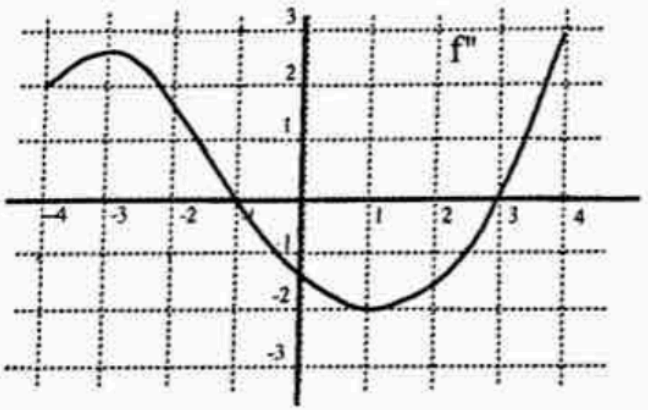
1. The graph of the **second derivative** of a function f is shown at the right. Which of the following is true?

the graph of f''



I. The graph of f has an inflection point at $x = -1$.

II. The graph of f is concave down on the interval $(-1, 3)$.

III. The graph of the derivative function f' is increasing at $x = 1$.

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

Ans

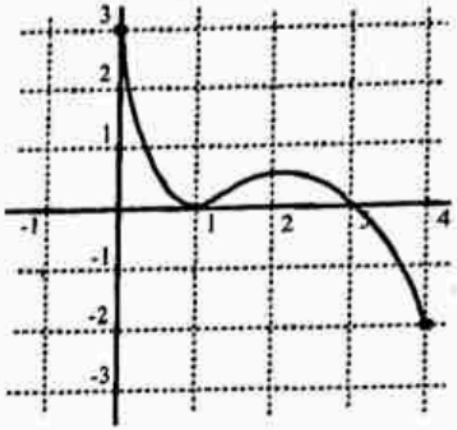
4. The graph of the second derivative of a function g is shown in the figure. Use the graph to determine which of the following are true.

I. The g-graph has points of inflection at $x = 1$ and $x = 3$.

II. The g-graph is concave down on the interval $(3, 4)$.

III. If $g'(0) = 0$, g is increasing at $x = 2$.

Graph of g''



(A) I only

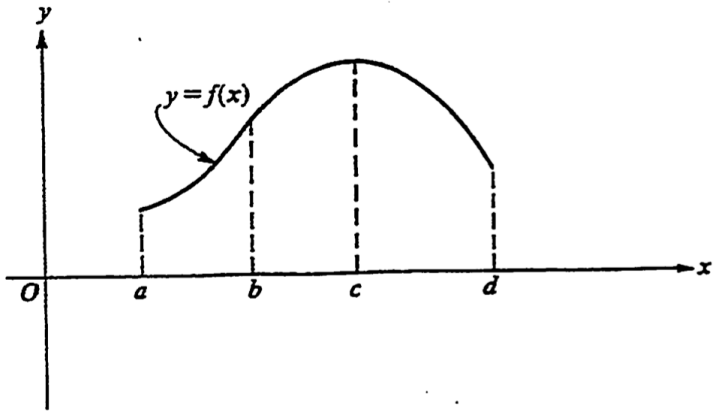
(B) II only

(C) II and III only

(D) I and II only

(E) I, II, III

Ans



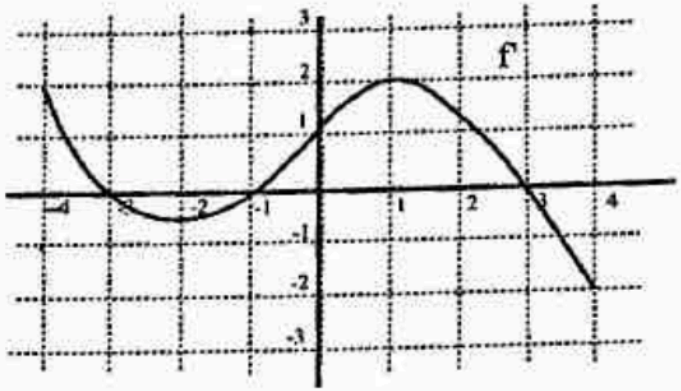
8. The graph of $y = f(x)$ is shown in the figure above. On which of the following intervals are $\frac{dy}{dx} > 0$ and $\frac{d^2y}{dx^2} < 0$?

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

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?

graph of the derivative of f



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

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

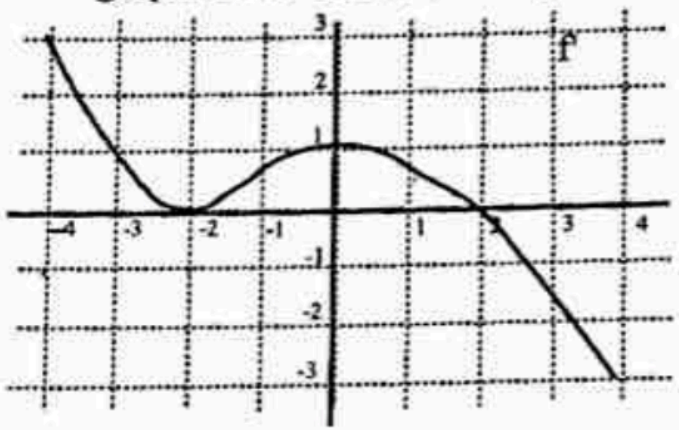
III. The graph of f has an inflection point at $x = -2$.

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

Ans

9. The graph of the *derivative* of f is shown at the right. If the graph of f' has horizontal tangents at $x = -2$ and 0, which of the following is true about the function f?

graph of the derivative of f



I. f is decreasing at $x = 0$.

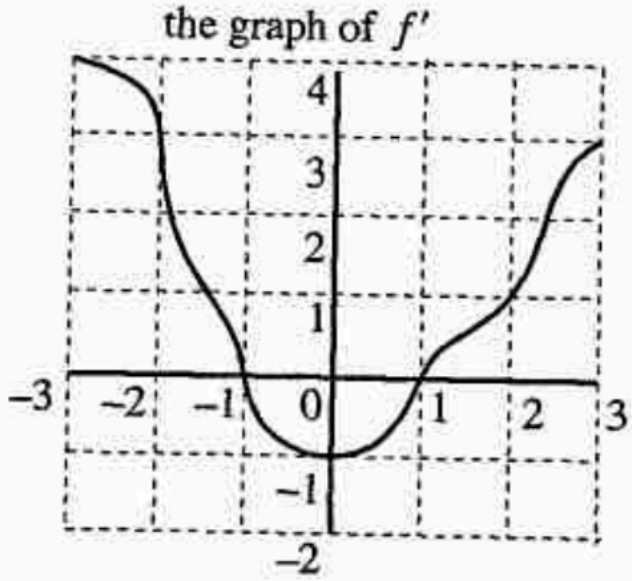
II. f has a local maximum at $x = 2$.

III. The graph of f is concave up at $x = -1$.

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

Ans

17. The graph of f', the derivative of a function f, is shown at the right. The graph of f', has a horizontal tangent at $x = 0$.



Which of the following statements are true about the function f?

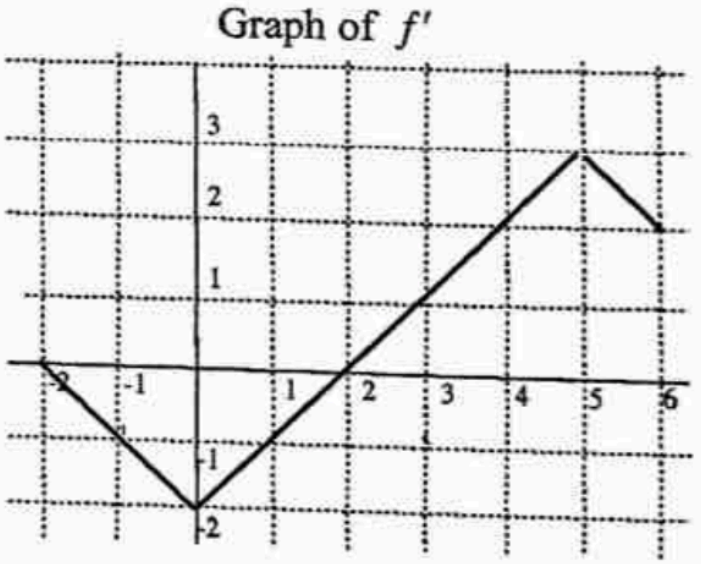
I. f is increasing on the interval $(-2, -1)$.

II. f has an inflection point at $x = 0$.

III. f is concave up on the interval $(-1, 0)$.

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

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?



I $f(4) = 3$

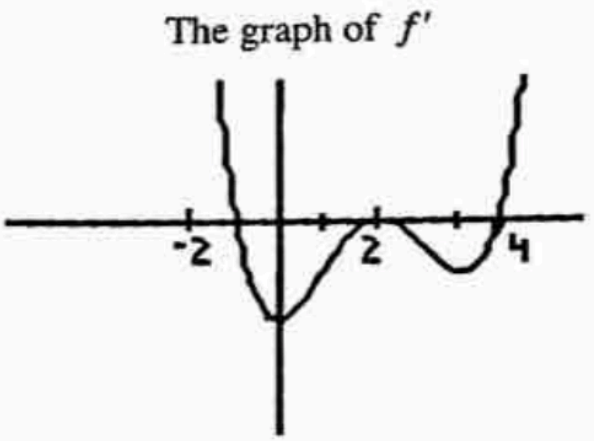
II The graph of f has a positive slope and is concave up on the interval $(0, 5)$.

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

8. Let f be a function that has domain $[-2, 5]$. The graph of f' is shown at the right. Which of the following statements are TRUE?



I. f has a relative maximum at $x = -1$.

II. f has an absolute minimum at $x = 0$.

III. The graph of f is concave down for $-2 < x < 0$.

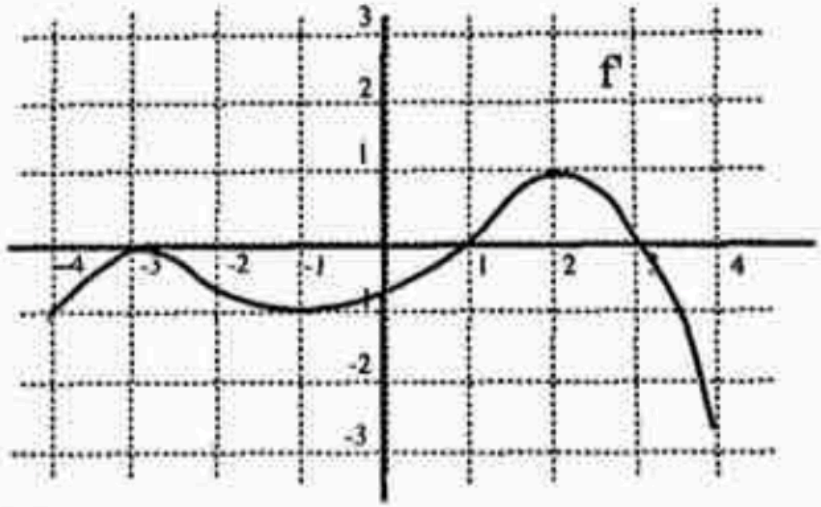
IV. The graph of f has inflection points at $x = 0$ and $x = 2$ and $x = 3$.

(A) I, II, IV (B) I, III, IV (C) II, III, IV (D) I, II, III (E) I, II, III, IV

Ans

13. The figure shows the graph of f', the *derivative* of a function f. The domain of f is the interval $-4 \le x \le 4$. Which of the following are true about the graph of f?

graph of the derivative of f



I. At the points where $x = -3$ and $x = 2$ there are horizontal tangents.

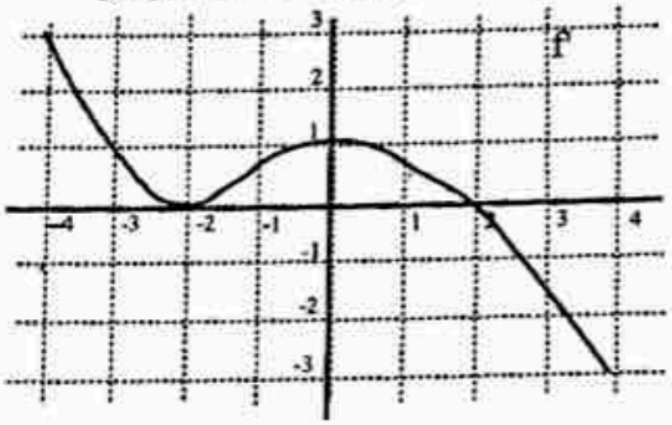
II. At the point where $x = 1$ there is a relative minimum point.

III. At the point where $x = -3$ there is an inflection point.

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

9. The graph of the *derivative* of f is shown at the right. If the graph of f' has horizontal tangents at $x = -2$ and 0, which of the following is true about the function f?

graph of the derivative of f



I. f is decreasing at $x = 0$.

II. f has a local maximum at $x = 2$.

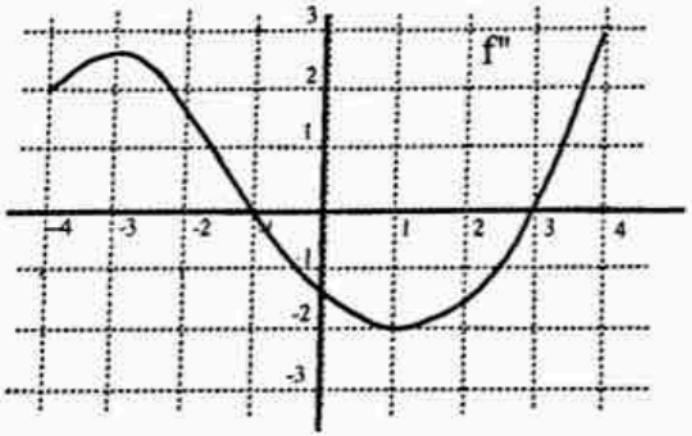
III. The graph of f is concave up at $x = -1$.

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

Ans

1. The graph of the **second derivative** of a function f is shown at the right. Which of the following is true?

the graph of f''



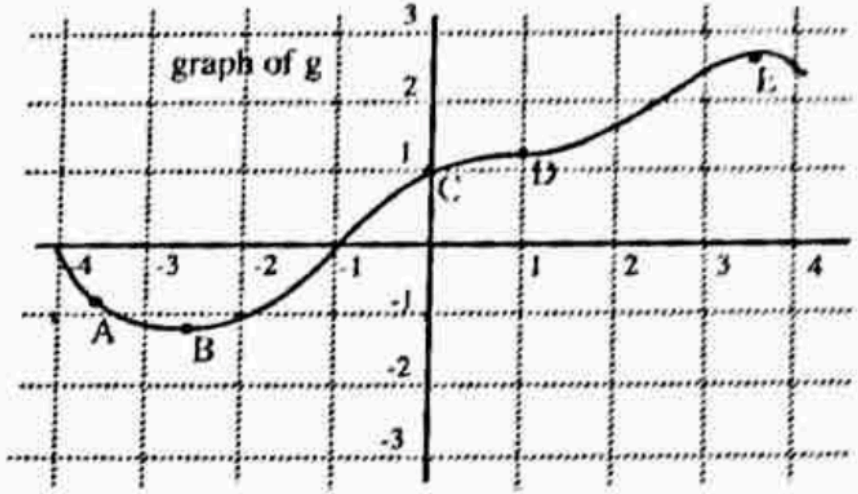
I. The graph of f has an inflection point at $x = -1$.

II. The graph of f is concave down on the interval $(-1, 3)$.

III. The graph of the derivative function f' is increasing at $x = 1$.

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

24. At which point on the graph of $y = g(x)$ below is $g'(x) = 0$ and $g''(x) = 0$?

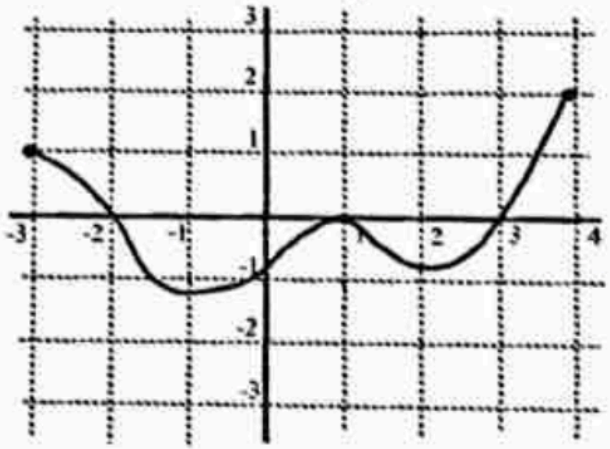


(A) A (B) B (C) C (D) D (E) E

Ans

23. The figure shows the graph of f', the derivative of a function f. The domain of f is the closed interval $[-3, 4]$. If the graph of f' has horizontal tangents at $x = -1$, 1 and 3, which of the following is true?

Graph of f'



I. f is increasing on the interval (2,4).

II. f has a relative minimum at $x = -2$.

III. The f-graph has an inflection point at $x = 1$.

(A) I only

(B) II only

(C) III only

(D) I and II only

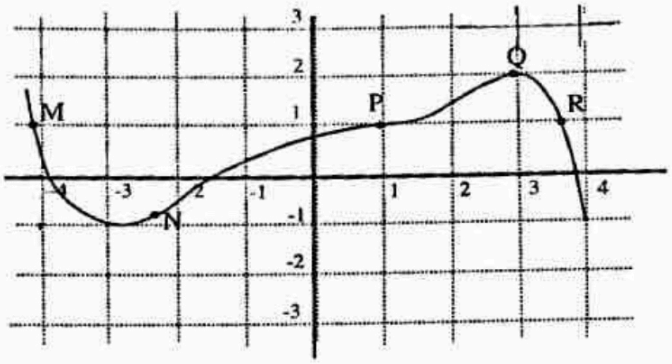
(E) I, II, III

Ans

3. The graph of the function f is shown at the right. At which point on the graph of f are all the following true?

$f(x) > 0$, and $f'(x) < 0$ and $f''(x) < 0$

the graph of f

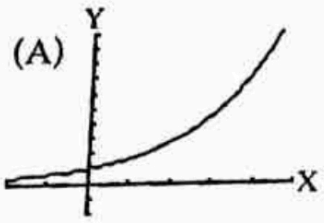


(A) M (B) N (C) P (D) Q (E) R

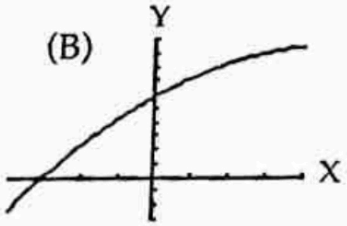
Ans

21. 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 $y = f(x)$?

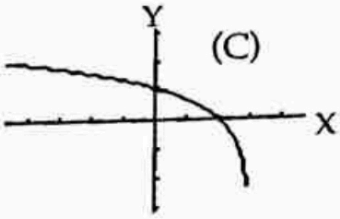
(A)



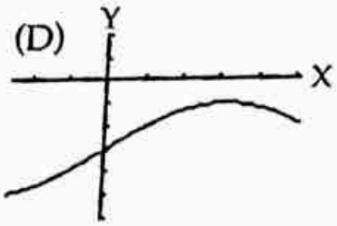
(B)



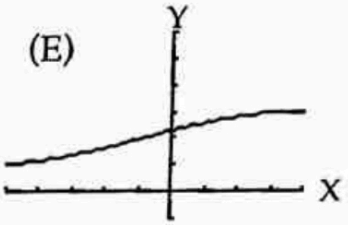
(C)



(D)



(E)



Ans

26. The function f is continuous and differentiable on the closed interval [1, 5]. The table below gives selected values of f on this interval. Which of the following statements must be TRUE?

x	1	2	3	4	5
$f(x)$	3	4	5	3	–2

(A) $f'(x) > 0$ for $1 < x < 3$

(B) $f''(x) < 0$ for $3 < x < 5$

(C) The maximum value of f on [1, 5] must be 5.

(D) The minimum value of f on [1, 5] must be –2.

(E) There exists a number c, $1 < c < 5$ for which $f(c) = 0$.

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?

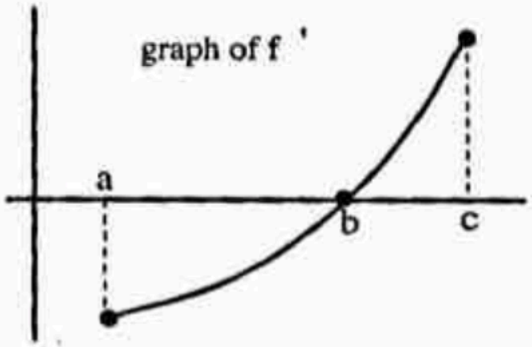
(A) f is increasing on the interval (a, b)

(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

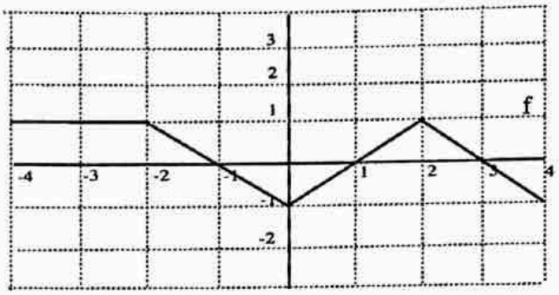
21. The graph of f is shown at the right. Which of the following statements are true?

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

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

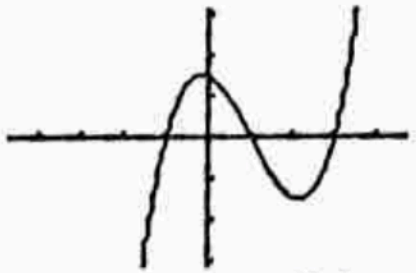
$y = f(x+1)$,

$y = f(x)+1$,

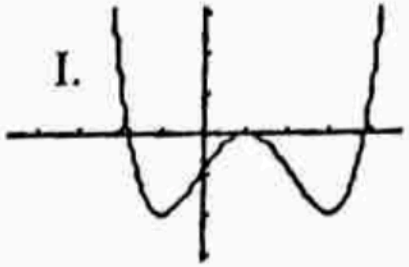
$y = f(-x)$,

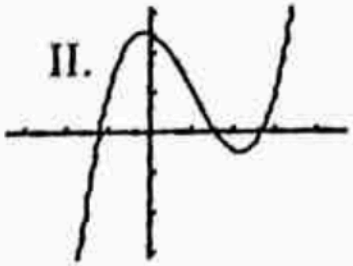
$y = f'(x)$ and

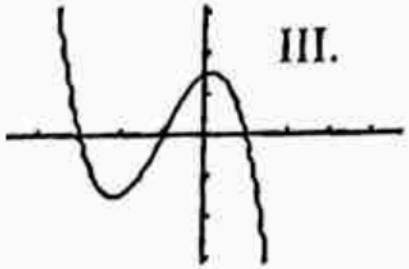
$y = \int_1^x f(t)\,dt$

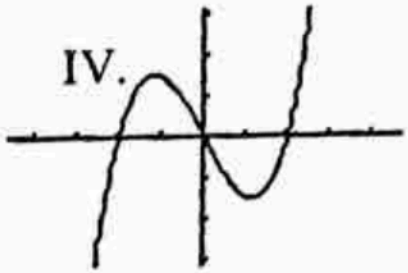


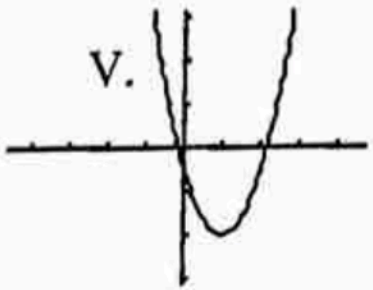
the graph of f











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

10. If functions f and g are defined so that $f'(x) = g'(x)$ for all real numbers x with $f(1) = 2$ and $g(1) = 3$, then the graph of f and the graph of g

(A) intersect exactly once;

(B) intersect no more than once;

(C) do not intersect;

(D) could intersect more than once;

(E) have a common tangent at each point of tangency.

Ans