Multiple Choice Questions

Part A. No Calculator.

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

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

2. $\frac{d}{dx}\left(\int_0^{x^3} \ln(t^2+1)\ dt\right) =$

(A) $\frac{2x^3}{x^6+1}$ (B) $\frac{3x^2}{x^6+1}$ (C) $\ln(x^6+1)$ (D) $2x^3\ln(x^6+1)$ (E) $3x^2\ln(x^6+1)$

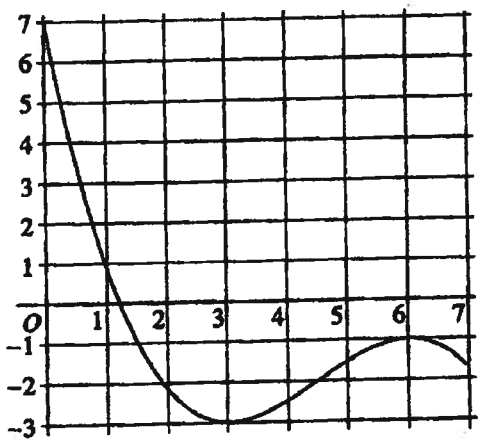
3. If $F(x) = \int_0^x \sqrt{t^3+1}\ dt$, then $F'(2) =$

(A) -3 (B) -2 (C) 2 (D) 3 (E) 18

Figure for #4

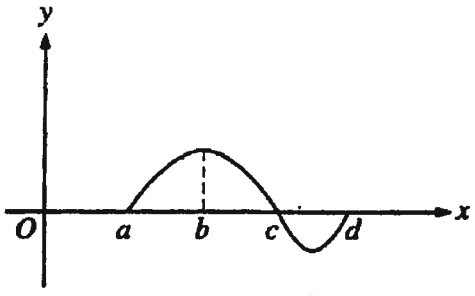
4. The graph of the function f shown in the figure ~~above~~ to the right has horizontal tangents at $x = 3$ and $x = 6$. If $g(x) = \int_0^{2x} f(t)\,dt$, what is the value of $g'(3)$?

(A) 0 (B) -1 (C) -2 (D) -3 (E) -6



Graph of f

Figure for #4 →

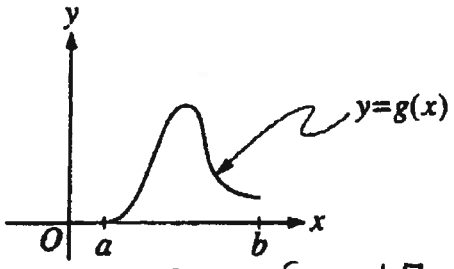


5. The graph of f is shown in the figure above. If $g(x) = \int_a^x f(t)\,dt$, for what value of x does $g(x)$ have a maximum?

(A) a
(B) b
(C) c
(D) d
(E) It cannot be determined from the information given.

Part B. Graphing Calculator Allowed.

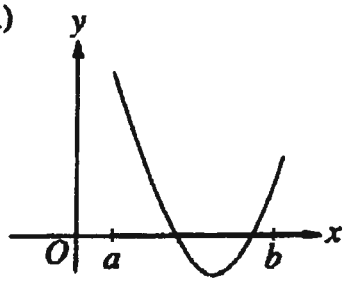
6. Let g be the function given by $g(x) = \int_0^x \sin(t^2)\ dt$ for $-1 \le x \le 3$. On which of the following intervals is g decreasing?
   (A) $-1 \le x \le 0$
   (B) $0 \le x \le 1.772$
   (C) $1.253 \le x \le 2.171$
   (D) $1.772 \le x \le 2.507$
   (E) $2.802 \le x \le 3$

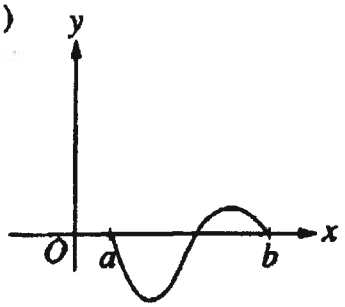


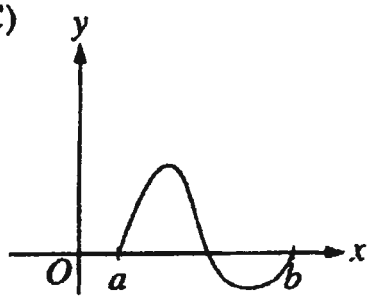
Graph for #7

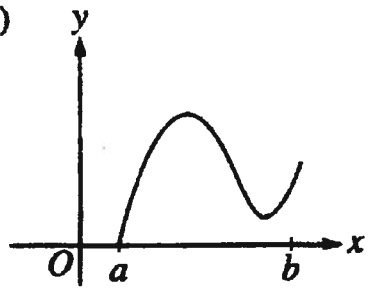
7. Let $g(x) = \int_a^x f(t)\,dt$, where $a \le x \le b$. The figure above shows the graph of g on $[a, b]$.

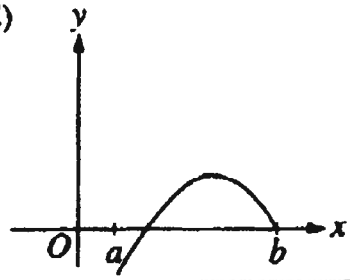
Which of the following could be the graph of f on $[a, b]$?

(A)


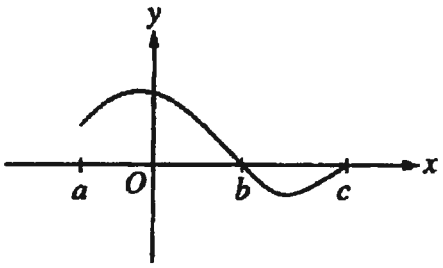
(B)


(C)


(D)


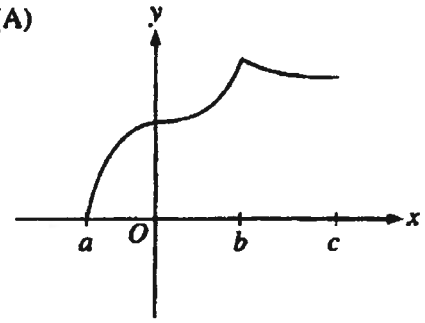
(E)


8.

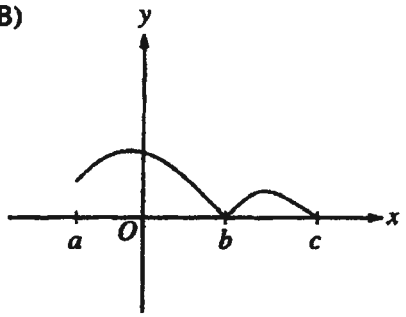


Let $f(x) = \int_a^x h(t)\,dt$ where h has the graph shown above. Which of the following could be the graph of f?

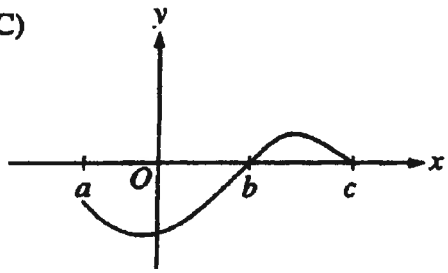
(A)



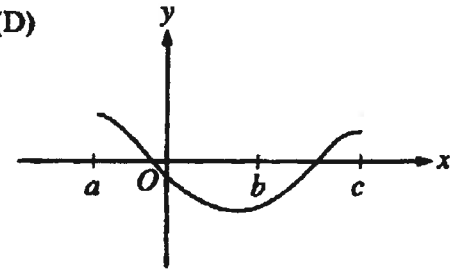
(B)



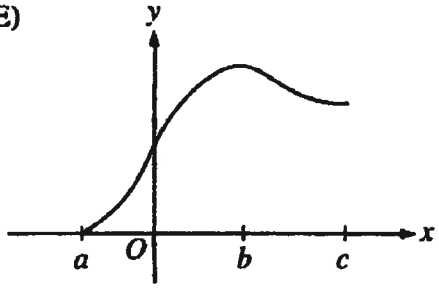
(C)



(D)



(E)



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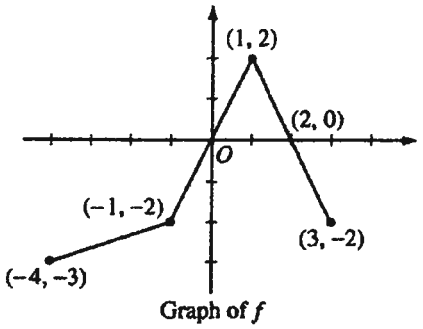
(4)

Question 4

The graph of the function f above consists of three line segments.



Graph of f

(a) Let g be the function given by $g(x) = \int_{-4}^{x} f(t)\,dt$.

For each of $g(-1)$, $g'(-1)$, and $g''(-1)$, find the value or state that it does not exist.

(b) For the function g defined in part (a), find the x-coordinate of each point of inflection of the graph of g on the open interval $-4 < x < 3$. Explain your reasoning.

(c) Let h be the function given by $h(x) = \int_{x}^{3} f(t)\,dt$. Find all values of x in the closed interval $-4 \le x \le 3$ for which $h(x) = 0$.

(d) For the function h defined in part (c), find all intervals on which h is decreasing. Explain your reasoning.

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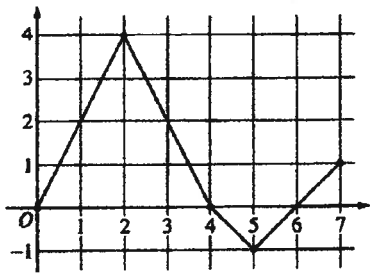
Question 5

Let f be a function defined on the closed interval $[0,7]$. The graph of f, consisting of four line segments, is shown above. Let g be the function given by $g(x) = \int_{2}^{x} f(t)\,dt$.



Graph of f

(a) Find $g(3)$, $g'(3)$, and $g''(3)$.

(b) Find the average rate of change of g on the interval $0 \le x \le 3$.

(c) For how many values c, where $0 < c < 3$, is $g'(c)$ equal to the average rate found in part (b)? Explain your reasoning.

(d) Find the x-coordinate of each point of inflection of the graph of g on the interval $0 < x < 7$. Justify your answer.

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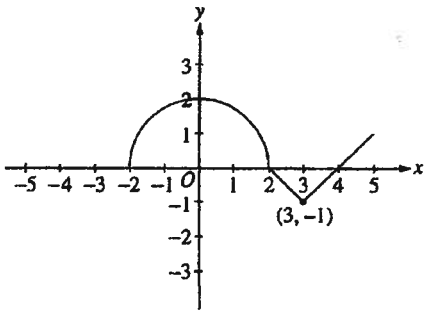
5. The graph of a function f consists of a semicircle and two line segments as shown above. Let g be the function given by $g(x) = \int_{0}^{x} f(t)\,dt$.



(a) Find $g(3)$.

(b) Find all values of x on the open interval $(-2, 5)$ at which g has a relative maximum. Justify your answer.

(c) Write an equation for the line tangent to the graph of g at $x = 3$.

(d) Find the x-coordinate of each point of inflection of the graph of g on the open interval $(-2, 5)$. Justify your answer.