

## Test over derivatives

1. Let  $f(x) = \sqrt{x}$ . What is the equation of the tangent line to  $f$  at the point  $(4, 2)$  ?
  - (A)  $y = \frac{1}{4}x + 1$
  - (B)  $y = -\frac{1}{2}x + 3$
  - (C)  $y = \frac{1}{2}x$
  - (D)  $y = 2x - 6$
  - (E) None of the above
2. What is the derivative of  $s(t) = \sec \sqrt{t}$  ?
  - (A)  $\tan^2 \sqrt{t}$
  - (B)  $\sec \frac{1}{2\sqrt{t}} \tan \frac{1}{2\sqrt{t}}$
  - (C)  $\frac{\sec \sqrt{t} \tan \sqrt{t}}{2\sqrt{t}}$
  - (D)  $\sec \sqrt{t} \tan \sqrt{t}$
  - (E) None of the above
3. If  $f, g$ , and  $h$  are nonzero differentiable functions, then the derivative of  $\frac{fg}{h}$  is
  - (A)  $\frac{fg' + f'g}{h'}$
  - (B)  $\frac{fg'h' - fgh'}{h^2}$
  - (C)  $\frac{fgh' - fg'h - f'gh}{h^2}$
  - (D)  $\frac{f'gh + fg'h + fgh'}{h^2}$
  - (E)  $\frac{fg'h + f'gh - fgh'}{h^2}$
4. The line tangent to the curve  $y = \sqrt{16 - x}$  at the point  $(0, 4)$  has slope
  - (A) 8
  - (B) 4
  - (C)  $1/8$
  - (D)  $-1/8$
  - (E) -8
5. At what point(s) on the curve  $x^2 - y^2 + x = 2$  is the tangent line vertical?
  - (A)  $(1, 0)$  only
  - (B)  $(-2, 0)$  only
  - (C)  $(1, \sqrt{2})$  only

- (D)  $(1, 0)$  and  $(-2, 0)$
- (E) The tangent line is never vertical
6. If  $y = 6 \cos(3x)$  then what is  $y'$  ?
- (A)  $-6 \sin(3x)$
- (B)  $18 \sin(x)$
- (C)  $18 \sin(3x)$
- (D)  $-18 \sin(3x)$
- (E) None of the above
7. What is the value of

$$\lim_{\Delta x \rightarrow 0} \frac{2(x + \Delta x)^2 - 2x^2}{\Delta x}$$

- (A)  $2x$
- (B)  $4x$
- (C)  $4$
- (D)  $2$
- (E) Does not exist
8. If  $w(t) = \sqrt{t^2 - 1}$  what is the value of  $w'(4)$  ?
- (A)  $\frac{4}{\sqrt{15}}$
- (B)  $\frac{2}{\sqrt{15}}$
- (C)  $\frac{1}{\sqrt{15}}$
- (D)  $\frac{1}{2\sqrt{15}}$
- (E) None of the above
9. At which  $x$  value does the graph of  $y = 3x^2 - 10x + 15$  have a horizontal tangent line?
- (A)  $\frac{3}{5}$
- (B)  $-\frac{3}{5}$
- (C)  $\frac{5}{3}$
- (D)  $-\frac{5}{3}$
- (E) None of the above
10. Find  $\frac{dy}{dx}$  if  $x^2 + 4xy + 2y^2 = 16$

- (A)  $\frac{-x-2y}{2x+2y}$
- (B)  $\frac{-2(x+y)}{x+2y}$
- (C)  $\frac{-2(x+y)}{2x+y}$
- (D)  $\frac{-x+2y}{x+y}$
- (E) None of the above
11. At which  $x$  value(s) does the graph of  $y = 2x^3 - 24x + 16$  have a horizontal tangent line?
- (A) 1 and -1
- (B) 2
- (C) 1
- (D) 2 and -2
- (E) None of the above
12. If  $h(x) = f(x^2 + 1)$  then which of the following is true?
- (A)  $h'(x) = f'(x^2 + 1)$
- (B)  $h'(x) = f'(2x)$
- (C)  $h'(x) = 2xf'(2x)$
- (D)  $h'(x) = 2xf'(x^2 + 1)$
- (E) None of the above
13. If  $f(x) = 10x^2 - 5$ , what is the average rate of change of  $f(x)$  over the interval

$$-1 \leq x \leq 2$$

- (A) 10
- (B) 30
- (C) 20
- (D)  $\frac{20}{3}$
- (E) None of the above
14. If  $h(x) = f(x)g(x)$  and  $f(5) = 3, f'(5) = -1, g(5) = -\frac{1}{2}, g'(5) = 2$ , then what is the value of  $h'(5)$  ?
- (A) -2
- (B)  $\frac{13}{2}$

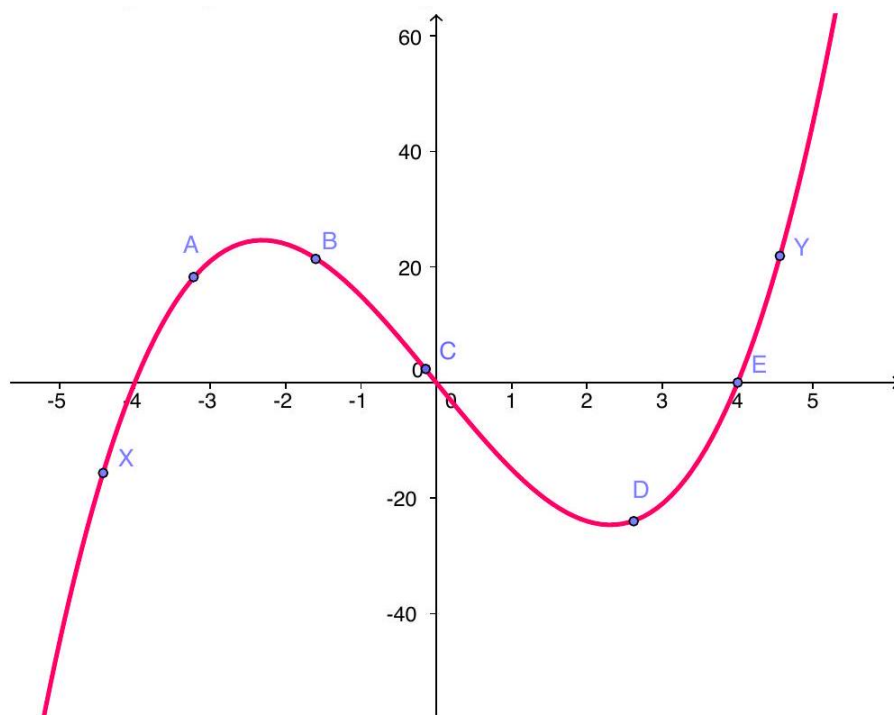
- (C)  $-\frac{9}{2}$
  - (D)  $\frac{9}{2}$
  - (E) None of the above
15. If  $f(x) = \sin(x^2 + 1)$  then find  $f''(x)$
- (A)  $4x^2 \sin(x^2 + 1) + 2 \cos(x^2 + 1)$
  - (B)  $-4x^2 \sin(x^2 + 1) + 2 \cos(x^2 + 1)$
  - (C)  $4x^2 \sin(x^2 + 1) - 2 \cos(x^2 + 1)$
  - (D)  $-4x^2 \sin(x^2 + 1) - 2 \cos(x^2 + 1)$
  - (E) None of the above

16. The height (in feet) of a ball thrown vertically upward is given by

$$s(t) = -16t^2 + 32t + 64$$

where  $t$  is in seconds. What is the velocity of the ball at time  $t = 3$  seconds?

- (A)  $-64\text{ft/s}$
  - (B)  $64\text{ft/s}$
  - (C)  $-16\text{ft/s}$
  - (D)  $16\text{ft/s}$
  - (E) None of the above
17. At which point on the graph is the slope of the tangent line closest to the average rate of change of  $f(x)$  between points  $X$  and  $Y$  ?



(A) A

(B) B

(C) C

(D) D

(E) E

18. Let  $f(x) = x^3 - 6x^2 + 10$ . At which point(s) on the graph of  $f$  is the tangent line parallel to the line  $15x - y = 11$  ?

(A)  $(2, -6)$  and  $(-2, 22)$

(B)  $(2, -6)$  and  $(-2, -22)$

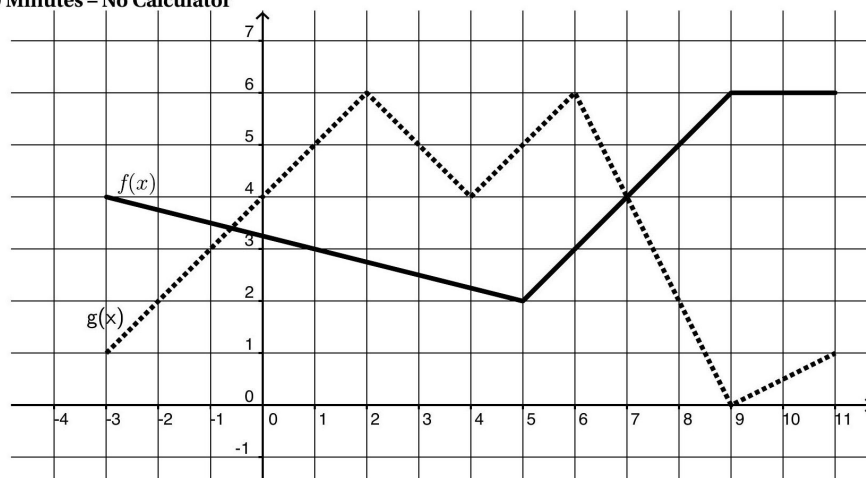
(C)  $(5, -15)$  and  $(-1, 3)$

(D)  $(5, -15)$  and  $(2, -6)$

(E) None of the above

## 5. AP Calculus AB: Section II

20 Minutes – No Calculator



Instructions: In the questions below, find the indicated derivatives using the following definitions

$$p(x) = f(x)g(x)$$

$$q(x) = \frac{f(x)}{g(x)}$$

$$c(x) = f(g(x))$$

$$s(x) = f(2x)$$

1.  $f'(4) =$
2.  $g'(-1) =$
3.  $p'(1) =$
4.  $q'(1) =$
5.  $c'(-1) =$
6.  $s'(3) =$
7.  $p'(7) =$