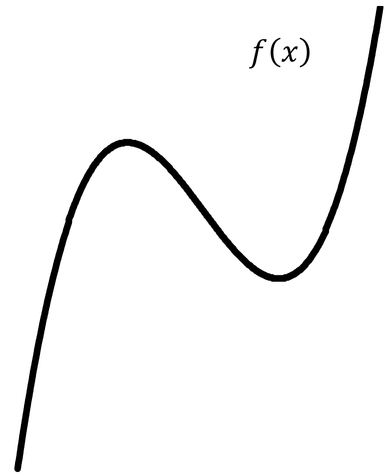
Calculus

5.7 The Second Derivative Test

Notes

Write your questions and thoughts here!



a. Identify the relative extrema.

b. What do we know about the value of $f'(x)$ at each extrema?

c. What do we know about the value of $f''(x)$ at each extrema?

The Second Derivative Test:

Suppose $f'(c) = 0$. Then…

- If $f''(c) > 0$, then f has a relative minimum at $x = c$.
- If $f''(c) < 0$, then f has a relative maximum at $x = c$.

1. Use the second derivative test to find the relative extrema of $f(x) = x^4 - 2x^2$.

2. Use the second derivative test to find the relative extrema of $f(x) = \sqrt{2}x - 2\cos x$ on the interval $[0, 2\pi]$

If there is only _____ critical point, and that CP is an extremum (max or min), then it is an ___________________ extremum (max or min).

3. $f(x) = -xe^{\frac{x}{4}}$

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Practice

Find the relative extrema by using the Second Derivative Test. Justify your answer.

1. $f(x) = 5 + 3x^2 - x^3$

2. $h(x) = (2x - 5)^2$

3. $g(x) = x + 2\sin x$ on the interval $(0, 2\pi)$

4 . $f(x) = 2x^4 - 8x + 3$

5. Which of the following statements about the function given by $f(x) = x^4 - 2x^3$ is true?

(A) The graph of the function has two points of inflection, and the function has one relative extremum.

(B) The graph of the function has one point of inflection, and the function has two relative extrema.

(C) The graph of the function has two points of inflection, and the function has two relative extrema.

(D) The graph of the function has two points of inflection, and the function has three relative extrema.

(E) The function has no relative extremum.

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6. At what value(s) of x does $f(x) = x^4 - 8x^2$ have a relative minimum?

(A) 0 and -2 only

(B) 0 and 2 only

(C) 0 only

(D) -2 and 2 only

(E) $-2, 0,$ and 2 only

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7. What is the maximum value of the <u>*derivative*</u> of $f(x) = 3x^2 - x^3$?

(A) 0

(B) 1

(C) 2

(D) 3

(E) 4