LESSON MAKER PRO

Motion Map Mission

Use parametric equations to track moving objects in the coordinate plane.

HIGH SCHOOL · MA.912.T.4.7

MA.912.T.4.7 "Apply parametric equations to model applications involving motion in the plane."

NAME _____ DATE _____

MODELING PLANE MOTION

A moving object's position after t seconds can be modeled by $x=x_0+v_xt$ and $y=y_0+v_yt$. The values x_0 and y_0 give the starting position, while v_x and v_y give the change in each coordinate per second. Substitute a time to find a position, or match a target coordinate to find a time.

WORKED EXAMPLE

A delivery robot starts at (13,-17) and moves 8 units right and 12 units up each second. Write its parametric equations and find its position at t=7.

1. Start with x=13+8t and y=-17+12t.
2. Substitute t=7 into x: x=13+8(7)=69.
3. Substitute t=7 into y: y=-17+12(7)=67.

Answer: x=13+8t, y=-17+12t; at t=7, the robot is at (69,67).

PRACTICE 6 problems

1 A skateboarder's position is modeled by x=-3+2t and y=10-t. Find the position at t=4.

ANSWER _____

2 A game character's motion is modeled by x=1-3t and y=-2+4t. State the starting position and the change in position each second.

ANSWER _____

3 A robot begins at (-5,2). It moves 4 units right and 3 units down each second. Write parametric equations for its motion.

ANSWER _____

4 A drone's motion is modeled by x=6-2t and y=-1+5t. When does the drone reach y=14, and what is its position then?

ANSWER _____

5 A bicycle's motion is modeled by x=-10+t and y=-1+2t. At what time does the bicycle have x=-4, and what is its y-coordinate then?

ANSWER _____

6 A robotic cart starts at (4,-6) and reaches (16,0) in 4 seconds at a constant rate. Write parametric equations for the cart's motion.

ANSWER _____

APPLY IT Show your work

1 For a student film project, a camera drone moves according to x=-6+2t and y=4+3t, where coordinates are in meters and t is in seconds. The filming point is at (4,19). Does the drone reach the filming point? If so, find the time.

WORK SPACE

ANSWER _____

2 An e-scooter rider starts at coordinate (4,10). The rider moves 2 units east and 1 unit south each second for the first 6 seconds. Write parametric equations for the motion, then find the rider's position after 6 seconds.

WORK SPACE

ANSWER _____

CHALLENGE One step up

Two robots move at the same time. Robot A follows x=-4+2t and y=1+t. Robot B follows x=5-t and y=10-2t. Do the robots collide? Explain by finding whether they have the same x-coordinate and y-coordinate at the same time.

WORK SPACE AND ANSWER

ANSWER KEY

Motion Map Mission

HIGH SCHOOL · MA.912.T.4.7

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	A skateboarder's position is modeled by x=-3+2t and y=10-t. Find the position at t=4.	**(5,6)**
2	A game character's motion is modeled by x=1-3t and y=-2+4t. State the starting position and the change in position each second.	**Starting position: (1,-2); change each second: (-3,4).**
3	A robot begins at (-5,2). It moves 4 units right and 3 units down each second. Write parametric equations for its motion.	**x=-5+4t, y=2-3t**
4	A drone's motion is modeled by x=6-2t and y=-1+5t. When does the drone reach y=14, and what is its position then?	**t=3; position (0,14)**
5	A bicycle's motion is modeled by x=-10+t and y=-1+2t. At what time does the bicycle have x=-4, and what is its y-coordinate then?	**t=6; y=11**
6	A robotic cart starts at (4,-6) and reaches (16,0) in 4 seconds at a constant rate. Write parametric equations for the cart's motion.	**x=4+3t, y=-6+(3/2)t**

PART 2 · APPLY IT

1. **Yes. The drone reaches (4,19) at t=5 seconds.** Set -6+2t=4 to get t=5. Checking y gives 4+3(5)=19, so the same time reaches the filming point.
2. **x=4+2t, y=10-t; after 6 seconds, the position is (16,4).** Use the starting coordinates and coordinate changes to write x=4+2t and y=10-t. Substitute t=6 to find the position.

CHALLENGE

Yes. Setting -4+2t=5-t gives t=3. At t=3, Robot A is at (2,4) and Robot B is also at (2,4), so they collide.

Accept equivalent parametric equations with terms in a different order. For position answers, accept ordered pairs with correct coordinates and units when students include them.