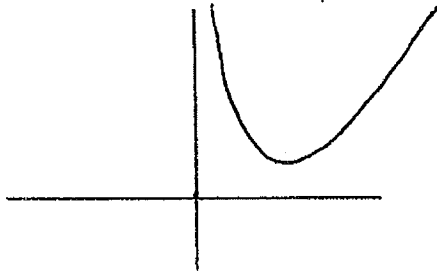


1. If $f(x) = 2x^3 + 3x^2 - 36$ on what interval is f both concave up and decreasing?

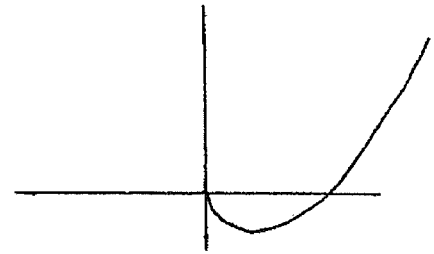
- A. $(0, \infty)$
- B. $(-\frac{1}{2}, 0)$
- C. $(-1, 0)$
- D. $(-1, -\frac{1}{2})$
- E. $(-\infty, -1)$

2. The graph of $g(x) = x \ln x$ looks most like

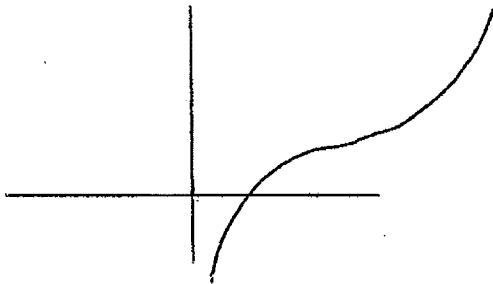
A.



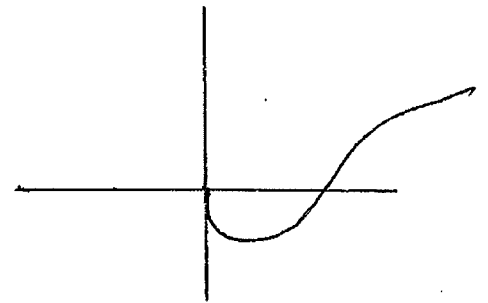
B.



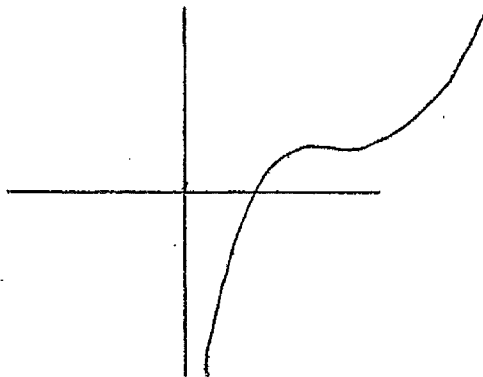
C.



D.



E.



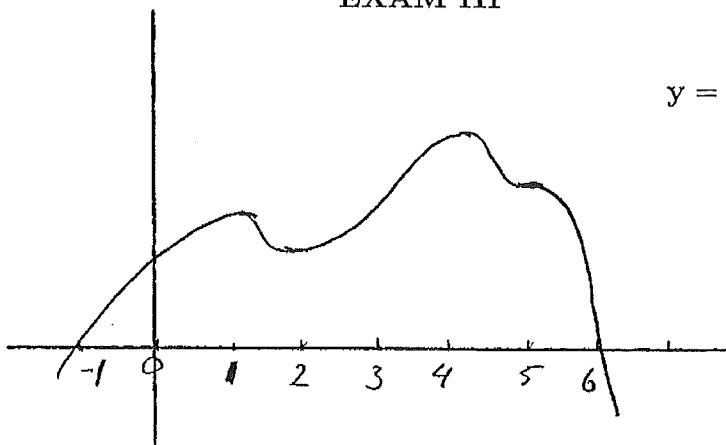
3. Let $f(x) = \frac{x^2}{x-2}$. On what interval(s) is f decreasing?

- A. $(-\infty, 0)$
- B. $(-\infty, 0) \cup (4, \infty)$
- C. $(0, 4)$
- D. $(0, 2) \cup (2, 4)$
- E. $(4, \infty)$

4. Let $f(x) = x^4 - 8x^2$ for $-1 \leq x \leq 3$. If m_1 is the absolute maximum of f and m_2 is the absolute minimum find $m_1 + m_2$.

- A. 2
- B. 9
- C. -7
- D. -16
- E. 0

5.

 $y = f'(x)$ 

The graph above is for $y = f'(x)$. For what value(s) of x does f have an inflection point?

- A. $\{-1, 6\}$
- B. $\{2, 5\}$
- C. $\{1, 2, 4\}$
- D. $\{1, 2, 6\}$
- E. $\{-1, 5, 6\}$

6. Let $g'(x) = (x - 1)x^2(x - 2)(x + 1)$.

For what values of x does g have local maxima?

- A. $\{-1, 0\}$
- B. $\{-1, 2\}$
- C. $\{0, 2\}$
- D. $\{1, 2\}$
- E. $\{1\}$

7. Find $\lim_{x \rightarrow 0} \frac{\cos(2x) - 1}{x^2}$.

- A. -2
- B. 2
- C. 1
- D. 0
- E. $\frac{1}{2}$

8. Find the differential of the following function.

$$y = \frac{\sinh(x)}{x^2 + 1}$$

- A. $\frac{(\sinh(x)x^2 + 2 \cosh(x)x + \sinh(x))}{(x^2 + 1)^2} dx$
- B. $\frac{(\cosh(x)x^2 + 2 \sinh(x)x - \sinh(x))}{(x^2 + 1)^2} dx$
- C. $\frac{(\sinh(x)x^2 - 2 \sinh(x)x + \cosh(x))}{(x^2 + 1)^2} dx$
- D. $\frac{(\cosh(x)x^2 - 2 \sinh(x)x + \sinh(x))}{(x^2 + 1)^2} dx$
- E. $\frac{(\cosh(x)x^2 - 2 \sinh(x)x + \cosh(x))}{(x^2 + 1)^2} dx$

9. Find the linearization of $f(x)$ at $a = 1$.

$$f(x) = \sin(\ln(x))$$

- A. $L(x) = x + 2$
- B. $L(x) = x - 1$
- C. $L(x) = \frac{1}{2}x + 2$
- D. $L(x) = \frac{1}{2}x - 2$
- E. $L(x) = x - 3$

10. If R the total resistance across a circuit is given by $1/R = 1/R_1 + 1/R_2$ for two resistors with resistances R_1 and R_2 , how fast is the total resistance changing when $R_1 = 5$, $R_2 = 10$ and R_1 is changing at 1 ohm/s and R_2 is changing at 2 ohm/s?

- A. $2/3$ ohm/s
- B. $5/7$ ohm/s
- C. $9/2$ ohm/s
- D. $4/5$ ohm/s
- E. $4/3$ ohm/s

11. What is the half-life of an element which decays to 75% of its original mass after one year?

A. $-\ln(2)/\ln(3/4)$

B. $-\ln(3/4)/\ln(2)$

C. $-\ln(2)/\ln(3)$

D. $-\ln(3)/\ln(2/3)$

E. $-\ln(3)/\ln(2/5)$

12. Suppose the radius of a circle is given by $r(t) = 2t + 1$. How fast is the area changing at $t = 1/2$?

A. $\pi/2$

B. π

C. 4π

D. 8π

E. 2π

13. The functions $f(x) = |x|$, $g(x) = x^2$, and $h(x) = x^4$ each have a local minimum at $x = 0$. The first derivative test can be applied to prove this

- A. just for $g(x)$.
- B. just for $g(x)$ and $h(x)$.
- C. just for $f(x)$.
- D. just for $g(x)$ and $f(x)$.
- E. for all three.

14. Find $\lim_{x \rightarrow 0^+} x^{\sqrt{x}}$.

- A. 0
- B. $\frac{1}{2}$
- C. 1
- D. 2
- E. ∞