along a straight line segment connecting two points $A$ and $B$. If $A(0,-1)$ and $B(1,1)$, and the robot travels from $A$ to $B$ in $t=1$ minute,
a. Where is the robot at $t=0$ ?
b. Where is the robot at $t=1$ ?
c. Draw a picture that shows where the robot will be at $0<t<1$.

## Exercise 1

A robot is programmed to move along a straight line path through two points $A$ and $B$. It travels at a uniform speed that allows it to make the trip from $A(0,-1)$ to $B(1,1)$ in $t=1$ minute. Find the location, $P$, when
a. $\quad t=\frac{1}{4}$
b. $\quad t=0.7$
c. $\quad t=\frac{5}{4}$
d. $\quad t=2.2$

## Example 2

Our robot has been reprogrammed so that it moves along the same straight line path through two points $A(0,-1)$ and $B(1,1)$ at a uniform rate but makes the trip in 0.6 minutes instead of 1 minute.

How does this change the way we calculate the location of the robot at any time, $t$ ?
a. Find the location, $P$, of the robot from Example 1 if the robot were traveling at a uniform speed that allowed it to make the trip from $A$ to $B$ in $t=0.6$ minutes. Is the robot's speed greater or less than the robot's speed in Example 1?
b. Find the location, $P$, of the robot from Example 1 if the robot were traveling at a uniform speed that allowed it to make the trip from $A$ to $B$ in $t=1.5$ minutes. Is the robot's speed greater or less than the robot's speed in Example 1?

## Exercise 2

Two robots are moving along straight line paths in a rectangular room. Robot 1 starts at point $A(20,10)$ and travels at a constant speed to point $B(120,50)$ in two minutes. Robot 2 starts at point $C(90,10)$ and travels at a constant speed to point $D(60,70)$ in 90 seconds.
a. Find the location, $P$, of Robot 1 after it has traveled for $t$ minutes along its path from $A$ to $B$.
b. Find the location, $Q$, of Robot 2 after it has traveled for $t$ minutes along its path from $A$ to $B$.
c. Are the robots traveling at the same speed? If not, which robot's speed is greater?
d. Are the straight line paths that the robots are traveling parallel, perpendicular, or neither? Explain your answer.

## Example 3

A programmer wants to program a robot so that it moves at a constant speed along a straight line segment connecting the point $A(30,60)$ to the point $B(200,100)$ over the course of a minute.

At time $t=0$, the robot is at point $A$.
At time $t=1$, the robot is at point $B$.
a. Where will the robot be at time $t=\frac{1}{2}$ ?
b. Where will the robot be at time $t=0.6$ ?

## Problem Set

1. Find the coordinates of the intersection of the medians of $\triangle A B C$ given $A(2,4), B(-4,0)$, and $C(3,-1)$.
2. Given a quadrilateral with vertices $A(-1,3), B(1,5), C(5,1)$, and $D(3,-1)$ :
a. Prove that quadrilateral $A B C D$ is a rectangle.
b. Prove that $(2,2)$ is a point on both diagonals of the quadrilateral.
3. The robot is programed to travel along a line segment at a constant speed. If $P$ represents the robot's position at any given time $t$ in minutes:

$$
P=(240,60)+\frac{t}{10}(100,100)
$$

a. What was the robot's starting position?
b. Where did the robot stop?
c. How long did it take the robot to complete the entire journey?
d. Did the robot pass through the point $(310,130)$ and, if so, how long into its journey did the robot reach this position?
4. Two robots are moving along straight line paths in a rectangular room. Robot 1 starts at point $A(20,10)$ and travels at a constant speed to point $B(120,50)$ in two minutes. Robot 2 starts at point $C(90,10)$ and travels at a constant speed to point $D(60,70)$ in 90 seconds. If the robots begin their journeys at the same time, will the robots collide? Why or why not?

