The Second Derivative Test

The point where a function changes from:

Concave Up to Concave Down OR Concave Down to Concave Up is called a Point of Inflection.

Outcome: Identify the Maximum and Minimum of functions using the second derivative test.

1. State the critical values for the following functions and identify them as maximums, minimums or points of inflection.
   a) $y = x^3 + 6x^2 + 9x + 2$ b) $f(x) = x^3 - 3x + 1$
   c) $y = x^4 - 4x^3 - 8x^2 - 1$ d) $y = x^3$

2. Find the second derivative for each of the above functions. Determine the value of the 2^{nd} derivative functions at the critical numbers for the first derivatives.

   a) $y = x^3 + 6x^2 + 9x + 2$
   b) $f(x) = x^3 - 3x + 1$
   c) $y = x^4 - 4x^3 - 8x^2 - 1$

   How can we determine if a function has a local maximum or minimum using second derivatives?

Examples Find critical numbers of first and second derivatives. Find points of inflection, max and/or min values. Use this information to sketch the graphs.

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

b) $f(x) = x^3 - 12x + 1$

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

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