§3.6A: Particle Motion: Day 1

"I WILL …

…identify components of a graph's speed, velocity, and acceleration."

I. Formulas and Definitions

When you see…	Think…
Initially	
At rest	
At the origin	
Velocity is POSITIVE	
Velocity is NEGATIVE	
Average Velocity (Given $x(t)$)	
Instantaneous Velocity	
Positive Acceleration	
Negative Acceleration	
Instantaneous Speed	

II. Motions

A. _____ is $s(t)$ or $x(t)$; also known as speed is the rate of motion

1. Label could be known as meters
2. "Initially" means when

   _____
3. "At the origin" means

   _____

B. _____ is $v(t) = s'(t)$; absolute value rate of motion or known as _____ and _____

1. Label could be known as meters/second or speed/time
2. "At rest" means _____
3. If the velocity of the particle is POSITIVE, then particle is moving _____
4. If the velocity of the particle is NEGATIVE, then particle is moving _____
5. If the order of the particle <u>changes direction</u>, the velocity _____

C. _____ is $a(t) = v'(t) = s''(t)$

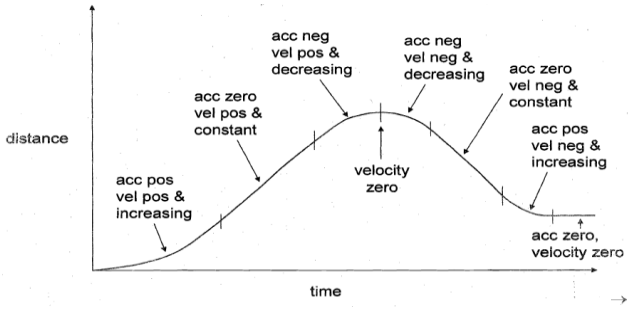
1. Label could be known as $units/time^2$
2. If the acceleration of the particle is POSITIVE, then the particle is _____
3. If the acceleration of the particle is NEGATIVE, then the particle is _____
4. If a particle <u>S</u>lows <u>D</u>own, signs from $v'(t)$ and $s''(t)$ which _____ are _____.

III. Formulas

A. Total Distance = Candidates Test

B. Average Velocity = ———————— or divide the change in position by the change in time

C. Instantaneous Speed = _____

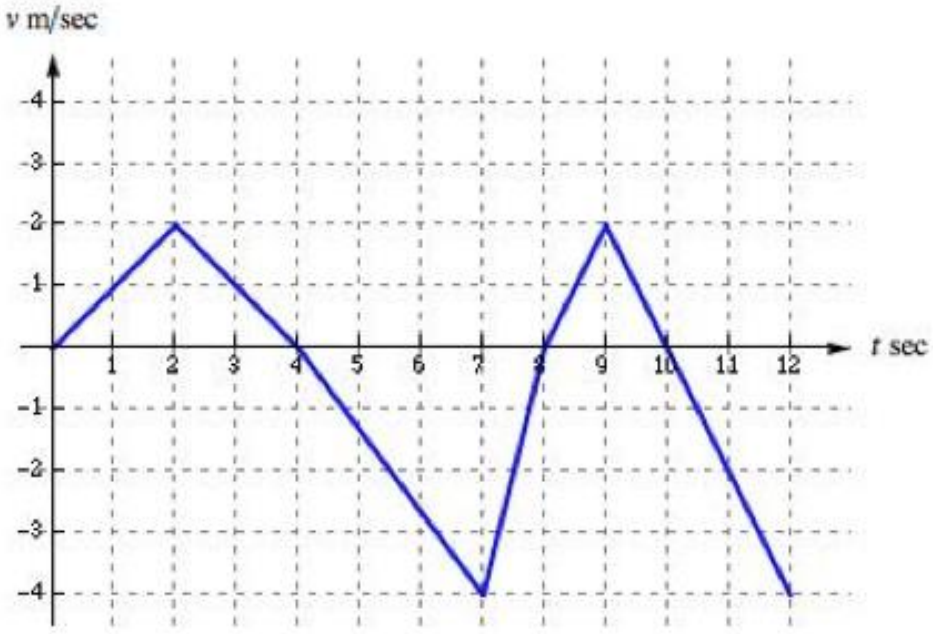


SPEEDING UP SAME SIGNS	SLOWING DOWN SIGNS DIFFERENT
Positive Velocity Positive Acceleration	Positive Velocity Negative Acceleration
Negative Velocity Negative Acceleration	Negative Velocity Positive Acceleration

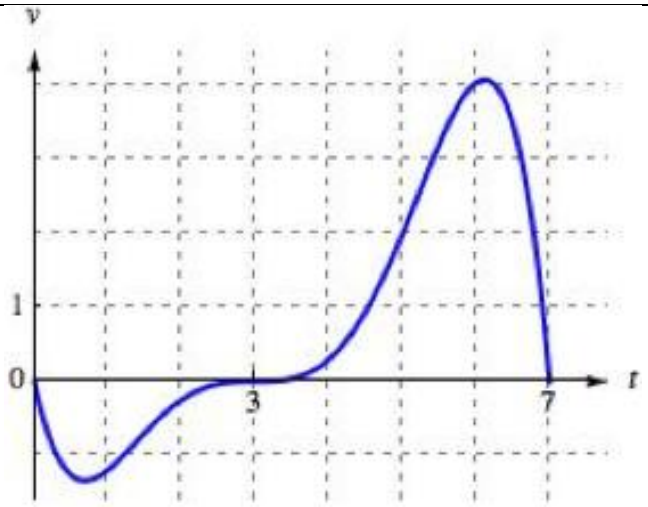
Ex 1: The position function of a particle moving on a straight line is $s(t) = 2t^3 - 10t^2 + 5$ where *t* is measured in seconds and *s* is in meters. Determine the a) position, b) instantaneous velocity, c) acceleration and d) speed of the particle at $t = 1$.

Ex 2: The position function of a particle moving on a straight line is $s(t) = 2t^3 - 19t^2 + 12t - 7$ where t is measured in seconds and x is in feet. Determine the a) velocity at time t, b) acceleration, c) at rest, d) particle moving furthest from the left, e) particle moving to the right, and f) slowing down?

Ex 3: This problem deals with a particle in motion along an x-axis. For $0 \leq t \leq 12$, the particle's velocity $v(t)$ is given by a piecewise-linear function as shown in the figure above. For $0 < t < 12$, on which of the given t-intervals is the particle slowing down?



Ex 4: The motion of a car moving along an east-west highway. Use eastward as the positive direction. The graph shows the velocity of a car moving along the highway at time t, where $0 \leq t \leq 7$. Which of the following statements is true? If the statement is untrue, explain why.



(A) The average acceleration of the car for $3 \leq t \leq 7$ is positive.

(B) The car travels in the same direction throughout the time interval $0 < t < 7$.

(C) The car has negative acceleration at $t = 5$.

(D) The car is slowing down at $t = 2$.

Your Turn: The position function of a particle moving on a straight line is $x(t) = 3t^4 - 16t^3 + 24t^2$ from $[0,5]$ where t is measured in seconds and x is in feet. Determine the a) velocity at time t, b) acceleration at time t, c) at rest, d) particle slows down, e) identify the velocity when acceleration is first zero

AP 1) The position of a particle moving along the x-axis is $x(t) = \sin(2t) - \cos(3t)$ for time $t \geq 0$. When $t = \pi$, the acceleration of the particle is

(A) 9 (B) $\frac{1}{9}$ (C) -9 (D) $-\frac{1}{9}$

Vocabulary	Connections and Process	Answer and Justifications

Assignment: Particle Motion WKST