

3.5 The Second Derivative Test

Multiple Choice Questions

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

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

2. If the graph of $y = ax^3 - 6x^2 + bx - 4$ has a point of inflection at (2,-2), what is the value of $a+b$?

- (A) -2 (B) 3 (C) 5 (D) 7 (E) 10

3. At what value of x does the graph of $f(x) = \sqrt{x} + \frac{1}{\sqrt{x}}$ have a point of inflection?

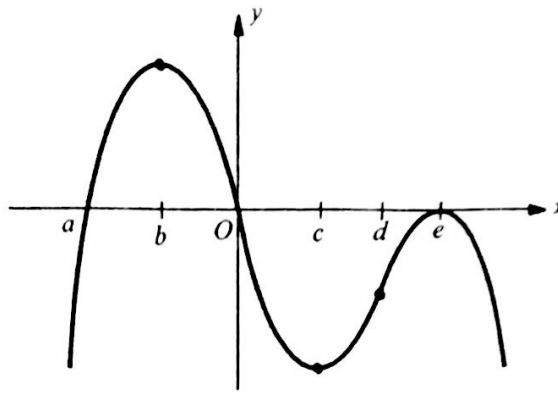
- (A) $\frac{1}{2}$ (B) 1 (C) 3 (D) $\frac{7}{2}$ (E) 5

4. The graph of $y = 3x^3 - 40x^2 - 21x$ is concave up for

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

5.) Find the max/min point using the 2nd derivative test

$$f(x) = 3x^2 + 2x - 1$$



6. 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) $a, 0$ and e (E) a and 0

7. The first derivative of the function f is given by $f'(x) = (x^3 + 2)e^x$. What is the x -coordinate of the inflection point of the graph of f ?

- (A) -3.196 (B) -1.260 (C) -1 (D) 0 (E) 1.762

Use the 2nd Derivative test to determine maximum and/or minimum points. Give the intervals of concavity. "Show work"

8.) $f(x) = x^4 - 4x^3$

10.) $f(x) = x^3 - 6x^2 + 12x - 8$

9.) $f(x) = x^4 - 4x^2$

Name _____

Inc/Dec Slopes

Determine the inflection points and intervals of concavity for the function. Use the 2nd Derivative test (if possible) to determine maximum points and minimum points; if not possible, use the 1st derivative test.

$$\textcircled{1} f(x) = x^3 - 6x^2 + 12x$$

$$\textcircled{2} f(x) = 2x^3 - 3x^2 - 12x +$$

$$\textcircled{3} f(x) = \frac{1}{4}x^4 - 2x^2$$

$$\textcircled{4} f(x) = 2x^4 - 8x + 3$$

$$\textcircled{5} f(x) = x(x-4)^3$$

$$\textcircled{6} f(x) = x^4 - 4x^3$$

$$\textcircled{7} f(x) = 3x^2 - x^3$$

$$\textcircled{8} f(x) = x^3 - 9x^2 + 27x$$

Name _____

Calculus FR

Test FR – Extrema and Optimization

1. Use the first derivative test to find the intervals in which $f(x)$ is increasing and decreasing. List the maximum and minimum points. Show all work that leads to your answer. (DO NOT USE THE 2nd DERIVATIVE TEST!) $f(x) = 2x^3 + 3x^2 - 12x$

2. Use the 2nd derivative to show intervals of concave up and concave down. List the inflection points if any. Show all work that leads to your answer. $F(x) = 2x^3 - 3x^2 - 12x + 5$

3. If $f'(x) = (x-1)(x+2)^2(x-4)^2$, then the graph of f has inflection points when $x = ?$. Show all work that leads to your answer.

3. If $f''(x) = (x-1)(x+2)^3(x-4)^2$, then the graph of f has inflection points when $x = ?$ Show all work that leads to your answer.

4. On what interval is the function $y = 5x^4 - 24x^3 + 24x^2 + 17$ Concave down? Show all work that leads to your answer.

5. The graph of the function $y = \frac{x^3}{3} - x^2 - 5x + 3\sin x$, changes concavity at $x = ?$ You may use a calculator to determine. (Round your answer to 2 decimal places.)