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**MCS22 EXAM 2 PRACTICE TEST**

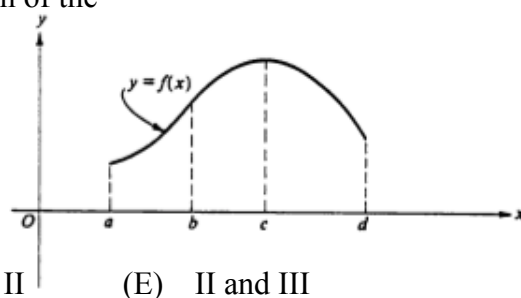
Do and show all work on this paper. All problems must be solved using calculus techniques. Problems 1 through 5 are worth five (5) points each; for each of these problems, circle the letter of your choice. Point values for the remaining problems are indicated in brackets next to each problem.

1. The graph of  $y = f(x)$  is shown in the accompanying figure. On which of the

following intervals are  $\frac{dy}{dx} > 0$  and  $\frac{d^2y}{dx^2} < 0$ .

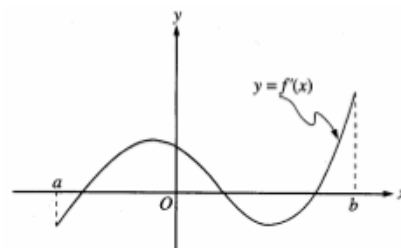
- I.  $a < x < b$
- II.  $b < x < c$
- III.  $c < x < d$

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

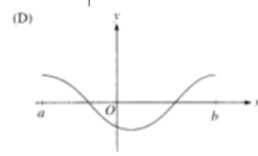
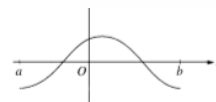
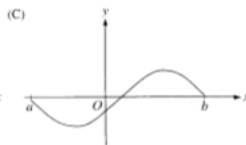
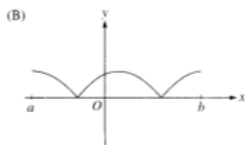
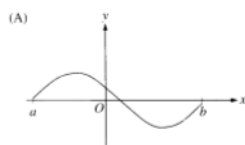


2. The graph of  $f'$ , the derivative of  $f$ , is shown in the accompanying figure. Which of the following describes all relative extrema of  $f$  on the open interval  $(a, b)$ ?

- (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



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



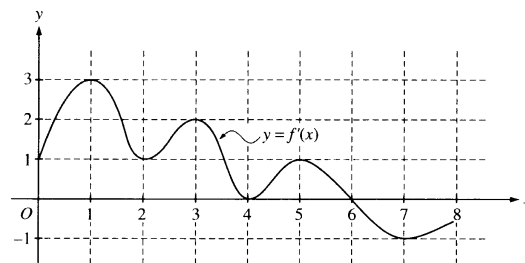
4. The derivative of  $f$  is  $x^3(x-1)^2(x+5)(x-2)$ . At how many points will the graph of  $f$  have a relative minimum?

- (A) None
- (B) One
- (C) Two
- (D) Three
- (E) Four

5. The graph of  $f'$ , the derivative of  $f$ , is shown at the right.

On what intervals is  $f$  concave down?

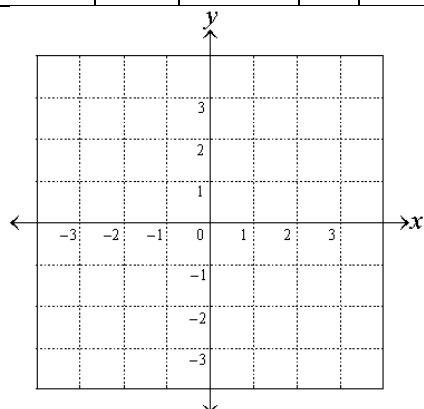
- (A)  $[6, 8]$  only
- (B)  $[0, 4]$  only
- (C)  $[0, 6]$  only
- (D)  $[1, 2]$ ,  $[3, 4]$ , and  $[5, 7]$
- (E)  $[0, 1]$ ,  $[2, 3]$ ,  $[4, 5]$ , and  $[7, 8]$



6. Sketch the graph of a function whose derivative [ 10 ]

satisfies the properties given in the following table:

$x$	$(-\infty, -2)$	$-2$	$(-2, 0)$	$0$	$(0, 3)$	$3$	$(3, \infty)$
$f'(x)$	$-2$	DNE	negative	$0$	positive	$0$	negative



7. Find the intervals on which the function [ 12 ]

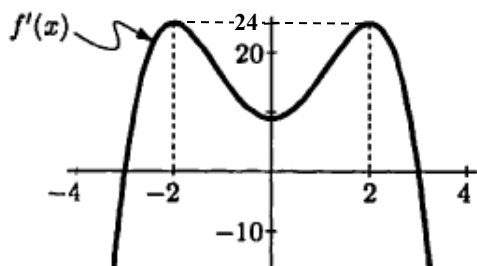
$$f(x) = \frac{x^2}{x^2 - 9}$$

is decreasing.

8. Find the absolute minimum value of  $f(x) = 2x^3 - 6x^2 + 9$  on the closed interval  $[-1, 3]$ . [ 11 ]

9. On what interval(s) is the function  $f(x) = 3x^4 - 4x^3 + 2$  decreasing and concave up? [ 12 ]

10. The figure below shows the graph of  $f'$ , the derivative of the function  $f$  with  $f(2) = 0$  and  $f(0) = -2$ . [ 30 ]  
The domain of  $f$  is the set of all real numbers  $x$  such that  $-4 \leq x \leq 4$  and  $f'(-3) = f'(3) = 0$ .



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

- (a) For what value(s) of  $x$  does the graph of  $f$  have a horizontal tangent?
- (b) For what value(s) of  $x$  does  $f$  have a relative minimum? Justify your answer.
- (c) On what interval(s) is the graph of  $f$  concave upward? Use  $f'$  to justify your answer.
- (d) Write an equation of the line tangent to the graph of  $f$  at the point  $(2, 0)$ .
- (e) In the  $xy$ -plane provided, draw a sketch that shows the general shape of the graph of the function  $f$  on the open interval  $0 < x < 3$ .

