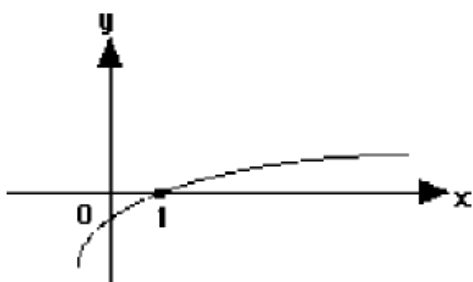
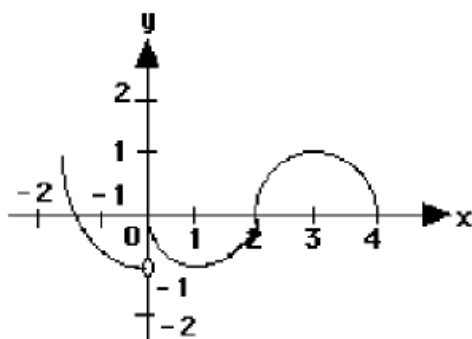


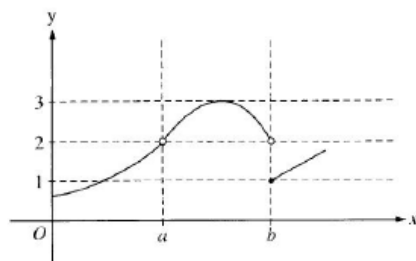
## Exam Review Day 1(Non-Calculator)



1. The graph of a twice-differentiable function  $f$  is shown in the figure above. Which of the following is true?
- A)  $f(1) < f'(1) < f''(1)$       B)  $f(1) < f''(1) < f'(1)$       C)  $f'(1) < f(1) < f''(1)$   
D)  $f''(1) < f(1) < f'(1)$       E)  $f''(1) < f'(1) < f(1)$
2. An equation of the line tangent to the graph of  $y = x + \cos x$  at the point  $(0, 1)$  is
- A)  $y = 2x + 1$       B)  $y = x + 1$       C)  $y = x$   
D)  $y = x - 1$       E)  $y = 0$
3. If  $f''(x) = x(x + 1)(x - 2)^2$ , then the graph of  $f$  has inflection points when  $x =$
- A)  $-1$  only      B)  $2$  only      C)  $-1$  and  $0$  only  
D)  $-1$  and  $2$  only      E)  $-1, 0,$  and  $2$  only
4. The minimum value of  $f(x) = x^2 + \frac{2}{x}$  on the interval  $\frac{1}{2} \leq x \leq 2$  is
- A)  $\frac{1}{2}$       B)  $1$       C)  $3$   
D)  $4.5$       E)  $5$
5. If the continuous and differentiable function  $f(x) = \begin{cases} ax^3 - 6x; & x \leq 1 \\ bx^2 + 4; & x > 1 \end{cases}$  then  $a =$
- A)  $0$       B)  $1$       C)  $-14$   
D)  $-24$       E)  $26$
6. A particle moves along a line according to the distance formula  $s(t) = 2t^2 - 6t + 17$ . The particle is at rest when  $t =$
- A)  $1$       B)  $1.5$       C)  $2$   
D)  $2.5$       E)  $4$



7. The graph of the function  $f$  shown in the figure above has a vertical tangent at the point  $(2,0)$  and horizontal tangents at the points  $(1,-1)$  and  $(3,1)$ . For what values of  $x$ ,  $-2 < x < 4$ , is  $f$  not differentiable?
- A) 0 only  
B) 0 and 2 only  
C) 1 and 3 only  
D) 0, 1, and 3 only  
E) 0, 1, 2, and 3
8.  $\lim_{x \rightarrow \infty} \frac{3x^2 - 4}{2 - 7x - x^2} =$
- A) 3  
B) 1  
C) -3  
D)  $\infty$   
E) 0
9. The total number of relative maximum and minimum points of the function whose derivative is  $f'(x) = x^2(x+1)^3(x-4)^3$  is
- A) 0  
B) 1  
C) 2  
D) 3  
E) 4
10. The slope of the curve  $y^2 - xy - 3x = 1$  at the point  $(0,1)$  is
- A) -1  
B) -2  
C) 1  
D) 2  
E) -3
11. If  $f(x) = \cos x \sin 3x$ , then  $f'\left(\frac{\pi}{6}\right)$  is equal to
- A)  $\frac{1}{2}$   
B)  $-\frac{\sqrt{3}}{2}$   
C) 0  
D) 1  
E)  $-\frac{1}{2}$
12. A particle moves in a straight line with velocity  $v(t) = t^2$ . How far does the particle move between times  $t = 1$  and  $t = 2$ ?
- A)  $\frac{1}{3}$   
B)  $\frac{7}{3}$   
C) 3  
D) 7  
E) 8

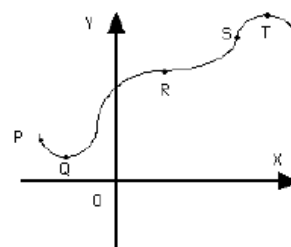


13. The graph of the function  $f$  is shown in the figure above. Which of the following statements about  $f$  is true?

- A)  $\lim_{x \rightarrow a} f(x) = \lim_{x \rightarrow b} f(x)$       B)  $\lim_{x \rightarrow a} f(x) = 2$       C)  $\lim_{x \rightarrow b} f(x) = 2$   
 D)  $\lim_{x \rightarrow b} f(x) = 1$       E)  $\lim_{x \rightarrow a} f(x)$  does not exist.

14. At which point on the following graph do both  $\frac{dy}{dx}$  and  $\frac{d^2y}{dx^2}$  equal zero?

- A) P      B) Q      C) R  
 D) S      E) T



15. What is the x-coordinate of the point of inflection on the graph of  $y = \frac{1}{3}x^3 + 5x^2 + 24$ ?

- A) 5      B) 0      C)  $-\frac{10}{3}$   
 D) -5      E) -10

16.  $\int_0^1 (3x-2)^2 dx =$

- A)  $-7/3$       B)  $-7/9$       C)  $1/9$   
 D) 1      E) 3

17. The radius  $r$  of a sphere is increasing at the uniform rate of 0.3 inches per second. At the instant when the surface area  $S$  becomes  $100\pi$  square inches, what is the rate of increase, in cubic inches per second, in the volume  $V$ ?

- A)  $10\pi$       B)  $12\pi$       C)  $22.5\pi$   
 D)  $25\pi$       E)  $30\pi$

18. The x-coordinate of the absolute max. of  $f(x) = 3x^3 - \frac{9}{2}x^2$  on  $[-2, 2]$  is:

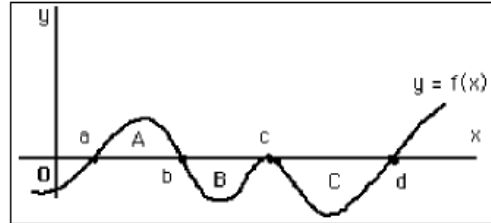
- A) 0      B) 2      C) 1  
 D) -2      E)  $\frac{1}{2}$

19. If, for all  $x$ ,  $f'(x) = (x-2)^4(x-1)^3$ , it follows that the function  $f$  has

- A) a relative minimum at  $x = 1$
- B) a relative maximum at  $x = 1$
- C) both a relative minimum at  $x = 1$  and a relative maximum at  $x = 2$
- D) neither a relative maximum nor a relative minimum
- E) relative minima at  $x = 1$  and  $x = 2$

20. The following graph represents  $y = f(x)$ . If  $A$ ,  $B$ , and  $C$  represent the areas of the respective

enclosed regions, then  $\int_d^a (-f(x)) dx =$



- A)  $A - B - C$
- B)  $B + C - A$
- C)  $A - (B - C)$
- D)  $A + B + C$
- E)  $B - C - A$

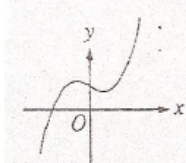
21.  $\frac{d}{dx} \left( \int_0^{x^2} \sin(t^3) dt \right) =$

- A)  $-\cos(x^6)$
- B)  $\sin(x^3)$
- C)  $\sin(x^6)$
- D)  $2x \sin(x^3)$
- E)  $2x \sin(x^6)$

22. The function  $f$  is given by  $f(x) = x^4 + x^2 - 2$ . On which of the following intervals is  $f$  increasing?

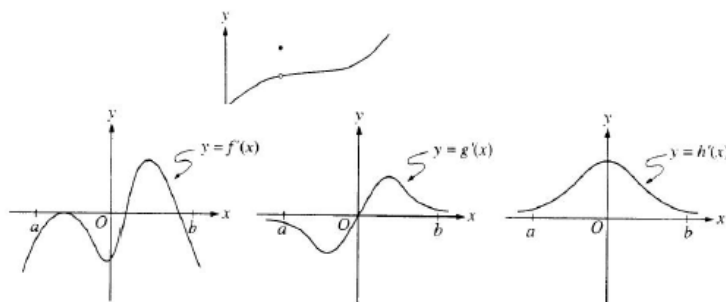
- A)  $\left(-\frac{1}{2}, \infty\right)$
- B)  $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$
- C)  $(0, \infty)$
- D)  $(-\infty, 0)$
- E)  $\left(-\infty, -\frac{1}{\sqrt{2}}\right)$

23. The graph of  $y = h(x)$  is shown below. Which of the following could be the graph of  $y = h'(x)$ ?



- (a)
- (b)
- (c)
- (d)
- (e)

## Calculator Practice



1. The graphs of the derivatives of the functions  $f$ ,  $g$ , and  $h$  are shown above. Which of the functions  $f$ ,  $g$ , or  $h$  have a relative maximum on the open interval  $a < x < b$ ?

(A)  $f$  only      (B)  $g$  only      (C)  $h$  only      (D)  $f$  and  $g$  only      (E)  $f$ ,  $g$ , and  $h$

2. A particle moves along the  $x$ -axis so that at any time  $t \geq 0$ , its velocity is given by  $v(t) = 3 + 4.1\cos(0.9t)$ . What is the acceleration of the particle at time  $t = 4$ ?

(A)  $-2.016$       (B)  $-0.677$       (C)  $1.633$       (D)  $1.814$       (E)  $2.978$

3. The first derivative of the function  $f$  is given by  $f'(x) = \frac{\cos^2 x}{x} - \frac{1}{5}$ . How many critical values does  $f$  have on the open interval  $(0, 10)$ ?

(A) One      (B) Three      (C) Four      (D) Five      (E) Seven

4. Let  $f$  be the function given by  $f(x) = |x|$ . Which of the following statements about  $f$  are true?

- I.  $f$  is continuous at  $x = 0$ .  
 II.  $f$  is differentiable at  $x = 0$ .  
 III.  $f$  has an absolute minimum at  $x = 0$ .

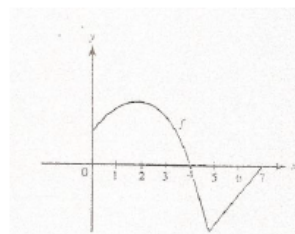
(A) I only      (B) II only      (C) III only      (D) I and III only      (E) II and III only

5. If  $a \neq 0$ , then  $\lim_{x \rightarrow a} \frac{x^2 - a^2}{x^4 - a^4}$  is

(A)  $\frac{1}{a^2}$       (B)  $\frac{1}{2a^2}$       (C)  $\frac{1}{6a^2}$       (D) 0      (E) nonexistent

6. The function  $f$  whose graph is shown has  $f' = 0$  at  $x =$

(A) 2 only      (B) 2 and 5 only  
 (C) 4 and 7 only      (D) 2, 4, and 7



(E) 2, 4, 5, and 7

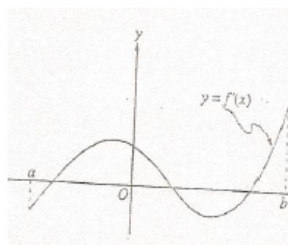
7. A differentiable function  $f$  has values show. Estimate  $f'(1.5)$

$x$	1.0	1.2	1.4	1.6
$f(x)$	8	10	14	22

- (A) 8                      (B) 12                      (C) 18                      (D) 40                      (E) 80

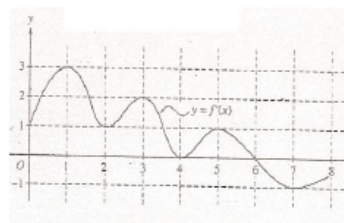
8. The graph of  $f'$ , is shown in the figure. Which of the following describes all relative extrema of  $f$  on the open interval  $(a,b)$

- (A) One relative maximum and two relative minima  
 (B) Two relative maxima and one relative minimum  
 (C) Three relative maxima and one relative minimum  
 (D) One relative maximum and three relative minima  
 (E) Three relative maxima and two relative minima



For Question # 9-10.

The function  $f$  is defined on the closed interval  $[0,8]$ . The graph of the derivative  $f'$  is shown below.



9. How many points of inflection does the graph of  $f$  have?

- (A) Two                      (B) Three                      (C) Four                      (D) Five                      (E) Six

10. At what value of  $x$  does the absolute minimum of  $f$  occur?

- (A) 0                      (B) 2                      (C) 4                      (D) 6                      (E) 8

11. The graph of the function  $y = x^3 + 6x^2 + 7x - 2\cos x$  changes concavity at  $x =$

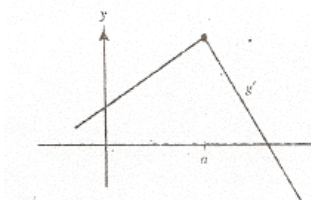
- (A) -1.58                      (B) -1.63                      (C) -1.67                      (D) -1.89                      (E) -2.33

12. Which of the following is an equation of the line tangent to the graph of  $f(x) = x^4 + 2x^2$  at the point where  $f'(x) = 1$ ?

- (A)  $y = 8x - 5$     (B)  $y = x + 7$     (C)  $y = x + 0.763$     (D)  $y = x - 0.122$     (E)  $y = x - 2.146$

13. The graph of  $g'$  is shown here. Which of the following statements are true of  $g$  at  $x = a$

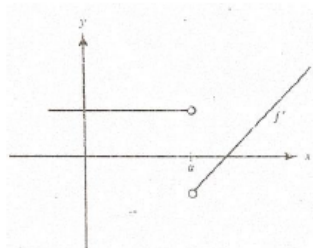
- I.  $g$  is continuous  
 II.  $g$  is differentiable  
 III.  $g$  is increasing



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

14. A function  $f$  has the derivative shown. Which of the following statements must be false?

- (A)  $f$  is continuous at  $x = a$   
 (B)  $f(a) = 0$   
 (C)  $f$  has a vertical asymptote at  $x = a$   
 (D)  $f$  has a jump discontinuity at  $x = a$   
 (E)  $f$  has a removable discontinuity at  $x = a$



15. If  $g$  is a differentiable function such that  $g(x) < 0$  for all real numbers  $x$  and if  $f'(x) = (x^2 - 4)g(x)$ , which of the following is true?

- (A)  $f$  has a relative maximum at  $x = -2$  and a relative minimum at  $x = 2$   
 (B)  $f$  has a relative maximum at  $x = 2$  and a relative minimum at  $x = -2$   
 (C)  $f$  has relative minima at  $x = -2$  and at  $x = 2$ .  
 (D)  $f$  has relative maxima at  $x = -2$  and at  $x = 2$ .  
 (E) It cannot be determined if  $f$  has any relative extrema.

16. Let  $f$  be a function that is differentiable on the open interval  $(1, 10)$ . If  $f(2) = -5$ ,  $f(5) = 5$ , and  $f(9) = -5$ , which of the following must be true?

- I.  $f$  has at least 2 zeros.  
 II. The graph of  $f$  has at least one horizontal tangent.  
 III. For some  $c$ ,  $2 < c < 5$ ,  $f(c) = 3$ .

- (A) None                      (B) I only                      (C) I and II only                      (D) I and III only                      (E) I, II, and III

17. If a particle moves on a line according to a law  $s = t^5 + 2t^3$  then the number of times it reverses direction is:

- (A) 4                      (B) 3                      (C) 2                      (D) 1                      (E) 0