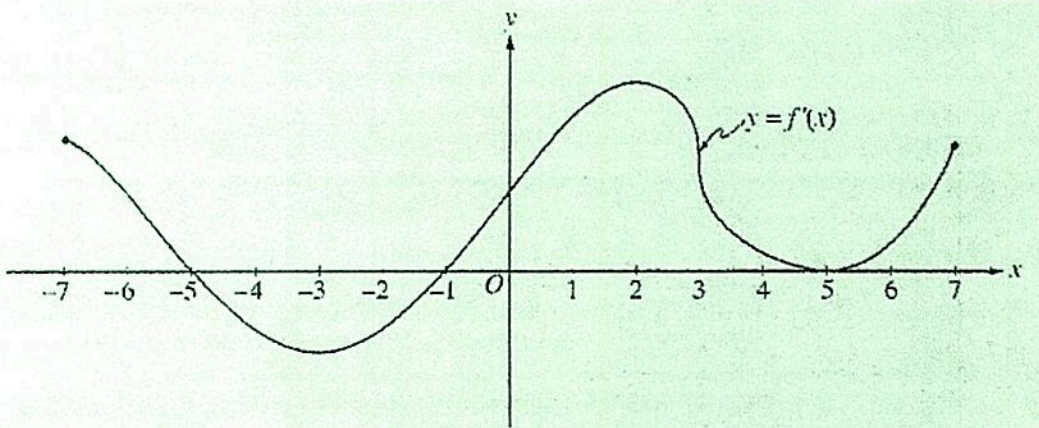


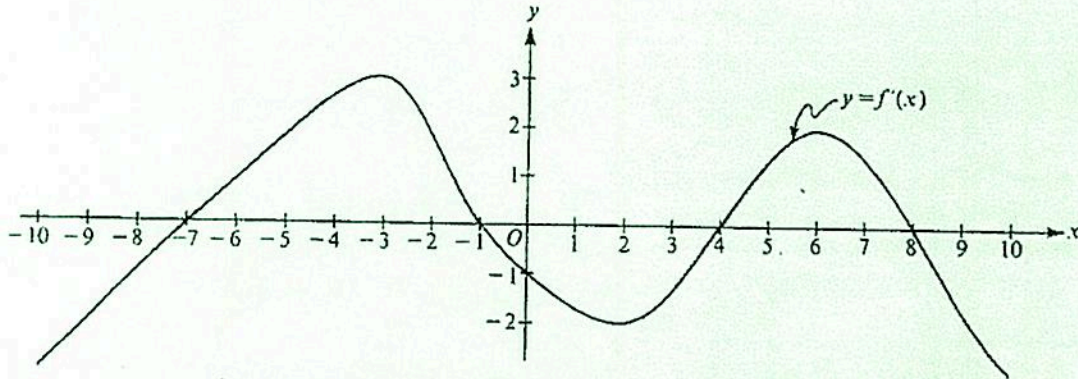
2



The figure above shows the graph of f' , the derivative of the function f , for $-7 \leq x \leq 7$. The graph of f' has horizontal tangent lines at $x = -3$, $x = 2$, and $x = 5$, and a vertical tangent line at $x = 3$.

- (a) Find all values of x , for $-7 < x < 7$, at which f attains a relative minimum. Justify your answer.
- (b) Find all values of x , for $-7 < x < 7$, at which f attains a relative maximum. Justify your answer.
- (c) Find all values of x , for $-7 < x < 7$, at which $f''(x) < 0$.
- (d) At what values of x , for $-7 \leq x \leq 7$, could f attain its absolute maximum? Justify.

3



Note: This is the graph of the derivative of f , not the graph of f .

The figure above shows the graph of f' , the derivative of a function f . The domain of f is the set of all real numbers x such that $-10 \leq x \leq 10$.

- (a) For what values of x does the graph of f have a horizontal tangent? Justify.
- (b) For what values of x in the interval $(-10, 10)$ does f have a relative maximum? Justify your answer.
- (c) For what values of x is the graph of f concave downward? Justify.

A function f is continuous on the closed interval $[-3, 3]$ such that $f(-3) = 4$ and $f(3) = 1$. The function f' and f'' have the properties given in the table below.

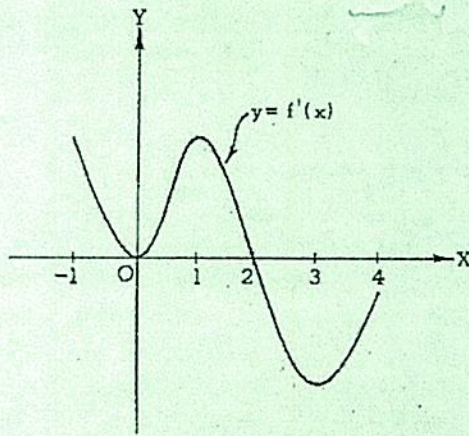
x	$-3 < x < -1$	$x = -1$	$-1 < x < 1$	$x = 1$	$1 < x < 3$
$f'(x)$	Positive	Fails to exist	Negative	0	Negative
$f''(x)$	Positive	Fails to exist	Positive	0	Negative

- (a) What are the x -coordinates of all absolute maximum and absolute minimum points of f on the interval $[-3, 3]$? Justify your answer.
- (b) What are the x -coordinates of all points of inflection of f on the interval $[-3, 3]$? Justify your answer.
- (c) Sketch a graph that satisfies the given properties of f .

Let f be a function that is even and continuous on the closed interval $[-3, 3]$. The function f and its derivatives have the properties indicated in the table below.

x	0	$0 < x < 1$	1	$1 < x < 2$	2	$2 < x < 3$
$f(x)$	1	Positive	0	Negative	-1	Negative
$f'(x)$	Undefined	Negative	0	Negative	Undefined	Positive
$f''(x)$	Undefined	Positive	0	Negative	Undefined	Negative

- (a) Find the x -coordinate of each point at which f attains an absolute maximum value or an absolute minimum value. For each x -coordinate you give, state whether f attains an absolute maximum or an absolute minimum.
- (b) Find the x -coordinate of each point of inflection on the graph of f . Justify your answer.
- (c) In the xy -plane sketch the graph of a function with all the given characteristics of f .



Note: This is the graph of the derivative of f , NOT the graph of f .

Let f be a function that has domain the closed interval $[-1, 4]$ and range the closed interval $[-1, 2]$. Let $f(-1) = -1$, $f(0) = 0$, and $f(4) = 1$. Also let f have the derivative function f' that is continuous and that has the graph shown in the figure above.

- Find all values of x for which f assumes a relative maximum. Justify your answer.
- Find all values of x for which f assumes a relative minimum. Justify your answer.
- Find the intervals on which f is concave downward.
- Give all values of x for which f has a point of inflection.
- Sketch the graph of f .