

Do Now + Explore!

t (minutes)	0	2	5	8	12
$v_A(t)$ (meters/minute)	0	100	40	-120	-150

Train A runs back and forth on an east-west section of railroad track. Train A 's velocity, measured in meters per minute, is given by a differentiable function $v_A(t)$, where time t is measured in minutes. Selected values for $v_A(t)$ are given in the table above.

a) Use the data in the table to estimate $v'_A(10)$.

b) Interpret the meaning of $v'_A(10)$ in the context of the problem.

c) Selected values of Train A 's velocity are given in meters per minute.

1. What units would be used to describe the displacement of the train?

2. What units would be used to describe the derivative of the velocity of the train?

Name _____

Seat # _____

Date _____

Pre-AP Calculus

Education is Freedom

11.04 – Mad Minute

Binder Section: MM

Topic: Sign Charts

Take #4

Goal Score: _____ / _____

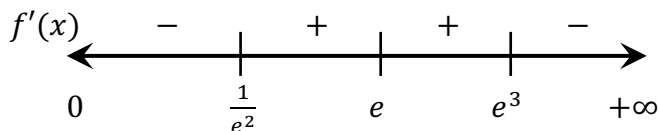
Actual Score: _____ / _____

Met Goal? Yes / No

Goal for tomorrow: ____ / ____

Mad Minute – Sign Charts – Take #4

Directions: Use the two sign charts below to answer the questions that follow about $f(x)$.



<p>1. At what value(s) of x does f have a relative minimum?</p>	<p>2. On what interval(s) is f concave up?</p>	<p>3. On what interval(s) is f increasing?</p>
<p>4. At what value(s) of x does f have a point of inflection?</p>	<p>5. On what interval(s) is f concave down?</p>	<p>6. At what value(s) of x does f have a relative maximum?</p>
<p>7. At what value(s) of x does f have a critical point that is not an extrema?</p>	<p>8. On what interval(s) is f both concave down and increasing?</p>	<p>9. On what interval(s) is f decreasing with an increasing slope?</p>

Name _____

Seat # _____

Date _____

Pre-AP Calculus

Education is Freedom

11.04 –Class Notes

Binder Section: CN

Teacher Note

This is not a student facing notes page. Students should be using their Pre-AP Calculus notebook to capture their “I Do” and “We Do” Example

Example 1

1. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = -t^3 + 7t^2 - 14t + 8$, where s is measured in meters and t is measured in seconds.
 - a) Find the position of the particle when $t = 2$.
 - b) Find the average velocity of the particle during the first 4 seconds.
 - c) Find the velocity of the particle when $t = 4$.
 - d) Find the acceleration of the particle when $t = 4$.

Name _____

Seat # _____

Date _____

Pre-AP Calculus

Education is Freedom

11.04 – Classwork

Binder Section: CW

Problem Set A

1. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = t^2 - 4t + 3$, where s is measured in meters and t is measured in seconds.

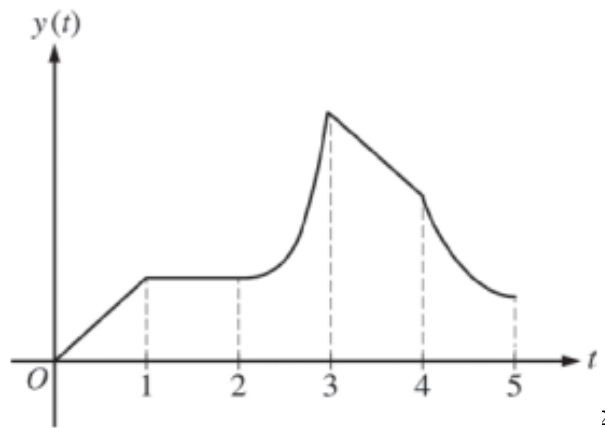
a) Find the velocity of the particle when $t = 4$.

b) Find the acceleration of the particle when $t = 4$.

c) Find the displacement of the particle after the first 2 seconds.

d) Find the average velocity of the particle during the first 4 seconds.

Example 2 – AP Multiple Choice!



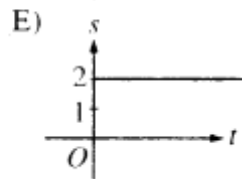
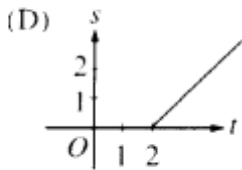
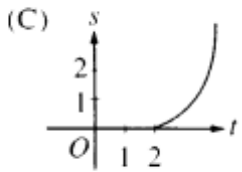
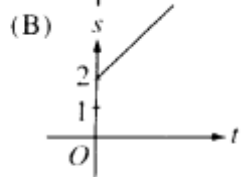
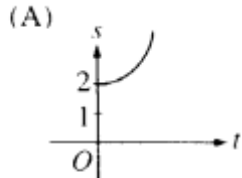
2. A particle moves along the y -axis. The graph of the particle's position $y(t)$ at time t is shown above for $0 \leq t \leq 5$. For what values of t is the velocity of the particle negative and the acceleration positive?

- (A) $0 < t < 1$
- (B) $1 < t < 2$
- (C) $2 < t < 3$
- (D) $3 < t < 4$
- (E) $4 < t < 5$

Justify your answer.

Problem Set B

1. A particle starts from rest at the point $(2, 0)$ and moves along the x -axis with a constant positive acceleration for time $t \geq 0$. Which of the following could be the graph of the distance $s(t)$ of the particle from the origin as a function of time t ? **Justify your answer.**



3

2. A particle moves along a straight line so that at time $t > 0$ the position of the particle is given by $s(t)$, the velocity is given by $v(t)$, and the acceleration is given by $a(t)$. Which of the following expressions gives the average velocity of the particle on the interval $[2, 8]$?

(A) $\frac{s(8)-s(2)}{6}$

(D) $v(8) - v(2)$

(B) $\frac{v(8)-v(2)}{6}$

(E) $a(8) - a(2)$

(C) $\frac{a(8)-a(2)}{6}$

t (hours)	0	1	2	3	4	5	6
$s(t)$ (miles)	0	25	55	92	150	210	275

3. The table above gives the distance $s(t)$, in miles, that a car has traveled at various times t , in hours, during a 6-hour trip. The graph of the function s is increasing and concave up. Based on the information, which of the following could be the velocity of the car, in miles per hour, at time $t = 3$?

- (A) 37
- (B) 49
- (C) 58
- (D) 65
- (E) 92

Justify your answer.

4. A particle moves along the x -axis such that its position $x(t)$ is given by $x(t) = \frac{1}{5}t^5 - \frac{1}{2}t^4 - 2t^2$. Find the particle's velocity at $t = 1$ and the particle's acceleration at $t = 1$. Is the speed of the particle increasing, decreasing, or neither? **Explain your reasoning.**

Fast Workers! Nice Job working through Problem Set A and Problem Set B. Keep the math fresh by working through these spiral problems below.

Composite Functions Review

- If $f(x) = x^3 + 3x^2 + 4x + 5$ and $g(x) = 5$, then $g(f(x)) =$

 - (A) $5x^2 + 15x + 25$
 - (B) $5x^3 + 15x^2 + 20x + 25$
 - (C) 1125
 - (D) 225
 - (E) 5

- If $f(g(x)) = \ln(x^2 + 4)$, $f(x) = \ln(x^2)$, and $g(x) > 0$ for all real x , then $g(x) =$

 - (A) $\frac{1}{\sqrt{x^2+4}}$
 - (B) $\frac{1}{x^2+4}$
 - (C) $\sqrt{x^2 + 4}$
 - (D) $x^2 + 4$
 - (E) $x + 2$

- If h is the function given by $h(x) = f(g(x))$, where $f(x) = 3x^2 - 1$ and $g(x) = |x|$, then $h(x) =$

 - (A) $3x^3 - |x|$
 - (B) $|3x^2 - 1|$
 - (C) $3x^2|x| - 1$
 - (D) $3|x| - 1$
 - (E) $3x^2 - 1$

Name _____

Seat # _____

Date _____

Pre-AP Calculus

Education is Freedom

11.04 – Exit Ticket

Binder Section: ET

1. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = 2t^2 - 4 \cos t$, where s is measured in miles and t is measured in hours.

a) Find the velocity of the particle when $t = \frac{\pi}{4}$.

b) Find the acceleration of the particle when $t = \frac{2\pi}{3}$.

2. A particle moves along the x -axis. The velocity of the particle at time t is given by $v(t)$, and the acceleration of the particle at time t is given by $a(t)$. Which of the following gives the average acceleration of the particle from $t = 0$ to $t = 8$?

(A) $\frac{a(8)-a(0)}{8}$

(B) $\frac{a(8)-a(0)}{8}$

(C) $\frac{v(0)+v(8)}{2}$

(D) $\frac{v(8)-v(0)}{8}$

Name _____

Seat # _____

Date _____

Pre-AP Calculus

Education is Freedom

11.04 – Homework

Binder Section: HW

Part I: New Material – Particle Motion Revisited

1. If the position of a particle on the x -axis at time t is $-5t^2$, then the average velocity of the particle for $0 \leq t \leq 3$ is
 - (A) -45
 - (B) -30
 - (C) -15
 - (D) -10
 - (E) -5

2. A particle moves along a line so that its position at any time $t \geq 0$ is given by the function $s(t) = -2t^3 + 3t^2 - 5t$, where s is measured in meters and t is measured in seconds.
 - a) Find the displacement of the particle after the first 3 seconds.

 - b) Find the average velocity of the particle during the first 3 seconds.

 - c) Find the velocity of the particle when $t = 3$.

 - d) Find the acceleration of the particle when $t = 3$.

Part II: Spiral Material – keep the math fresh!

3. Let f be a differentiable function whose derivative is given by the equation $f'(x) = x^2e^x - xe^x$. Which of the following statements about f is true?

- (A) f has inflection points at $x = 0$ and $x = -1$.
- (B) f has inflection points at $x = 0$ and $x = 1$.
- (C) f has a relative maximum at $x = 0$ and relative minimum at $x = 1$.
- (D) f has a relative minimum at $x = 0$ and a relative maximum at $x = 1$.
- (E) f has a relative minimum at $x = -1$ and a relative maximum at $x = 1$.

4. The average rate of change of $f(x) = x^3$ over the interval $[a, b]$ is

- (A) $3b + 3a$
- (B) $b^2 + ab + a^2$
- (C) $\frac{b^2+a^2}{2}$
- (D) $\frac{b^3-a^3}{2}$
- (E) $\frac{b^4-a^4}{4(b-a)}$

5. The point on the curve $2y = x^2$ nearest to $(4, 1)$ is

- (A) $(0, 0)$
- (B) $(2, 2)$
- (C) $(\sqrt{2}, 1)$
- (D) $(2\sqrt{2}, 4)$
- (E) $(4, 8)$

¹ Author and Source Unknown. Uncommon Schools does not own the copyright in “Do Now + Explore” and claims no copyright in this material. The material is being used exclusively for non-profit educational purposes under fair use principles in U.S. Copyright law. The user should make the judgement about whether this material may be used under fair use/fair dealing permissions in the user’s country.

² Author and Source Unknown. Uncommon Schools does not own the copyright in “Problem Set A” and claims no copyright in this material. The material is being used exclusively for non-profit educational purposes under fair use principles in U.S. Copyright law. The user should make the judgement about whether this material may be used under fair use/fair dealing permissions in the user’s country.

³ Author and Source Unknown. Uncommon Schools does not own the copyright in “Problem Set B” and claims no copyright in this material. The material is being used exclusively for non-profit educational purposes under fair use principles in U.S. Copyright law. The user should make the judgement about whether this material may be used under fair use/fair dealing permissions in the user’s country.