

Unit: Rates of Change and Particle Motion

Topic: Particle Motion and Rates of Change Review

Objective: SWBAT will be able to interpret the derivative in order to model and explain particle motion and rates of change in preparation for the upcoming exam.

Part I: Read each question carefully and then choose the correct answer.

<p>1) If the position of a particle on a line is given by $s(t) = 3 + (t - 2)^4$, then the how many times does the particle change direction?</p> <p>(a) 0 (b) 1</p> <p>(c) 2 (d) 3</p>	<p>2) If the position of a particle on a line at time t is given by $x(t) = t^3 + 3t$, then the velocity of the particle is increasing when</p> <p>(a) $-1 < t < 1$ (b) $-1 < t < 0$</p> <p>(c) $t < 0$ (d) $t > 0$</p>
<p>3) A particle moves along the $x - axis$ so that at time $t \geq 0$ its position is given by $x(t) = 2t^3 - 21t^2 + 72t - 53$. At what time is the particle at rest?</p> <p>(a) $t = 1$ only</p> <p>(b) $t = 3$ only</p> <p>(c) $t = 3$ and $t = 4$</p> <p>(d) $t = 3$ and $t = \frac{7}{2}$</p>	<p>4) If the position of a particle moving on the $x - axis$ at any time $t \geq 0$, is given by $s(t) = 2t^3 - 3t^2$, what is the average acceleration of the particle for $[0,3]$?</p> <p>(a) 15 (b) 27</p> <p>(c) 9 (d) 12</p>
<p>5) The position of a particle at any time t is given by $x(t) = t^3 - 6t^2 + 9t + 12$. During what times is the speed of the particle increasing?</p> <p>(a) $t < 1$ or $2 < t < 3$</p> <p>(b) $1 < t < 2$ or $t > 3$</p> <p>(c) $t < 2$ or $t > 3$</p> <p>(d) $1 < t < 3$</p>	<p>6) A particle moves along a coordinate line so that its position is given by $s(t) = 2\sin\frac{1}{2}t + \frac{1}{2}\cos 2t$ for $[0,2\pi]$. What is the acceleration of the particle at $t = \pi$?</p> <p>(a) $-\frac{3}{2}$ (b) $-\frac{1}{2}$</p> <p>(c) $-\frac{5}{2}$ (d) $\frac{5}{2}$</p>

7) The table below shows the position of a particle, s , at various times, t , as it moves along a straight line.

$t(\text{sec})$	1.0	1.4	1.8	2.2	2.6
$s(\text{ft})$	6.0	7.0	10.0	15.0	21.0

What is the approximate velocity of the particle at time $t = 2$?

- (a) 15 ft/sec (b) 12.5 ft/sec
 (c) 20 ft/sec (d) 10 ft/sec

8) A particle moves along the $x - axis$ in such a way that its position at any time t is given by $x(t) = t^4 - 8t^3 + 18t^2 + 2$ for $t > 0$. What is the velocity of the particle when the acceleration is equal to 36?

- (a) 3 (b) 4
 (c) 12 (d) 16

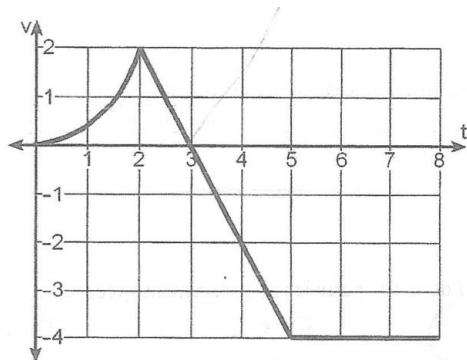
9) The position of a particle moving along a straight line is given by $x(t) = t^3 - 6t^2 + 12t - 8$. The position of the particle is increasing for

- (a) $t < 2$ (b) *all t except t = 2*
 (c) $1 < t < 3$ (d) $t > 2$

10) A particle moving along the $x - axis$ so that its position is given by $s(t) = \frac{1}{2}t^4 - 2t^3$. What is the particle's displacement during the first two seconds?

- (a) 9.5 units to the left
 (b) 8 units to the left
 (c) 9.5 units to the right
 (d) 8 units to the right

11) The graph below shows the velocity of a particle that moves on a horizontal line for time $0 \leq t \leq 8$. How many times does the particle change direction?



12) What is the maximum acceleration of a particle on the interval $0 \leq t \leq 3$ if its position is given by $s(t) = t^4 - 4t^3$?

- (a) -16
 (b) -12
 (c) 0
 (d) 36

Part II: Read each question carefully and show all work.

13) A particle moves along a horizontal line with position equation $s(t) = (3t - 2)(t - 5)$ with $s(t)$ measured in feet and t measured in seconds with $t \geq 0$.

- (a) What is the initial position of the particle?
- (b) What is the particle's displacement during the first four seconds?
- (c) When does the particle change direction?
- (d) What is the particle's average velocity during the first four seconds?
- (e) What is the particle's acceleration at $t = 2$?

14) CALCULATOR ALLOWED

The position of a particle, in inches, moving along the x -axis after t seconds have elapsed is given by the following equation: $s(t) = t^4 - 2t^3 - 6t^2 + 9t$

- (a) Find the velocity of the particle at time t .
- (b) Find the particle's velocity at $t = 1, 2,$ and 4 seconds.
- (c) When is the particle at rest?
- (d) When is the particle moving to the right? to the left? Explain your reasoning.
- (e) Find the total distance traveled by the particle after $t = 5$ seconds.
- (f) Find the acceleration of the particle at 4 seconds.

15) The table below shows the velocity of a particle, $v(t)$, at various times, t , as it moves along a straight line.

t (sec)	0	1	3	6	8	12
$v(t)$ (feet)	1	2	-2	-7	4	2

- (a) How many times does the particle change direction during the twelve seconds? Justify your answer.
- (b) During which intervals is the particle speeding up? slowing down?
- (c) What is the acceleration at $t = 7$?

16) The position of a particle moving along the x - axis is given by $s(t) = 2t^3 - 9t^2$, where s is measured in meters and t is measured in seconds.

- (a) Find the average velocity during the first 5 seconds.
- (b) Find the instantaneous velocity at $t = 4$.
- (c) Find the acceleration of the particle at $t = 4$.
- (d) When is the particle speeding up? slowing down?

17) The graph below shows the position of a particle that moves on a horizontal line for time $0 \leq t \leq 6$.

- (a) When is the particle moving to the left? to the right?
- (b) What is the total distance traveled by the particle for $0 \leq t \leq 6$?
- (c) During what time(s) is the particle at rest?
- (d) What is the velocity of the particle at $t = 2.5$?
- (e) When is the particle speeding up and slowing down?

