

Motion Map Mission

Use parametric equations to track moving objects.

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 _____

TRACK POSITION OVER TIME

A parametric motion model gives x and y as functions of time t . To find an object's location, substitute a time value into both equations and write the result as an ordered pair. To describe a change in location, compare the coordinates at two times.

WORKED EXAMPLE

A robot has $x=7t+11$ and $y=13-6t$.
Find its position when $t=1$.

1. Substitute $t=1$ into x : $x=7(1)+11$.
2. Calculate $x=18$.
3. Substitute $t=1$ into y : $y=13-6(1)$.
4. Calculate $y=7$.

Answer: (18,7)

PRACTICE 6 problems

- 1** A point moves according to $x=3t+2$ and $y=4t-5$. Find its position when $t=0$.

ANSWER _____

- 2** A point moves according to $x=4t+4$ and $y=3t+3$. Find its position when $t=2$.

ANSWER _____

- 3** A point moves according to $x=5-2t$ and $y=4t+3$. Find its initial position.

ANSWER _____

- 4** A point moves according to $x=4t+3$ and $y=5t+2$. Find its displacement from $t=0$ to $t=2$.

ANSWER _____

- 5** A point moves according to $x=5-2t$ and $y=3t+4$. As t increases, does the point move left or right? Does it move up or down?

ANSWER _____

- 6** A point moves according to $x=3t+2$ and $y=2t+4$, where $0 \leq t \leq 4$. Write a rectangular equation for its path.

ANSWER _____

APPLY IT Show your work

- 1** A robotics club programs a small camera cart to move across a stage. Its position in feet after t seconds is $x=4t+2$ and $y=3t+5$. Find its position and displacement from its starting point when $t=3$.

WORK SPACE

ANSWER _____

- 2** In a video game, a character's position is modeled by $x=16-2t$ and $y=3t+2$, where t is measured in seconds. When does the character reach the vertical line $x=8$, and where is the character then?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

Two autonomous carts start moving at the same time. Cart A has $x=2t+4$ and $y=3t+2$. Cart B has $x=12-2t$ and $y=2t+5$. Do the carts ever occupy the same point at the same time? Explain your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	A point moves according to $x=3t+2$ and $y=4t-5$. Find its position when $t=0$.	(2,-5)
2	A point moves according to $x=4t+4$ and $y=3t+3$. Find its position when $t=2$.	(12,9)
3	A point moves according to $x=5-2t$ and $y=4t+3$. Find its initial position.	(5,3)
4	A point moves according to $x=4t+3$ and $y=5t+2$. Find its displacement from $t=0$ to $t=2$.	<8,10>
5	A point moves according to $x=5-2t$ and $y=3t+4$. As t increases, does the point move left or right? Does it move up or down?	It moves left and up.
6	A point moves according to $x=3t+2$ and $y=2t+4$, where $0 \leq t \leq 4$. Write a rectangular equation for its path.	$y=2/3x+8/3$, where $2 \leq x \leq 14$

PART 2 • APPLY IT

- Position: (14,14). Displacement: <12,9> feet.** Substitute $t=3$ into both equations to find the position. Subtract the starting coordinates, (2,5), from (14,14) to find the displacement.
- $t=4$ seconds, at (8,14).** Set $16-2t$ equal to 8 and solve for t . Substitute $t=4$ into $y=3t+2$.

CHALLENGE

No. Their x-coordinates are equal only when $2t+4=12-2t$, so $t=2$. At $t=2$, Cart A is at (8,8) and Cart B is at (8,9), so their y-coordinates differ.

Accept displacement written as <8,10> or (8,10). For the rectangular equation, accept equivalent forms such as $3y=2x+8$, with the stated x-range.