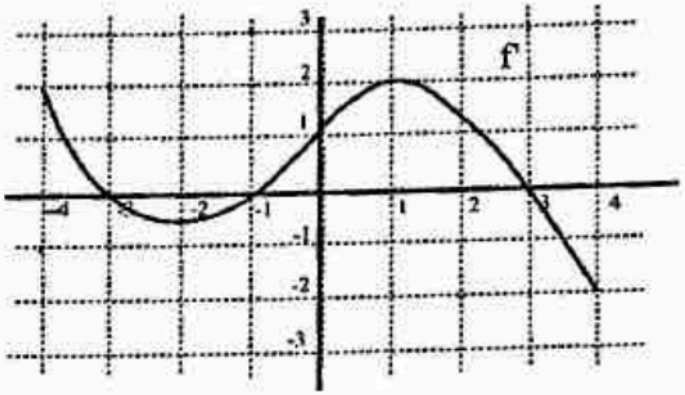
8. The graph of the **derivative** of a function f is shown to the right. If the graph of f' has horizontal tangents at $x = -2$ and 1, which of the following is true about the function f?

I. f is increasing on the interval $(-2, 1)$.

II. f is continuous at $x = 0$.

III. The graph of f has an inflection point at $x = -2$.

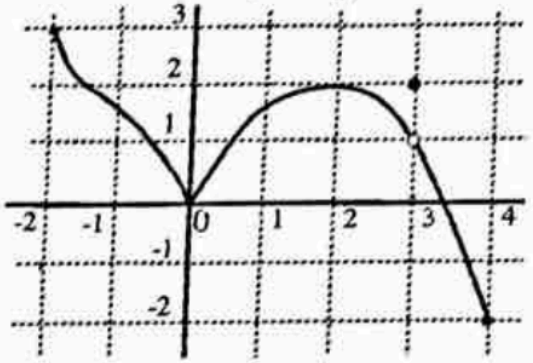
graph of the derivative of f



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

13. The graph of the function f is shown in the figure. For what values of x, $-2 < x < 4$, is f not differentiable?

Graph of f



(A) 0 only

(B) 0 and 2 only

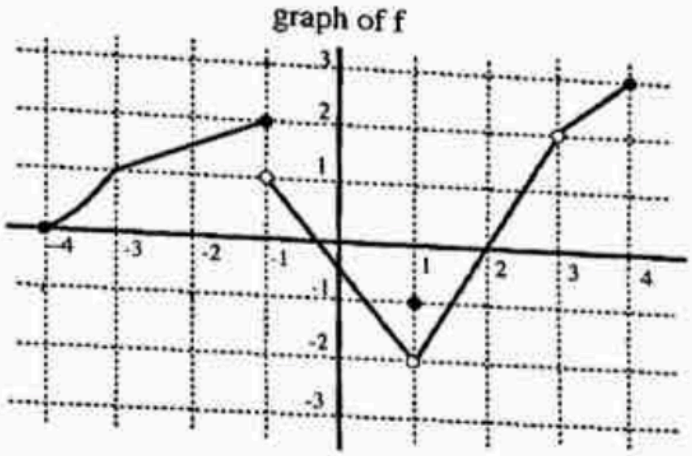
(C) 2 and 3 only

(D) 0 and 3 only

(E) 0, 1 and 3 only

Ans

1. The function f is defined on the interval $[-4, 4]$ and its graph is shown to the right. Which of the following statements are true?



I. $\lim_{x \to 1} f(x) = -1$

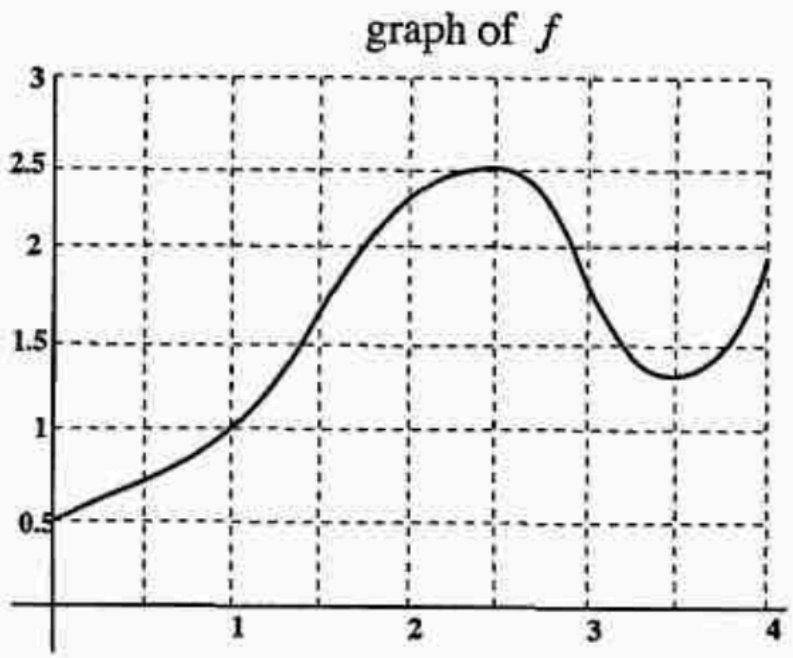
II. $\lim_{h \to 0} \frac{f(2+h) - f(2)}{h} = 2$

III. $\lim_{x \to -1^+} f(x) = f(-3)$

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

7. A graph of the function f is shown at the right.

Which of the following statements are true?



I. $f(1) > f'(3)$

II. $\int_1^2 f(x)\,dx > f'(3.5)$

III. $\lim_{h\to 0} \frac{f(2+h)-f(2)}{h} > \frac{f(2.5)-f(2)}{2.5-2}$

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

Ans

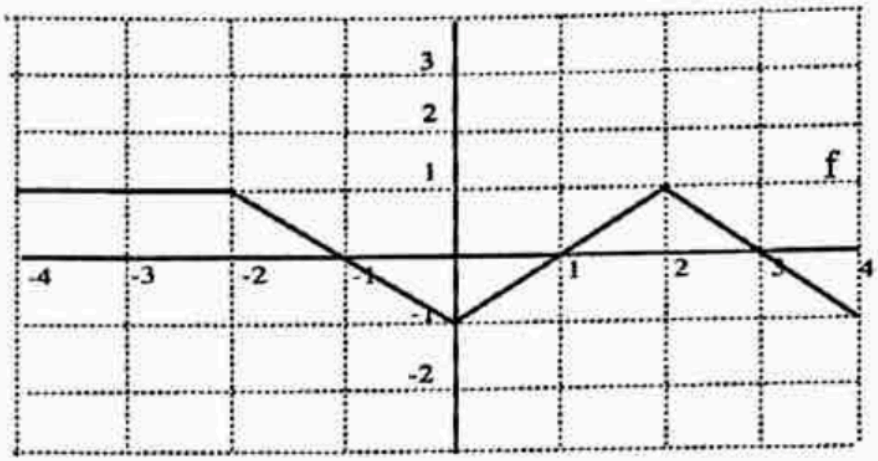
21. The graph of f is shown at the right. Which of the following statements are true?

I. $f(2) > f'(1)$

II. $\int_0^1 f(x)\,dx > f'(3.5)$

III. $\int_{-1}^{1} f(x)\,dx > \int_{-1}^{2} f(x)\,dx$

the graph of f

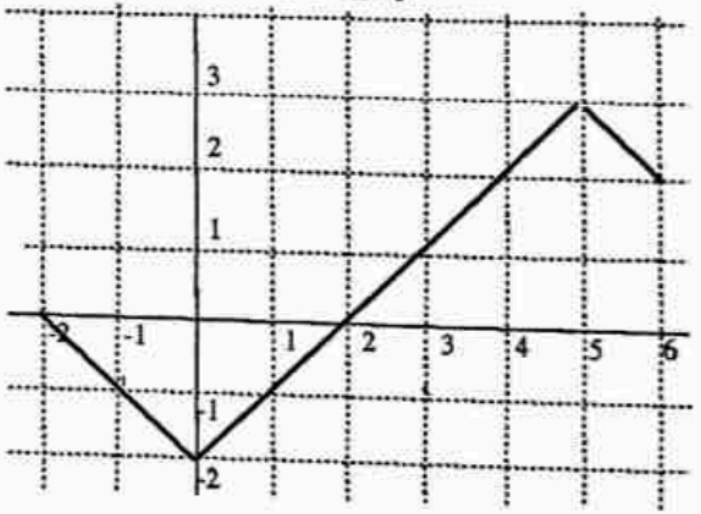


(A) I only (B) II only (C) I and II only (D) II and III only (E) I, II, III

Ans

8. Let f be a function defined on the closed interal $-2 \leq x \leq 6$ with $f(0) = 3$. The graph of f', the derivative of the function f, is shown on the right. The graph consists of three line segments. Which of the following statements must be true?

Graph of f'



I $f(4) = 3$

II The graph of f has a positive slope and is concave up on the interval $(0, 5)$.

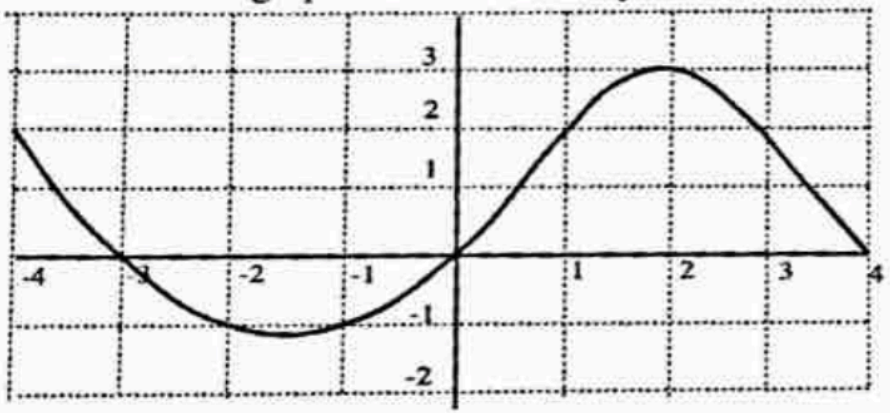
III The graph of f has points of inflection at $x = 0$ and $x = 5$.

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

Ans

11. The graph of a function f whose domain is the interval $[-4, 4]$ is shown in the figure. If the graph of f has horizontal tangents at $x = -1.5$ and 2, which of the following statements are true?

the graph of the function f



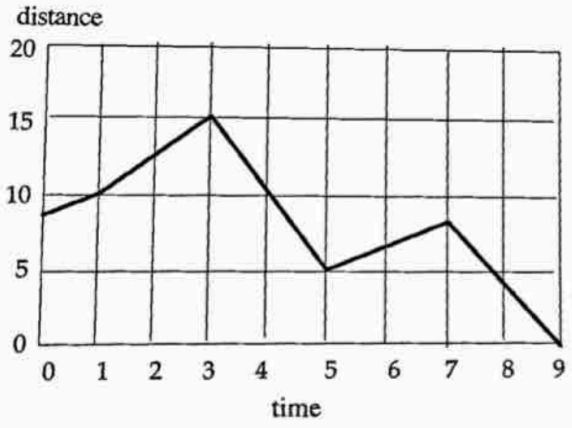
I. The average rate of change of f over the interval from $x = -2$ to $x = 3$ is $\frac{1}{5}$.

II. The slope of the tangent line at the point where $x = 2$ is 0.

III. The left-sum approximation of $\int_{-1}^{3} f(t)\,dt$ with 4 equal subdivisions is 4.

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

26. A leaf falls from a tree into a swirling wind. The graph at the right shows its vertical distance (feet) above the ground plotted against time (seconds).



According to the graph, in what time interval is the speed of the leaf the greatest?

(A) $1 < t < 3$

(B) $3 < t < 5$

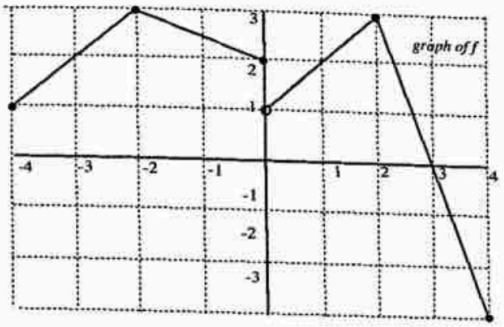
(C) $5 < t < 7$

(D) $7 < t < 9$

(E) none of these

Ans

1. Two functions, f and g, are defined on the closed interval $-4 \le x \le 4$. A graph of the function f is given in the following figure.



The table below contains some values of the continuous function g.

x	–4	–3	–2	–1	0	1	2	3	4
$g(x)$	10	9	5	–1	0	2	6	0	–3

(a) Find $f'(3)$.

(b) Approximate $g'(0)$. Show your work.

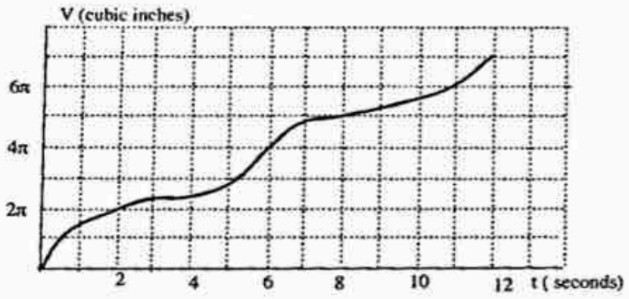
(c) If the function h is defined by $h(x) = g[f(x)]$, evaluate: i) $h(2)$ and ii) $h'(3)$

(d) Find $\int_0^4 f(x)\,dx$

12. The function V whose graph is sketched below gives the volume of air, $V(t)$, (measured in cubic inches) that a man has blown into a balloon after t seconds.

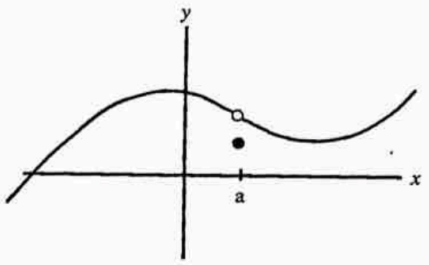
$$\left(V = \frac{4}{3}\pi r^3\right)$$

The rate at which the radius is changing after 6 seconds is nearest to



(A) 0.05 in/sec (B) 0.12 in/sec (C) 0.21 in/sec (D) 0.29 in/sec (E) 0.37 in/sec

1. The graph of a function f is shown to the right.
Which of the following statements about f is false?



(A) f has a relative minimum at $x = a$.

(B) $\lim_{x \to a^-} f(x) = \lim_{x \to a^+} f(x)$

(C) $\lim_{x \to a} f(x) \neq f(a)$

(D) $f(a) > 0$

(E) $f'(a) < 0$

Ans

11. Suppose f is a function with continuous first and second derivatives on the closed interval [a, c]. If the graph of its derivative f' is given in the figure, which of the following is true?

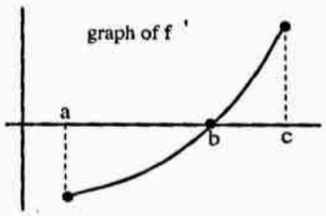
(A) f is increasing on the interval (a, b)

(B) f has a relative maximum at $x = b$.

(C) f has an inflection point at $x = b$.

(D) The graph of f is concave down on the interval (a, b).

(E) $\int_a^c f'(x)\,dx = f(c) - f(a)$

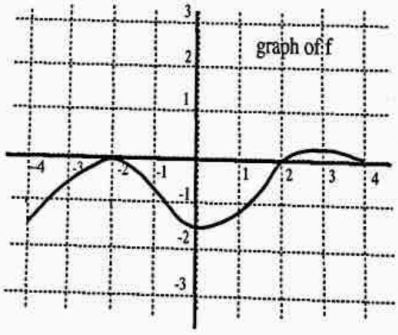


Ans

15. The graph of the function f, shown at the right, has horizontal tangents at $x = -2, 0$, and 3. If the function G is defined by

$G(x) = \int_{-4}^{x} f(t)\,dt$, for $-4 \le x \le 4$, which of the following statements about G are true?

graph of the function f



I. G is increasing on $(1, 2)$.

II. G is decreasing on $(-4, -3)$.

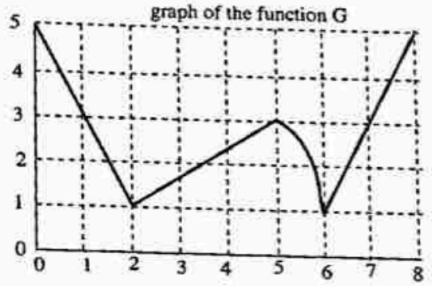
III. $G(0) < 0$.

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

3. The function F is defined by

$F(x) = G[x + G(x)]$

where the graph of the function G is shown at the right.



The approximate value of $F'(1)$ is

(A) $\frac{7}{3}$

(B) $\frac{2}{3}$

(C) -2

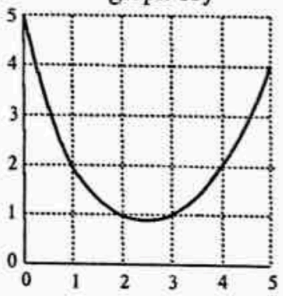
(D) -1

(E) $-\frac{2}{3}$

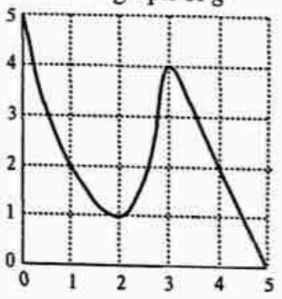
Ans

5. The graphs of functions f and g are shown at the right.

graph of f



graph of g



If $h(x) = g[f(x)]$, which of the following statements are true about the function h?

I. $h(0) = 4$.

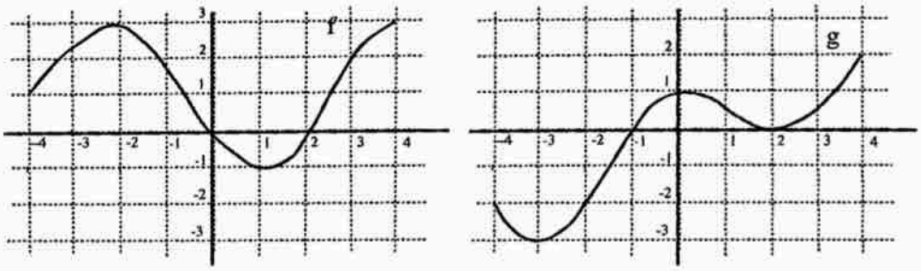
II. h is increasing at $x = 2$.

III. The graph of h has a horizontal tangent at $x = 4$.

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

Ans

17. The composite function h is defined by $h(x) = f[g(x)]$, where f and g are functions whose graphs are shown below. The graph of f has horizontal tangents at $x = -2$ and $x = 1$. The graph of g has horizontal tangents at $x = -3$, 0 and 2.



The number of points on the graph of h where there are horizontal tangent lines is

(A) 3 (B) 4 (C) 5 (D) 6 (E) 7

Ans

6. The graph of the function f is shown at the right. The graphs of the five functions:

$y = f(x+1)$,

$y = f(x)+1$,

$y = f(-x)$,

$y = f'(x)$ and

$y = \int_1^x f(t)\,dt$

are shown in the *wrong* order.

The correct order is

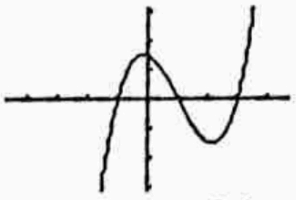
(A) II, IV, III, V, I

(B) IV, II, III, I, V

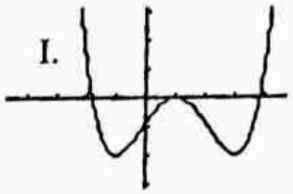
(C) IV, II, III, V, I

(D) IV, III, II, V, I

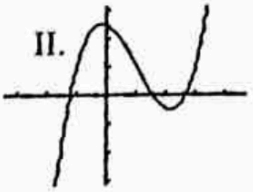
(E) II, IV, III, I, V



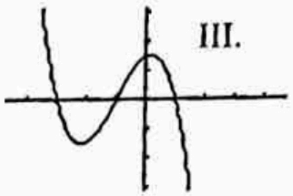
the graph of f



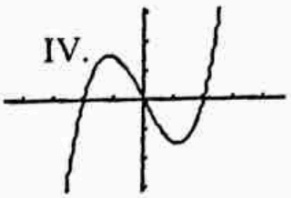
I.



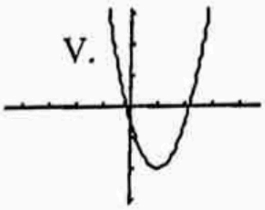
II.



III.



IV.



V.

Ans