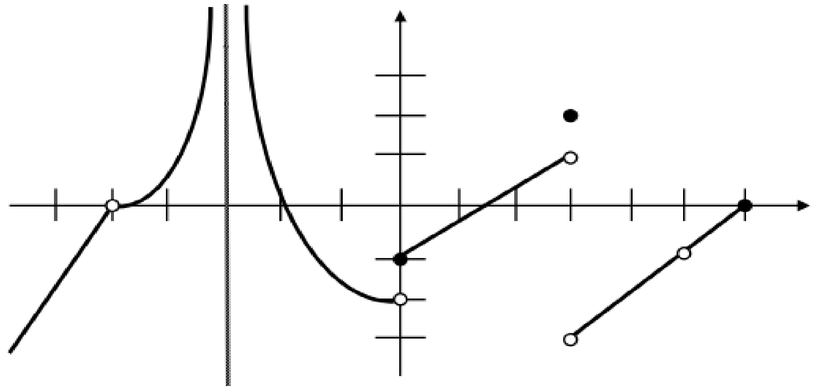
Calculus AB Review Limits and Derivatives Name: ________________________________

1) Answer the following using the graph of f(x) shown below.



(a) f(0) =

(b) f(3) =

(c) $\lim_{x\to -5} f(x)$ =

(d) $\lim_{x\to 0^+} f(x)$ =

(e) $\lim_{x\to 3^-} f(x)$ =

2) Let $f(x) = \begin{cases} 3x^2+1, x<1 \\ 4x, \quad x \geq 1 \end{cases}$. Which of the following is true?

I. f(x) is continuous at x = 1

II. f(x) is differentiable at x = 1

III. $\lim_{x\to 1^-} f(x) = \lim_{x\to 1^+} f(x)$

(A) I only (B) II only (C) III only (D) I and III only (E) II and III only

3) $\lim_{h\to 0} \frac{\cos\left(\frac{\pi}{6}+h\right)-\cos\left(\frac{\pi}{6}\right)}{h} =$

(A) Does not exist (B) 1/2 (C) -1/2 (D) $\sqrt{3}/2$ (E) $-\sqrt{3}/2$

4) Find the value of the limit: $\lim_{h\to 0} \frac{\sqrt{\tan(2x+2h)}-\sqrt{\tan(2x)}}{h}$

5) Let *f* be a differentiable function with *f*(2) = 3 and *f* '(2) = -5, and let *g* be the function defined by $g(x) = x \cdot f(x)$. What is the equation for the line tangent to the graph of *g* at the point where x = 2?

Find the derivatives of the following functions.

6) $f(x) = (3x^2 + 7)(x^2 - 2x + 3)$

7) $f(x) = \sqrt{x} \cdot sinx$

8) $f(x) = 3x^2 sec^3 x$

9) $f(x) = \frac{x^4 + x}{tan^2 x}$

10) Given the equation $y = \sin(3x + 4y)$, find $\frac{dy}{dx}$.

11) Suppose that *f* and *g* are twice differentiable functions having selected values given in the table below.

x	*f(x)*	*f'(x)*	*g(x)*	*g'(x)*
1	5	4	2	7
2	8	6	-6	-4

If *h(x) = f(g(x))*, what is the value of *h'(x)* at the point where x = 1?

12) A particle moves along the x-axis according to the position function $x(t) = 3\sin(2t) + 1$.

(a) Determine the instantaneous velocity of the particle at $t = \pi$. Which direction is the particle moving?

(b) What is the acceleration of the particle at $t = \frac{\pi}{4}$?

(c) Is the particle speeding up or slowing down at $t = \frac{\pi}{4}$? Justify your answer.

13) If the nth derivative of y is denoted as $y^{(n)}$ and $y = -\sin x$, then $y^{(14)}$ is the same as

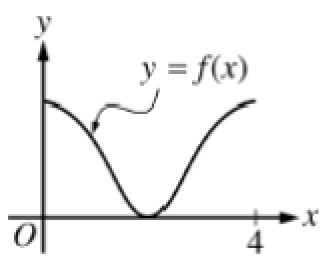
(A) y

(B) $\frac{dy}{dx}$

(C) $\frac{d^2y}{dx^2}$

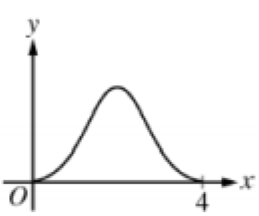
(D) $\frac{d^3y}{dx^3}$

14)

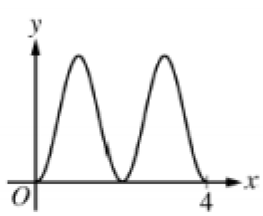


The graph of $y = f(x)$ on the closed interval [0, 4] is shown above. Which of the following could be the graph of $y = f'(x)$?

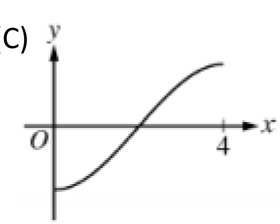
(A)



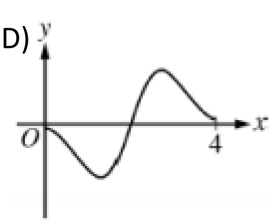
(B)



(C)



(D)



15)

t (hours)	0	1	3	4	7	8	9
L(t) (people)	120	156	176	126	150	80	0

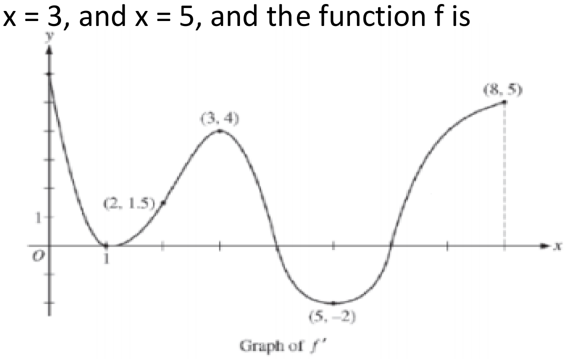
Concert tickets went on sale at noon (t = 0) and were sold out within 9 hours. The number of people waiting in line to purchase tickets at time t is modeled by a twice-differentiable function L for $0 \le t \le 9$. Values of L(t) at various times t are shown in the table above.

(a) Use the data in the tale to estimate the rate at which the number of people waiting in line was changing at 5:30 P.M. (t = 5.5). Show the computations that lead to your answer. Indicate units of measure.

(b) For $0 \le t \le 9$, what is the fewest number of times at which L'(t) must equal 0? Give a reason for your answer.

(c) Is there a time on the interval [1, 4] where the rate at which the number of people waiting in line was decreasing at a rate of 10 people per hour? Justify your answer.

16) The figure below shows the graph of f ', the derivative of a twice differentiable function f, on the closed interval $0 \le x \le 8$. The graph of f ' has horizontal tangent lines at x = 1, x = 3, and x = 5, and the function f is defined for all real numbers.



Graph of f'

(a) Find all values of x on the open interval 0 < x < 8 for which the function *f* has a local maximum. Justify your answer.

(b) On what open intervals contained in 0 < x < 8 is the graph of *f* both concave down and increasing? Explain your reasoning.

(c) Does the tangent line to the graph of y = f(x) at the point where x = 4 lie above or below the curve near that point? Justify your response.