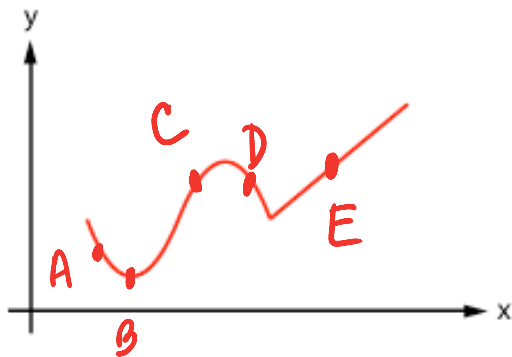


My 2<sup>nd</sup> Chapter 3 Quiz \_\_\_\_\_

A graphing calculator is required for some questions

Directions: Same as always

1.



graph of  $f$

At which of the five points on the graph in the figure above are  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  both negative?

(A) A

(B) B

(C) C

(D) D

(E) E

Since  $\frac{dy}{dx} < 0$ , then function would be decreasing. Since  $\frac{d^2y}{dx^2}$

is also negative, then function would be concave down. Hence D is the point.

2. A differentiable function  $g$  has the property that  $g(10)=6$  and  $g'(10)=8$ . What is the estimate for  $g(9.6)$  using the local linear approximation for  $g$  at  $x=10$ ?

- (A) 2.8
- (B) 3.0
- (C) 3.2
- (D) 6.4
- (E) 9.2

$$y-6=8(x-10) \text{ let } x=9.6$$

$$y-6=8(9.6-10)$$

Hence, an approximation for  $g(9.6)$  is 2.8

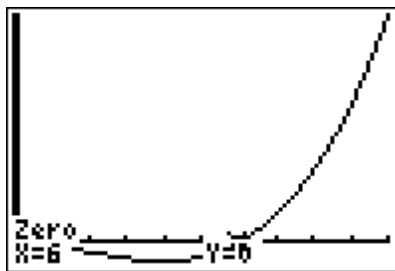
3. Let  $f$  be a twice-differentiable function of  $x$  such that, when  $x=c$ ,  $f$  is decreasing, concave up, and has an  $x$ -intercept. Which of the following is true?

- (A)  $f(c) < f'(c) < f''(c)$
- (B)  $f(c) < f''(c) < f'(c)$
- (C)  $f'(c) < f(c) < f''(c)$
- (D)  $f'(c) < f''(c) < f(c)$
- (E)  $f''(c) < f(c) < f'(c)$

$f(c) = 0$  because of the intercept,  $f'(c) < 0$  because  $f$  is decreasing,  $f''(c) > 0$  because  $f$  is concave up

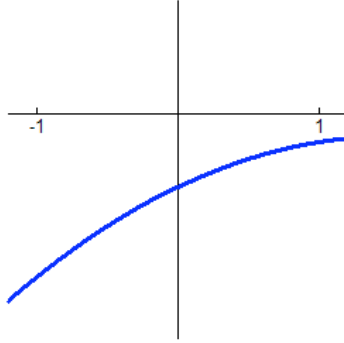
4. The velocity of a particle moving on the  $X$ -axis is given by  $v(t) = t^3 - 6t^2$  for the time interval  $0 \leq t \leq 10$ . When is the particle farthest to the left?

- (A)  $t = 0$
- (B)  $t = 4$
- (C)  $t = 6$
- (D)  $t = 8$
- (E)  $t = 10$



graph of velocity

$v(t)$  changes from negative to positive at  $t = 6$  so the particle is moving left from  $0 < t < 6$ . Hence the particle is farthest left at  $t = 6$



$h(x)$

5. The graph of  $y = h(x)$  is shown above. Which of the following could be a table of values for the derivative of  $h$ ,  $h'(x)$ ?

$h(x)$  is increasing and concave down which means it is increasing at a decreasing rate. The only table that fits is table C

(A)

$x$	-1	0	1
$h'(x)$	0.5	0.5	0.5

(B)

$x$	-1	0	1
$h'(x)$	$-\frac{1}{3}$	$-\frac{1}{2}$	-1

(C)

$x$	-1	0	1
$h'(x)$	0.5	0.333	0.25

(D)

$x$	-1	0	1
$h'(x)$	0.25	0.333	0.5

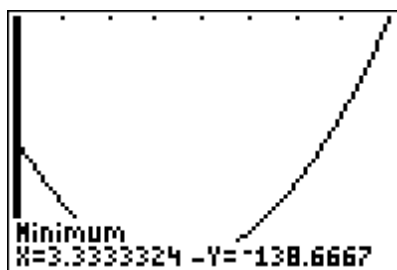
(E)

$x$	-1	0	1
$h'(x)$	-1	-0.5	-0.25

6. The number of liters of water remaining in a tank  $t$  minutes after the tank has started to drain is  $R(t) = 2t^3 - 20t^2 - 72t + 820$ . At what moment is the water *draining the fastest*?

- (A) 0 minutes
- (B) 2 minutes
- (C) 3.333 minutes
- (D) 5.333 minutes
- (E) It drains at the same rate the whole time

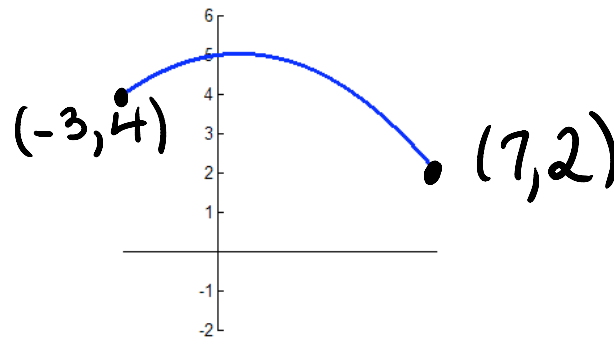
$R(t)$  is the number of liters in the tank. We need to consider  $R'(t)$  which is the rate of change of  $R(t)$  and  $R'(t)$  is in liters/minute. Look for the minimum value of  $R'(t)$  [not  $R(t)$ ]



graph of  $R'(t)$  on the window  $[0, 10]$  with the

minimum labeled.

7.



$$y = f(x)$$

The graph of  $y = f(x)$  on the closed interval  $[-3, 7]$  is shown above. If  $f$  is continuous on  $[-3, 7]$  and differentiable on  $(-3, 7)$ , then there exists a  $c$ ,  $-3 < c < 7$ , such that

- (A)  $f'(c) = 0$
- (B)  $f'(c)$  is undefined
- (C)  $f'(c) = 0.2$
- (D)  $f'(c) = -0.2$
- (E)  $f'(c) = -5$

This is just a Mean Value Theorem problem.

By the MVT, there is a  $c$ ,  $-3 < c < 7$ , such that  $f'(c) = \frac{f(7) - f(-3)}{7 - (-3)}$

which equals  $-0.2$

Bonus Multiple-Choice [Optional] Please mark as #8 on your Scantron.

If  $\lim_{x \rightarrow \infty} f(x) = 5$  and  $\lim_{x \rightarrow 5} f(x) = -\infty$ , then which of the following must be true about  $y = f(x)$ ?

- I.  $f(x)$  is continuous for all  $x \in \text{Reals}$  **Not true because of the second limit**
- II.  $y = 5$  is a horizontal asymptote **Yes because of the first limit given**
- III.  $x = 5$  is a vertical asymptote **Yes because of the second limit given**

**Hence the correct choice was B**

- (A) I and II
- (B) II and III
- (C) I and III
- (D) I, II, and III
- (E) none are true

18x	2÷		100x	
		60x		
2			12+	3+
1-	5x			

		6				4		
		5	6	4	1	8		
9			2			7		3
6					8		4	
	2	9	7			5		1
			3					7
			8	2	7	6		
7		3	5	1		9		8

Free Response Directions: Please show ALL work/steps in the space provided. Be sure to write clearly and legibly and use standard mathematical notation. You will be graded on the correctness and completeness of your methods as well as the accuracy of your final answers. Justifications require that you give mathematical [non-calculator] reasons and that you clearly identify functions, graphs, tables or other objects you use. Correct answers without supporting work will not receive credit. Unless

otherwise specified, answers [numeric or algebraic] need not be simplified. If your answer is given as a decimal approximation, it should be correct to three decimal places after the decimal point.

A cauldron [big pot] of Polyjuice potion is placed on a counter to cool. Let  $T(x)$  represent the temperature of the potion at time  $x$ , where  $T$  is a differentiable function of  $x$ . The temperature of the potion at selected times is given in the table below. Notice that the potion is not always cooling because it is a magical potion.

$x$ (hours)	0	2	4	6	8
$T(x)$ [degrees]	200	182	210	170	150

(A) Use data from the table to find the average rate of change of  $T(x)$  over the time interval  $0 \leq x \leq 8$ . Indicate units.

(B) Use the data from the table to estimate  $T'(4)$  and use it to write the equation of the tangent line to  $T$  at  $x=4$ .

(C) Use the tangent line from part (B) to estimate a value for  $T(5)$

*End of Quiz. Please make sure that your name is on the quiz and on the Scantron.*