§3.4A: Second Derivative Test
"I WILL …
…identify the relative extrema using the Second Derivative Test."

I. First Derivative Test and Concavity

A. f'positive then f is: _____

B. f' negative then f is: _____

C. f'' positive then f' is Concave _____

D. f'' negative then f' is Concave _____

E. $f'(c) = 0$ of $f'(c) = DNE$ to which c is x of a critical point, then the point is called _____

F. $f''(x) = 0$ of $f''(x) = DNE$ and $f''(x)$ changes signs, then the point is called _____

II. Second Derivative Test

A. Let f be a function such that $f'(c) = 0$ and f'' exists on an open interval containing c:

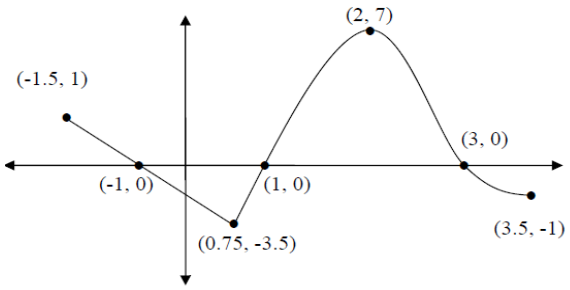
1. If $f''(c) > 0$, then $f(x)$ has a _____ at $(c,\ f(c))$ and f is concave up
2. If $f''(c) < 0$, then $f(x)$ has a _____ at $(c,\ f(c))$ and f is concave down
3. If $f'(x) = 0$ and $f''(x) = 0$, then $f(x)$ is _____. Use the first derivative test.

Ex 1: Using the Second Derivative Test to find the relative extrema of $f(x) = x + \frac{2}{x}$ and justify.	Ex 2: Using the Second Derivative Test to find the relative extrema of $f(x) = -3x^5 + 5x^3$ and justify.

Your Turn: Using the Second Derivative Test to find the relative extrema of $f(x) = \frac{1}{3}x^3 - x^2 - 3x$ and justify.

Ex 3: Suppose that the function f has a continuous second derivative for all x and that $f(-1) = 2$, $f'(-1) = -3$, $f''(-1) = 5$. Let g be a function whose derivative is given by $g'(x) = (x^4 - 6x^3)\big(3f(x) + 2\,f'(x)\big)$ for all x. Write an equation of the tangent line to the graph of f at the point of where $x = -1$. Justify response.

Ex 4: The figure below shows the graph of the derivative of f, f' on the closed interval $[-1.5,3.5]$. The graph of f' has a horizontal tangent line at $x = 2$ and is linear on the interval $[-1.5,0.75]$.



Graph of f'

(a) Find the x-coordinates of the relative maxima of f. Justify your answer.

(b) Find the x-coordinates of the points of inflection of f. Justify your answer.

(c) On what intervals is f decreasing? Justify your answer.

(d) Is the function f twice-differentiable? Justify your answer.

AP 1: Let h be twice differentiable. $h'(x) > 0$ and $h''(x) > 0$ for all reals. What is a possible value for $h(3)$ if $h(0) = 0$, $h(1) = 2$ and $h(2) = 7$?

(A) 12 (B) 7 (C) 4 (D) 14

Vocabulary	Connections and Process	Answer and Justifications

Assignment: Page 192: 31-40 all & Justify all responses