

## Curve Analysis and Optimization Practice

1. At what values of  $x$  does  $f(x) = x - 2x^{2/3}$  have a relative minimum?

- (A)  $\frac{64}{27}$                       (B)  $\frac{16}{9}$                       (C)  $\frac{4}{3}$                       (D) 2

2. What is the minimum value of  $f(x) = x^2 \ln x$ ?

- (A)  $-e$                       (C)  $-\frac{1}{e}$   
 (B)  $-\frac{1}{2e}$                       (D)  $-\frac{1}{\sqrt{e}}$

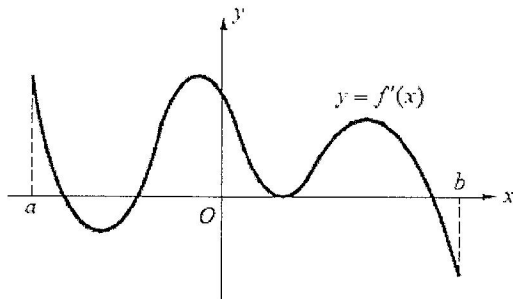
3. At what values of  $x$  does  $f(x) = (x-1)^3(3-x)$  have the absolute maximum?

- (A) 1                      (B)  $\frac{3}{2}$                       (C) 2                      (D)  $\frac{5}{2}$

4. At  $x = 2$ , which of the following is true of the function  $f$  defined by  $f(x) = x^2 e^{-x}$ ?

- (A)  $f$  has a relative maximum.  
 (B)  $f$  has a relative minimum.  
 (C)  $f$  is increasing.  
 (D)  $f$  is decreasing.

5.



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) Two relative maxima and two relative minima  
 (D) Three relative maxima and two relative minima

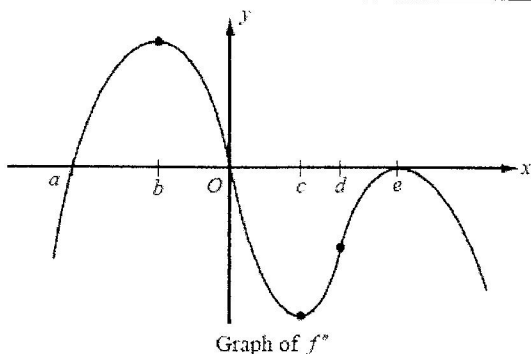
6. The graph of  $y = x^4 - 2x^3$  has a point of inflection at

- (A)  $(0, 0)$  only                      (C)  $(1, -1)$  only  
 (B)  $(0, 0)$  and  $(1, -1)$                       (D)  $(0, 0)$  and  $(\frac{3}{2}, -\frac{27}{16})$

7. The graph of  $y = 3x^5 - 40x^3 - 21x$  is concave up for

- (A)  $x < 0$
- (B)  $x > 2$
- (C)  $x < 0$  or  $0 < x < 2$
- (D)  $-2 < x < 0$  or  $x > 2$

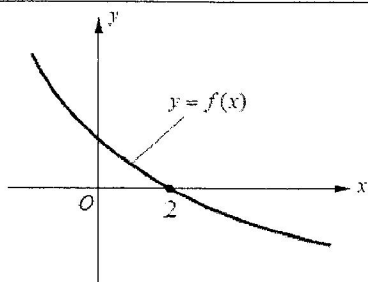
8.



The second derivative of the function  $f$  is given by  $f''(x) = x(x+a)(x-e)^2$  and the graph of  $f''$  is shown above. For what values of  $x$  does the graph of  $f$  have a point of inflection?

- (A)  $b$  and  $c$
- (B)  $b, c$  and  $e$
- (C)  $b, c$  and  $d$
- (D)  $a$  and  $0$

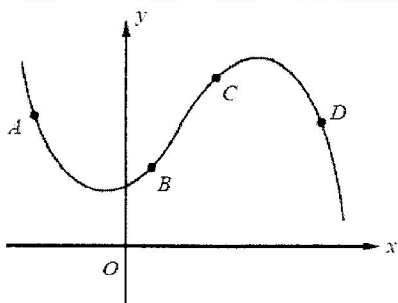
9.



The graph of a twice differentiable function  $f$  is shown in the figure above. Which of the following is true?

- (A)  $f''(2) < f(2) < f'(2)$
- (B)  $f'(2) < f''(2) < f(2)$
- (C)  $f'(2) < f(2) < f''(2)$
- (D)  $f(2) < f'(2) < f''(2)$

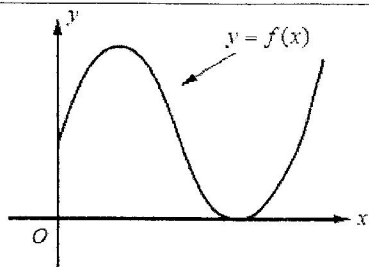
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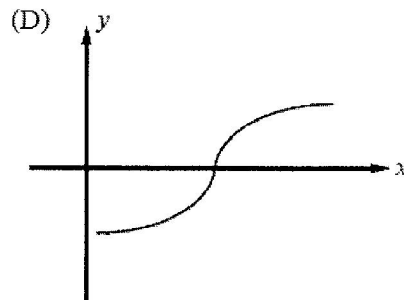
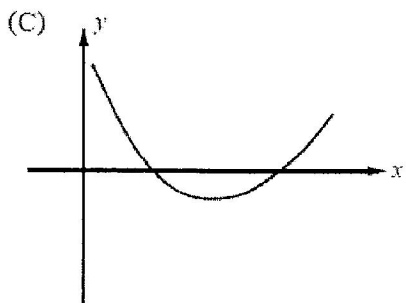
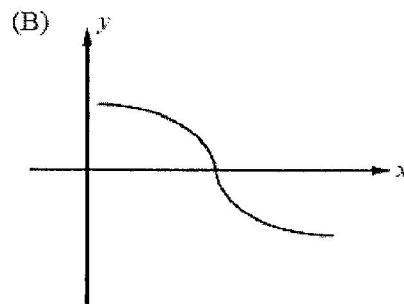
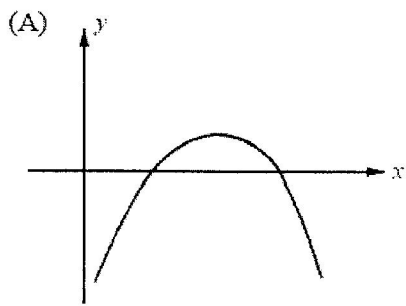
At which of the five points on the graph in the figure above is  $\frac{dy}{dx} > 0$  and  $\frac{d^2y}{dx^2} > 0$ ?

- (A)  $A$
- (B)  $B$
- (C)  $C$
- (D)  $D$

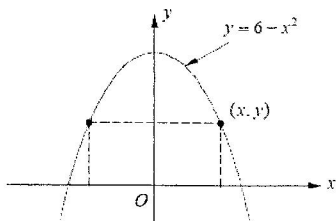
11.



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



12.



What is the area of the largest rectangle that has its base on the  $x$ -axis and its other two vertices on the parabola  $y = 6 - x^2$ ?

(A)  $8\sqrt{2}$

(B)  $6\sqrt{2}$

(C)  $4\sqrt{3}$

(D)  $3\sqrt{2}$

13. The point on the curve  $y = 2 - x^2$  nearest to  $(3, 2)$  is

(A)  $(0, 2)$

(B)  $(\frac{1}{2}, \frac{7}{4})$

(C)  $(\frac{3}{4}, \frac{23}{16})$

(D)  $(1, 1)$