

Straight Line Motion Revisited

Warm-up

1. Given the position function $s(t) = 4t^3 - 10t + 2$, find the velocity and acceleration functions.

2. Summarize the relationships between the position function, $s(t)$, the velocity function, $v(t)$, and the acceleration function, $a(t)$.

3. Imagine that a man starts walking 5 miles due north, then turns around and walks 3 miles due south.
 - a) What is the total distance that he walked?
 - b) How far away from his initial position (and what direction) does he end up?

Finding Position and Velocity by Integration

If we know the position function, we can find the velocity function by _____.

If we know the velocity function, we can find the position function by _____.

If we know the acceleration function, we can find the velocity function by _____.

If we know the velocity function, we can find the position function by _____.

<h3>Summary</h3>

Example 1: Suppose that a particle moves with velocity $v(t) = \cos \pi t$ along a straight line. Assuming that the particle has coordinate $s = 4$ at time $t = 0$, find its position function.

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Practice Problem 1: Suppose that a particle is moving along a straight line with velocity $v(t) = 2t + 1$. If at time $t = 0$ the particle is at position $s = 2$, find its position function.

Displacement versus Distance

$$\text{Displacement} = \int_{t_0}^{t_1} v(t) dt$$

Example 2: Suppose that a particle moves on a straight line so that its velocity at time t is $v(t) = t^2 - 2t$ meters/second. Find the displacement of the particle over $[0, 3]$.

Practice Problem 2: A particle is moving so that its velocity, $v(t) = 8 - 2t$ over $[0, 5]$. Find the displacement of the particle.

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Class Work

1. A particle is moving so that its velocity, $v(t) = 4 - t$ over $[0, 6]$. Find the displacement of the particle.

2. A particle is moving so that its velocity, $v(t) = t^2 - t - 2$ over $[0, 3]$. Find the displacement of the particle.

3. Find the position, velocity, speed, and acceleration at time $t = 1$ second of a particle if $v(t) = 2t - 4$; $s = 3$ when $t = 0$.

4. Find the mean value of the function over the given interval:

a) $f(x) = -x^2 - 2x + 5$ over $[-4, 0]$

b) $f(x) = 4/x^2$ over $[-4, -2]$