Caluclus AB NAME: _____

MC Packet 4 - Using f, f', and f'' PERIOD: _____

In-Class Together: Problems 1-6

① What are all values of x for which the function f defined by $f(x)=(x^2-3)e^{-x}$ is increasing?

(A) There are no such values of x.

(B) $x<-1$ and $x>3$

(C) $-3<x<1$

(D) $-1<x<3$

(E) All values of x

② At $x=0$. which of the following is true of the function f defined by $f(x)=x^2-e^{-2x}$?

(A) f is increasing.

(B) f is decreasing.

(C) f is discontinuous.

(D) f has a relative mininum.

(E) f has a relative maximum.

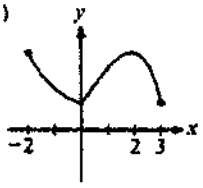
③ For what value of k will $x+\frac{k}{x}$ have a relative maximum at $x=-2$?

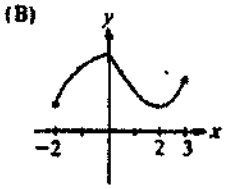
(A) -4 (B) -2 (C) 2 (D) 4 (E) None of these

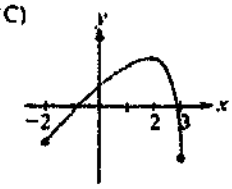
④ If $f''(x) = x(x+1)(x-2)^2$, then the graph of f has inflection points when $x =$

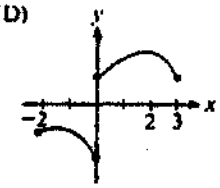
(A) -1 only (B) 2 only (C) -1 and 0 only (D) -1 and 2 only (E) -1, 0, and 2 only

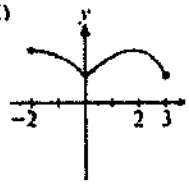
⑤ Let f be a function that is continuous on the closed interval $[-2,3]$ such that $f'(0)$ does not exist, $f'(2) = 0$, and $f''(x) < 0$ for all x except $x = 0$. Which of the following could be the graph of f?

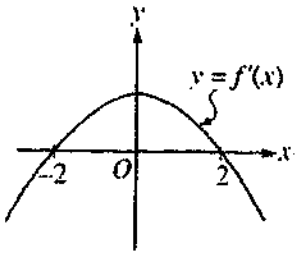
(A) 

(B) 

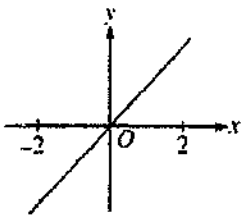
(C) 

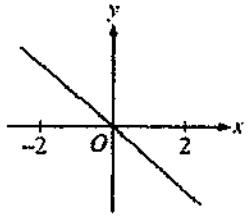
(D) 

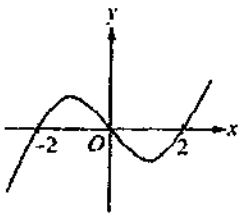
(E) 

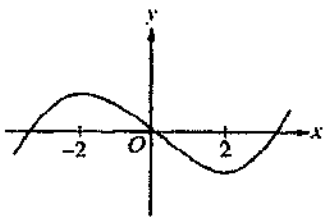


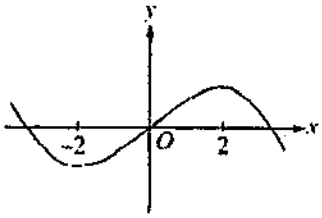
⑥ The graph of the derivative of f is shown in the figure above. Which of the following could be the graph of f?

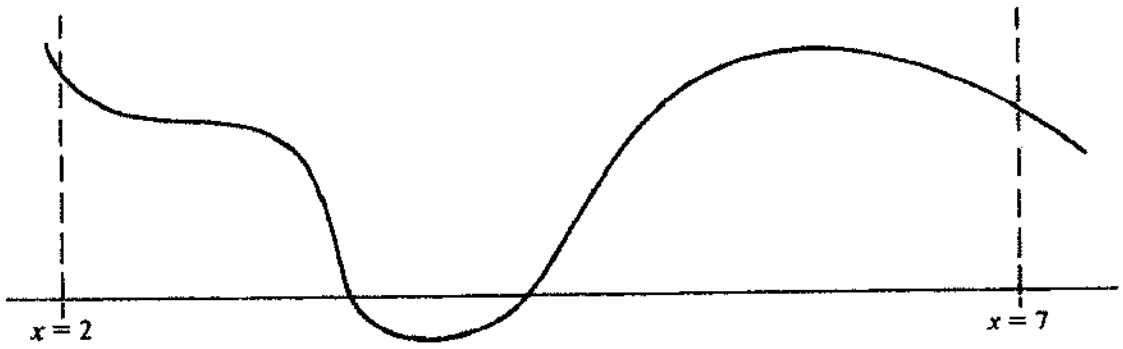
(A) 

(B) 

(C) 

(D) 

(E) 



(7) The graph of $y = f(x)$ on the closed interval $[2, 7]$ is shown above. How many points of inflection does this graph have on this interval?

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

(8) The graph of $y = 3x^4 - 16x^3 + 24x^2 + 48$ is concave down for

(A) $x < 0$

(B) $x > 0$

(C) $x < -2$ or $x > -\frac{2}{3}$

(D) $x < \frac{2}{3}$ or $x > 2$

(E) $\frac{2}{3} < x < 2$

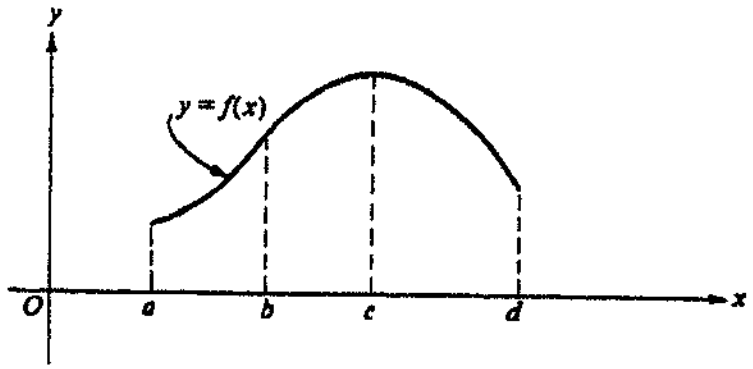
(9) If $y = 2x - 8$, what is the minimum value of the product xy?

(A) -16 (B) -8 (C) -4 (D) 0 (E) 2

(10) The graph of $y = 5x^4 - x^5$ has a point of inflection at

(A) (0,0) only (B) (3.162) only (C) (4,256) only

(D) (0,0) and (3.162) (E) (0,0) and (4,256)



(11) The graph of $y = f(x)$ is shown in the figure above. On which of the following intervals are $\frac{dy}{dx} > 0$ and $\frac{d^2y}{dx^2} < 0$?

I. $a < x < b$
II. $b < x < c$
III. $c < x < d$

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

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

(A) $\left(-\frac{1}{\sqrt{2}}, \infty\right)$

(B) $\left(-\frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}}\right)$

(C) $(0, \infty)$

(D) $(-\infty, 0)$

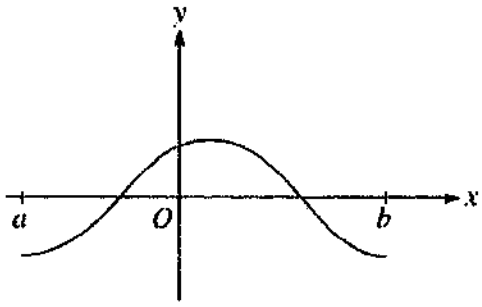
(E) $\left(-\infty, -\frac{1}{\sqrt{2}}\right)$

(13) The *derivative* of $f(x) = \frac{x^4}{3} - \frac{x^5}{5}$ attains its maximum value at $x =$

(A) -1 (B) 0 (C) 1 (D) $\frac{4}{3}$ (E) $\frac{5}{3}$

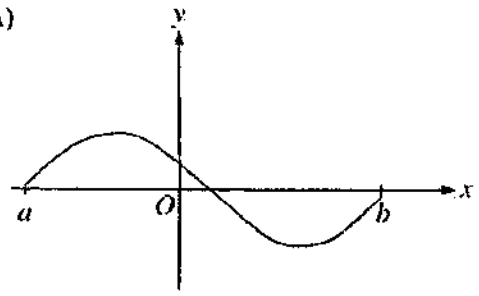
(14) At what values of x does $f(x) = 3x^5 - 5x^3 + 15$ have a relative maximum?

(A) -1 only (B) 0 only (C) 1 only (D) -1 and 1 only (E) -1, 0 and 1

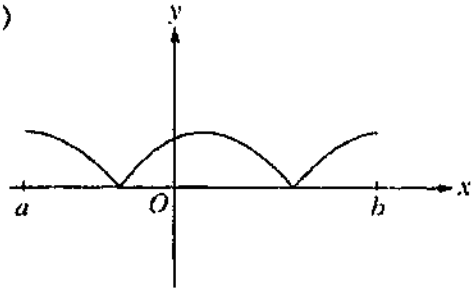


(15) The graph of f is shown in the figure above. Which of the following could be the graph of the derivative of f?

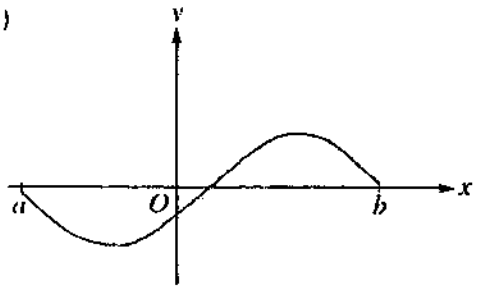
(A)



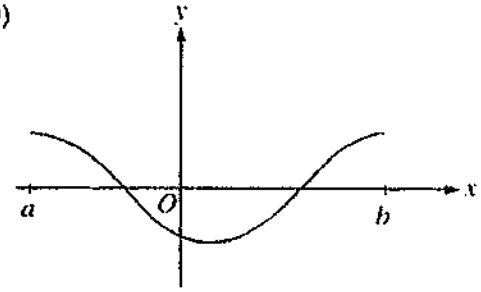
(B)



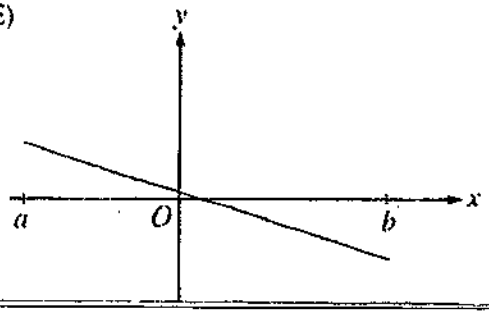
(C)



(D)



(E)



(16) Let f be a function defined for all real numbers x. If $f'(x)=\dfrac{|4-x^2|}{x-2}$, then f is decreasing on the interval

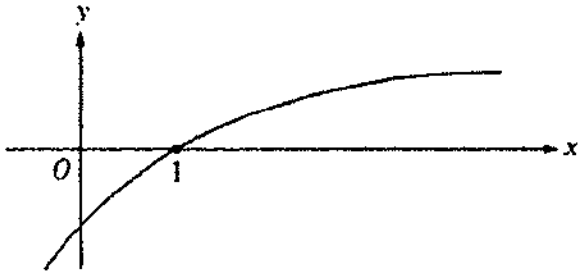
(A) $(-\infty,2)$ (B) $(-\infty,\infty)$ (C) $(-2,4)$ (D) $(-2,\infty)$ (E) $(2,\infty)$

(17) At what value of x does the graph of $y = \frac{1}{x^2} - \frac{1}{x^3}$ have a point of inflection?

(A) 0 (B) 1 (C) 2 (D) 3 (E) At no value of x

(18) The absolute maximum value of $f(x) = x^3 - 3x^2 + 12$ on the closed interval $[-2, 4]$ occurs at $x =$

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



(19) The graph of a twice-differentiable function f is shown in the figure above. Which of the following is true?

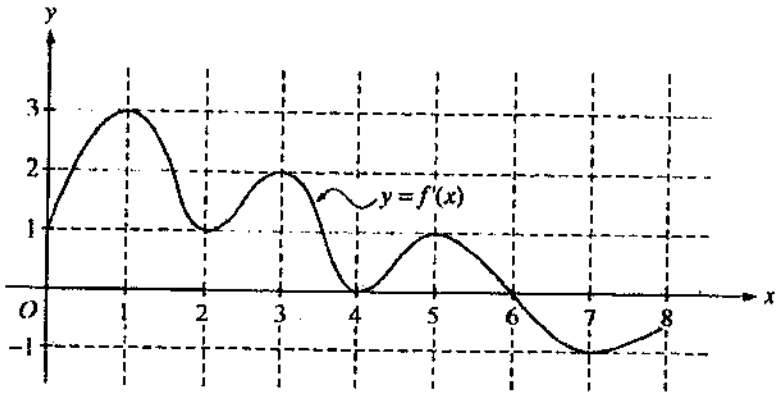
(A) $f(1) < f'(1) < f''(1)$

(B) $f(1) < f''(1) < f'(1)$

(C) $f'(1) < f(1) < f''(1)$

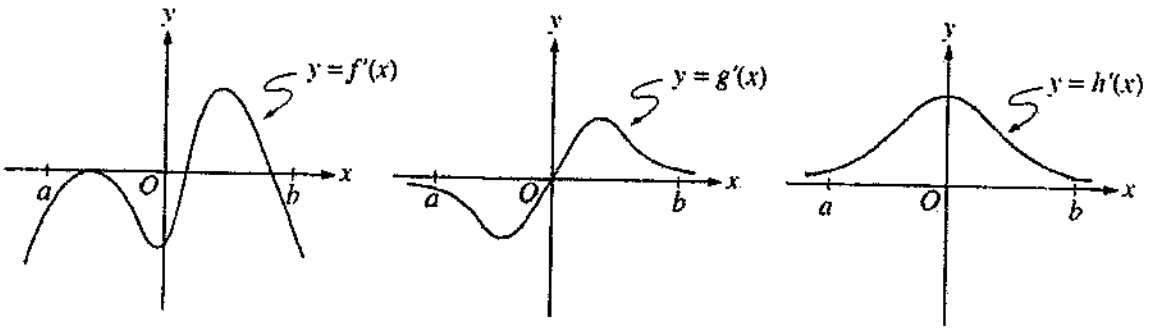
(D) $f''(1) < f(1) < f'(1)$

(E) $f''(1) < f'(1) < f(1)$



(20) The function f is defined on the closed interval $[0, 8]$. The graph of its derivative f' is shown above. How many points of inflection does the graph of f have?

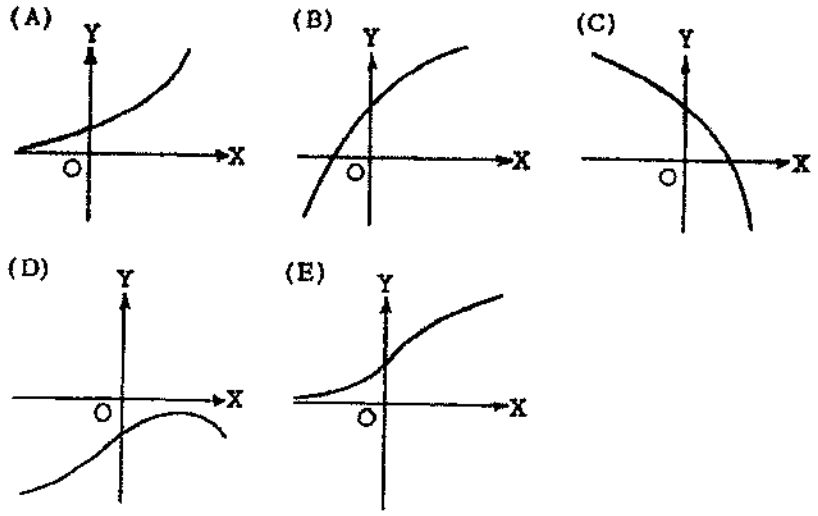
(A) Two
(B) Three
(C) Four
(D) Five
(E) Six



(21) 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 $a < x < b$?

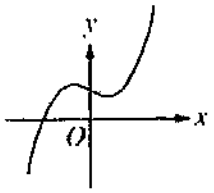
(A) f only
(B) g only
(C) h only
(D) f and g only
(E) f, g, and h

(22) If y is a function of x such that $y' > 0$ for all x and $y'' < 0$ for all x, which of the following could be part of the graph of $y = f(x)$?

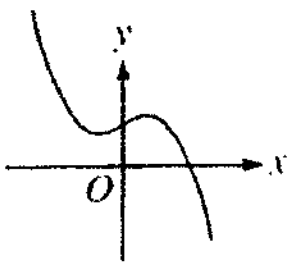


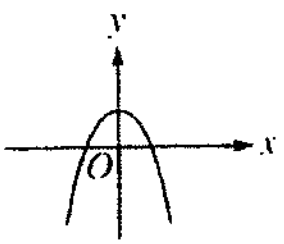
(23) If $f(x) = \dfrac{\ln x}{x}$, for all $x > 0$, which of the following is true?

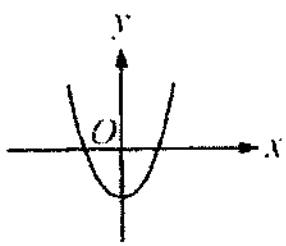
(A) f is increasing for all x greater than 0.
(B) f is increasing for all x greater than 1.
(C) f is decreasing for all x between 0 and 1.
(D) f is decreasing for all x between 1 and e.
(E) f is decreasing for all x greater than e.



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

(A)


(C)


(E)


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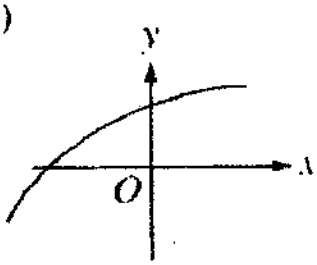
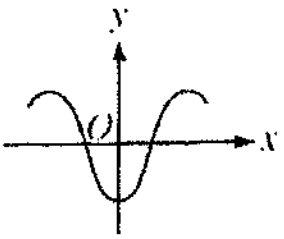


(D)


(25) If g is a differentiable function such that $g(x) < 0$ for all real numbers x and if $f'(x) = \left(x^2 - 4\right)g(x)$, 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 minimum at $x = -2$ and a relative maximum 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.

(26) How many critical points does the function $f(x) = (x+2)^5(x-3)^4$ have?

(A) One (B) Two (C) Three (D) Five (E) Nine

(27) The graph of $y = \dfrac{-5}{x-2}$ is concave downward for all values of x such that

(A) $x < 0$ (B) $x < 2$ (C) $x < 5$ (D) $x > 0$ (E) $x > 2$

(28) What is the minimum value of $f(x) = x \ln x$?

(A) $-e$ (B) -1 (C) $-\dfrac{1}{e}$ (D) 0 (E) $f(x)$ has no minimum value.