

## AP Mixed Review (after 6.1)

Use a calculator only on those that say it's permitted. Put the CAPITAL letter in the blank for each problem.

\_\_\_\_\_ 1. (Calculator Permitted)

A particle moves along a straight line with velocity given by  $v(t) = 7 - (1.01)^{-t^2}$  at time  $t \geq 0$ . What is the acceleration of the particle at time  $t = 3$ ?

- (A) -0.914    (B) 0.055    (C) 5.486    (D) 6.086    (E) 18.087

\_\_\_\_\_ 2.

$$\lim_{x \rightarrow \infty} \frac{(2x-1)(3-x)}{(x-1)(x+3)} \text{ is}$$

- (A) -3    (B) -2    (C) 2    (D) 3    (E) nonexistent

\_\_\_\_\_ 3.

$$\int \frac{1}{x^2} dx =$$

- (A)  $\ln x^2 + C$     (B)  $-\ln x^2 + C$     (C)  $x^{-1} + C$     (D)  $-x^{-1} + C$     (E)  $-2x^{-3} + C$

\_\_\_\_\_ 4.

If  $f(x) = (x-1)(x^2+2)^3$ , then  $f'(x) =$

- (A)  $6x(x^2+2)^2$   
(B)  $6x(x-1)(x^2+2)^2$   
(C)  $(x^2+2)^2(x^2+3x-1)$   
(D)  $(x^2+2)^2(7x^2-6x+2)$   
(E)  $-3(x-1)(x^2+2)^2$

\_\_\_\_\_ 5.  
 $\lim_{x \rightarrow 0} \frac{5x^4 + 8x^2}{3x^4 - 16x^2}$  is

- (A)  $-\frac{1}{2}$       (B) 0      (C) 1      (D)  $\frac{5}{3} + 1$       (E) nonexistent

\_\_\_\_\_ 6.

$$f(x) = \begin{cases} \frac{x^2 - 4}{x - 2} & \text{if } x \neq 2 \\ 1 & \text{if } x = 2 \end{cases}$$

Let  $f$  be the function defined above. Which of the following statements about  $f$  are true?

- I.  $f$  has a limit at  $x = 2$ .  
II.  $f$  is continuous at  $x = 2$ .  
III.  $f$  is differentiable at  $x = 2$ .

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

\_\_\_\_\_ 7.

If  $f(x) = \cos(3x)$ , then  $f'\left(\frac{\pi}{9}\right) =$

- (A)  $\frac{3\sqrt{3}}{2}$       (B)  $\frac{\sqrt{3}}{2}$       (C)  $-\frac{\sqrt{3}}{2}$       (D)  $-\frac{3}{2}$       (E)  $-\frac{3\sqrt{3}}{2}$

\_\_\_\_\_ 8.

If  $f(x) = e^{(2/x)}$ , then  $f'(x) =$

- (A)  $2e^{(2/x)} \ln x$       (B)  $e^{(2/x)}$       (C)  $e^{(-2/x^2)}$       (D)  $-\frac{2}{x^2}e^{(2/x)}$       (E)  $-2x^2e^{(2/x)}$

\_\_\_\_\_ 9.

If  $\sin(xy) = x$ , then  $\frac{dy}{dx} =$

- (A)  $\frac{1}{\cos(xy)}$   
(B)  $\frac{1}{x \cos(xy)}$   
(C)  $\frac{1 - \cos(xy)}{\cos(xy)}$   
(D)  $\frac{1 - y \cos(xy)}{x \cos(xy)}$   
(E)  $\frac{y(1 - \cos(xy))}{x}$

\_\_\_\_\_ 10.

In the  $xy$ -plane, the line  $x + y = k$ , where  $k$  is a constant, is tangent to the graph of  $y = x^2 + 3x + 1$ . What is the value of  $k$ ?

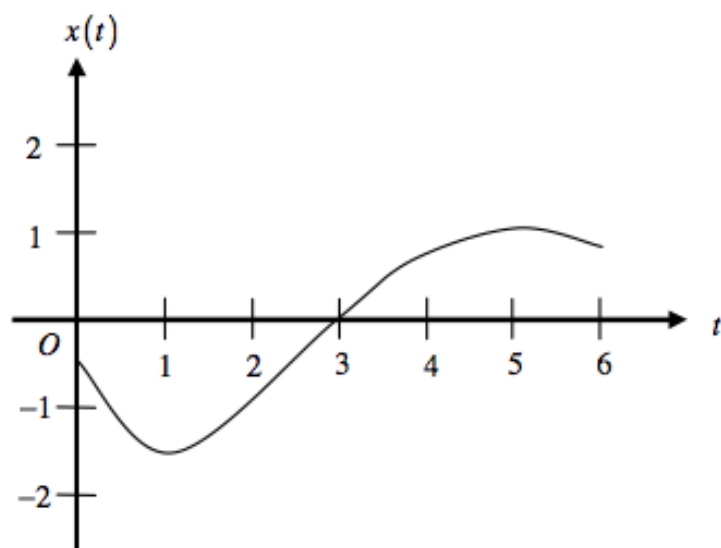
- (A) -3      (B) -2      (C) -1      (D) 0      (E) 1

\_\_\_\_\_ 11.

What is the slope of the line tangent to the curve  $y = \arctan(4x)$  at the point at which  $x = \frac{1}{4}$ ?

- (A) 2      (B)  $\frac{1}{2}$       (C) 0      (D)  $-\frac{1}{2}$       (E) -2

\_\_\_ 12.



A particle moves along a straight line. The graph of the particle's position  $x(t)$  at time  $t$  is shown above for  $0 < t < 6$ . The graph has horizontal tangents at  $t = 1$  and  $t = 5$  and a point of inflection at  $t = 2$ . For what values of  $t$  is the velocity of the particle increasing?

- (A)  $0 < t < 2$
- (B)  $1 < t < 5$
- (C)  $2 < t < 6$
- (D)  $3 < t < 5$  only
- (E)  $1 < t < 2$  and  $5 < t < 6$

\_\_\_ 13.

$$f(x) = \begin{cases} cx + d & \text{for } x \leq 2 \\ x^2 - cx & \text{for } x > 2 \end{cases}$$

Let  $f$  be the function defined above, where  $c$  and  $d$  are constants. If  $f$  is differentiable at  $x = 2$ , what is the value of  $c + d$ ?

- (A) -4
- (B) -2
- (C) 0
- (D) 2
- (E) 4

\_\_\_\_\_ 14.

Let  $f$  be a differentiable function such that  $f(3) = 15$ ,  $f(6) = 3$ ,  $f'(3) = -8$ , and  $f'(6) = -2$ . The function  $g$  is differentiable and  $g(x) = f^{-1}(x)$  for all  $x$ . What is the value of  $g'(3)$ ?

(A)  $-\frac{1}{2}$

(B)  $-\frac{1}{8}$

(C)  $\frac{1}{6}$

(D)  $\frac{1}{3}$

(E) The value of  $g'(3)$  cannot be determined from the information given.

\_\_\_\_\_ 15. (Calculator Permitted)

The first derivative of the function  $f$  is defined by  $f'(x) = \sin(x^3 - x)$  for  $0 \leq x \leq 2$ . On what interval(s) is  $f$  increasing?

(A)  $1 \leq x \leq 1.445$

(B)  $1 \leq x \leq 1.691$

(C)  $1.445 \leq x \leq 1.875$

(D)  $0.577 \leq x \leq 1.445$  and  $1.875 \leq x \leq 2$

(E)  $0 \leq x \leq 1$  and  $1.691 \leq x \leq 2$

\_\_\_\_\_ 16. (Calculator Permitted)

The derivative of the function  $f$  is given by  $f'(x) = x^2 \cos(x^2)$ . How many points of inflection does the graph of  $f$  have on the open interval  $(-2, 2)$ ?

(A) One

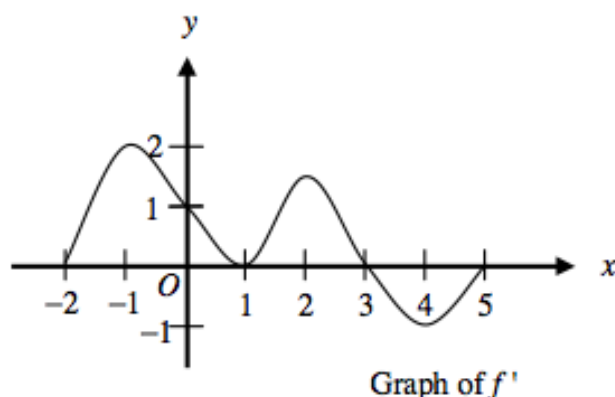
(B) Two

(C) Three

(D) Four

(E) Five

17.



The graph of  $f'$ , the derivative of  $f$ , is shown above for  $-2 \leq x \leq 5$ . On what intervals is  $f$  increasing?

- (A)  $[-2, 1]$  only
- (B)  $[-2, 3]$
- (C)  $[3, 5]$  only
- (D)  $[0, 1.5]$  and  $[3, 5]$
- (E)  $[-2, -1]$ ,  $[1, 2]$ , and  $[4, 5]$

18.

The radius of a sphere is decreasing at a rate of 2 centimeters per second. At the instant when the radius of the sphere is 3 centimeters, what is the rate of change, in square centimeters per second, of the surface area of the sphere? (The surface area  $S$  of a sphere with radius  $r$  is  $S = 4\pi r^2$ )

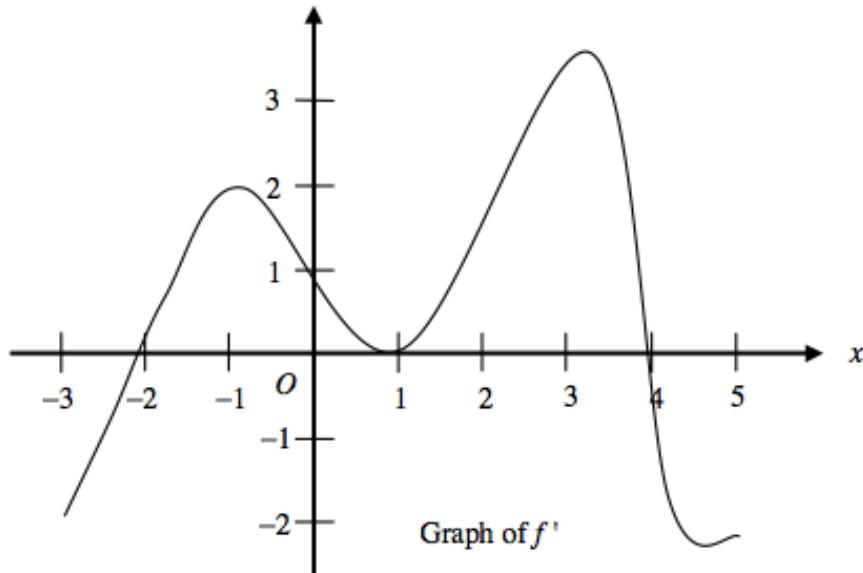
- (A)  $-108\pi$
- (B)  $-72\pi$
- (C)  $-48\pi$
- (D)  $-24\pi$
- (E)  $-16\pi$

19.

The function  $f$  is continuous for  $-2 \leq x \leq 2$  and  $f(-2) = f(2) = 0$ . If there is no  $c$ , where  $-2 < c < 2$ , for which  $f'(c) = 0$ , which of the following statements must be true?

- (A) For  $-2 < k < 2$ ,  $f'(k) > 0$ .
- (B) For  $-2 < k < 2$ ,  $f'(k) < 0$ .
- (C) For  $-2 < k < 2$ ,  $f'(k)$  exists.
- (D) For  $-2 < k < 2$ ,  $f'(k)$  exists, but  $f'$  is not continuous.
- (E) For some  $k$ , where  $-2 < k < 2$ ,  $f'(k)$  does not exist.

20.



The graph of the derivative of a function  $f$  is shown in the figure above. The graph has horizontal tangent lines at  $x = -1$ ,  $x = 1$ , and  $x = 3$ . At which of the following values of  $x$  does  $f$  have a relative maximum?

- (A)  $-2$  only
- (B)  $1$  only
- (C)  $4$  only
- (D)  $-1$  and  $3$  only
- (E)  $-2$ ,  $1$ , and  $4$