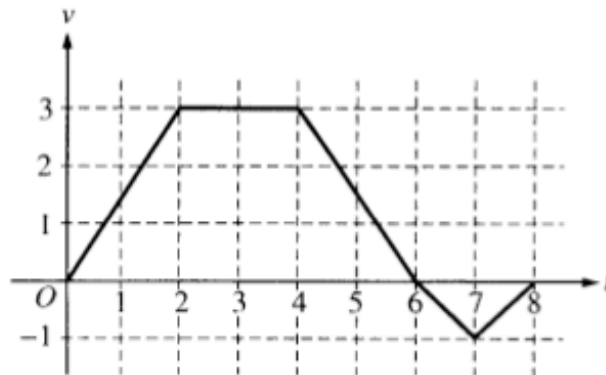


# Multiple-Choice Problems Based on Graphs

[From previously released AP Exams]

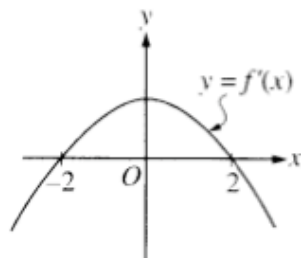
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Questions 8-9 refer to the following situation.

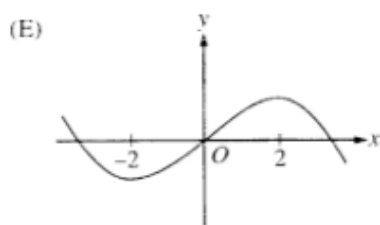
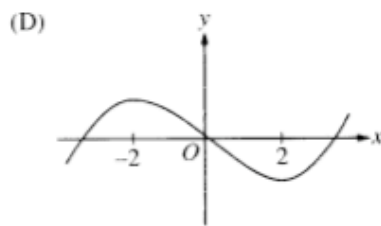
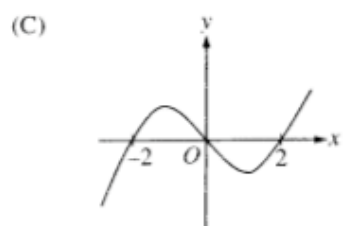
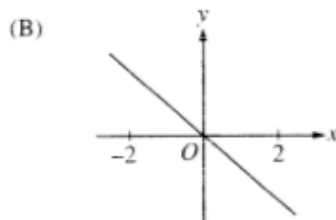
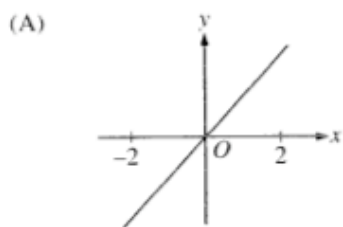


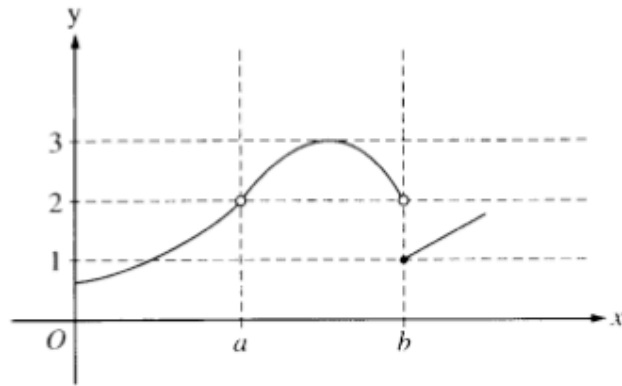
A bug begins to crawl up a vertical wire at time  $t = 0$ . The velocity  $v$  of the bug at time  $t$ ,  $0 \leq t \leq 8$ , is given by the function whose graph is shown above.

8. At what value of  $t$  does the bug change direction?
- (A) 2                      (B) 4                      (C) 6                      (D) 7                      (E) 8
- 
9. What is the total distance the bug traveled from  $t = 0$  to  $t = 8$ ?
- (A) 14                      (B) 13                      (C) 11                      (D) 8                      (E) 6



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

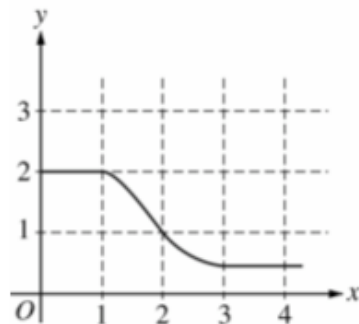




The graph of the function  $f$  is shown in the figure above. Which of the following statements about  $f$  is true?

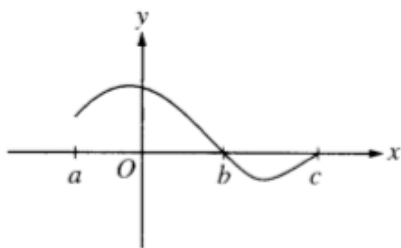
- (A)  $\lim_{x \rightarrow a} f(x) = \lim_{x \rightarrow b} f(x)$
- (B)  $\lim_{x \rightarrow a} f(x) = 2$
- (C)  $\lim_{x \rightarrow b} f(x) = 2$
- (D)  $\lim_{x \rightarrow b} f(x) = 1$
- (E)  $\lim_{x \rightarrow a} f(x)$  does not exist.

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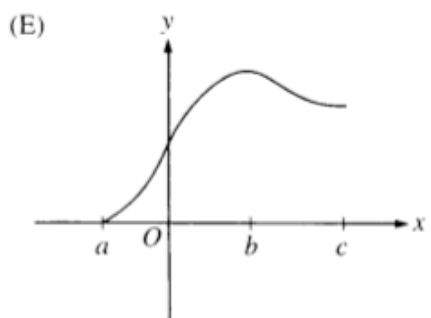
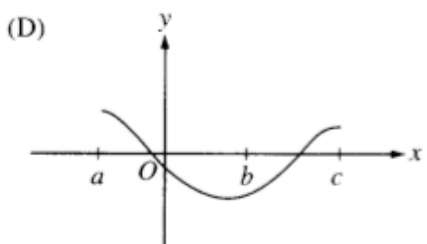
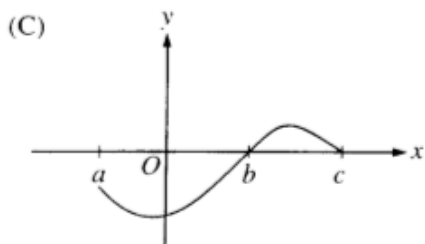
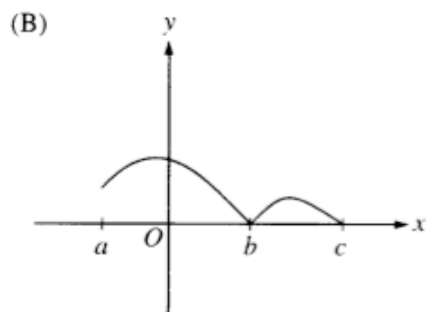
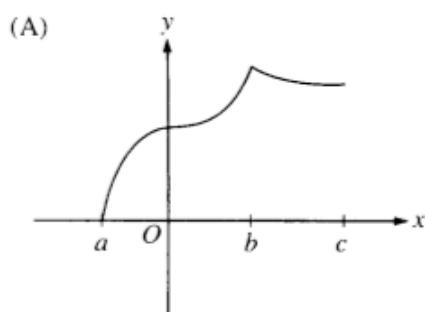


The graph of  $f$  is shown in the figure above. If  $\int_1^3 f(x) dx = 2.3$  and  $F'(x) = f(x)$ , then  $F(3) - F(0) =$

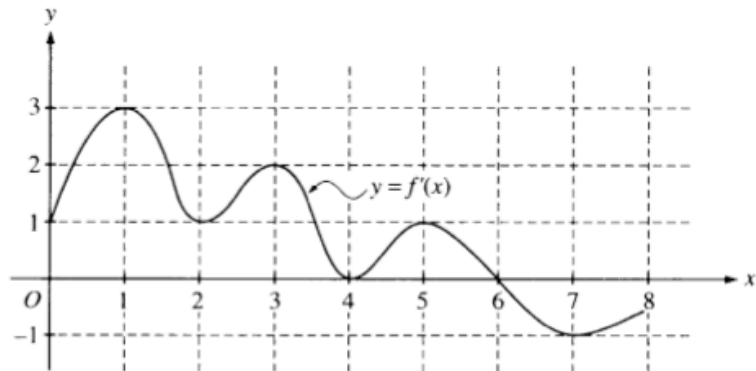
- (A) 0.3
- (B) 1.3
- (C) 3.3
- (D) 4.3
- (E) 5.3



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  $f$ ?



Questions 7-9 refer to the graph and the information below.



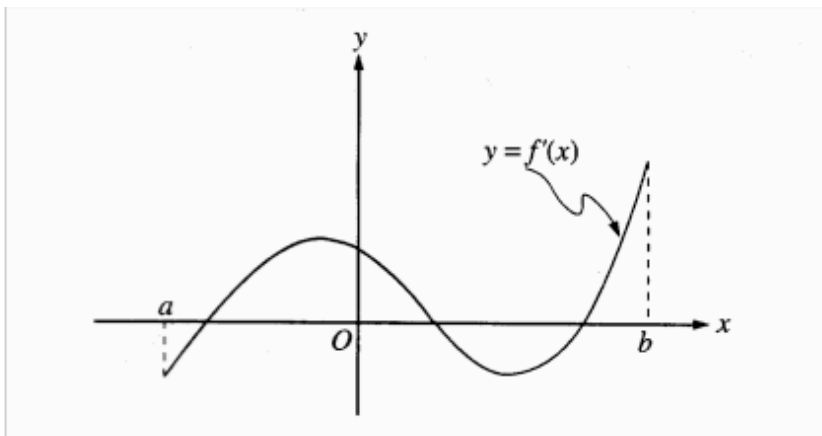
The function  $f$  is defined on the closed interval  $[0, 8]$ . The graph of its derivative  $f'$  is shown above.

7. The point  $(3, 5)$  is on the graph of  $y = f(x)$ . An equation of the line tangent to the graph of  $f$  at  $(3, 5)$  is
- (A)  $y = 2$
  - (B)  $y = 5$
  - (C)  $y - 5 = 2(x - 3)$
  - (D)  $y + 5 = 2(x - 3)$
  - (E)  $y + 5 = 2(x + 3)$
- 
8. How many points of inflection does the graph of  $f$  have?
- (A) Two
  - (B) Three
  - (C) Four
  - (D) Five
  - (E) Six

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

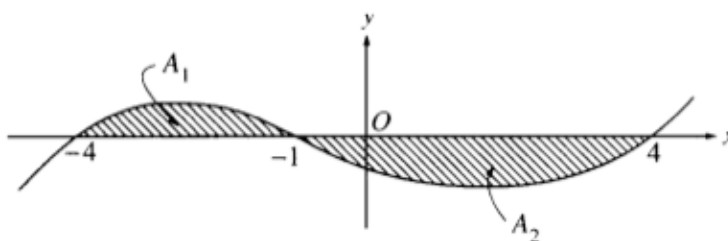
- (A) 0
- (B) 2
- (C) 4
- (D) 6
- (E) 8



The graph of  $f'$ , the derivative of  $f$ , is shown in the figure above. 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

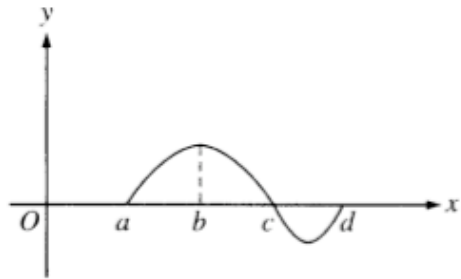
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The graph of  $y = f(x)$  is shown in the figure above. If  $A_1$  and  $A_2$  are positive numbers that represent the areas of the shaded regions, then in terms of  $A_1$  and  $A_2$ ,

$$\int_{-4}^4 f(x) dx - 2 \int_{-1}^4 f(x) dx =$$

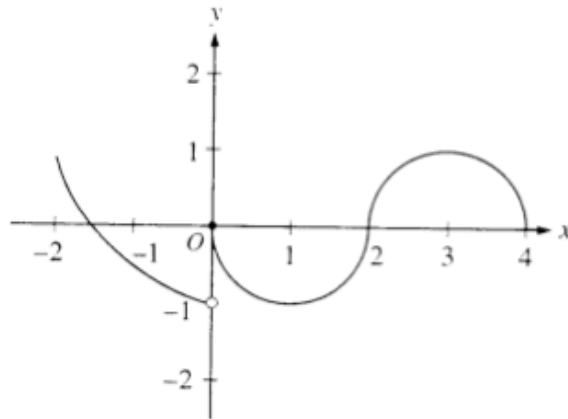
- (A)  $A_1$
- (B)  $A_1 - A_2$
- (C)  $2A_1 - A_2$
- (D)  $A_1 + A_2$
- (E)  $A_1 + 2A_2$



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?

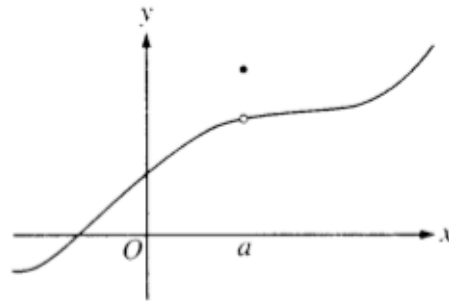
- (A)  $a$
- (B)  $b$
- (C)  $c$
- (D)  $d$
- (E) It cannot be determined from the information given.

\*\*\*\*\*



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?

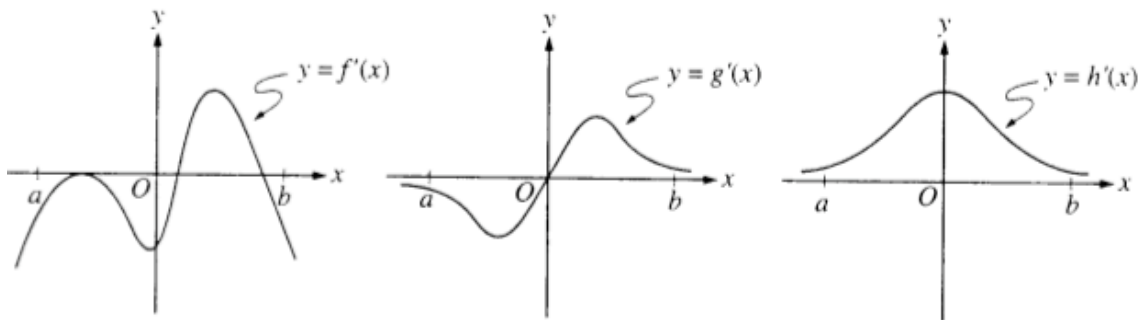
- (A) 0 only
- (B) 0 and 2 only
- (C) 1 and 3 only
- (D) 0, 1, and 3 only
- (E) 0, 1, 2, and 3



The graph of a function  $f$  is shown above. Which of the following statements about  $f$  is false?

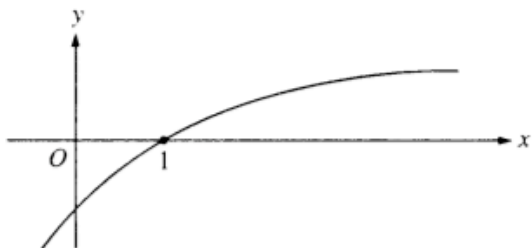
- (A)  $f$  is continuous at  $x = a$ .
- (B)  $f$  has a relative maximum at  $x = a$ .
- (C)  $x = a$  is in the domain of  $f$ .
- (D)  $\lim_{x \rightarrow a^+} f(x)$  is equal to  $\lim_{x \rightarrow a^-} f(x)$ .
- (E)  $\lim_{x \rightarrow a} f(x)$  exists.

\*\*\*\*\*



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  $a < x < b$ ?

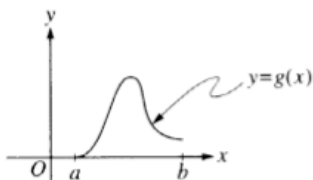
- (A)  $f$  only
- (B)  $g$  only
- (C)  $h$  only
- (D)  $f$  and  $g$  only
- (E)  $f$ ,  $g$ , and  $h$



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

\*\*\*\*\*



Let  $g(x) = \int_a^x f(t) dt$ , where  $a \leq x \leq b$ . 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)