

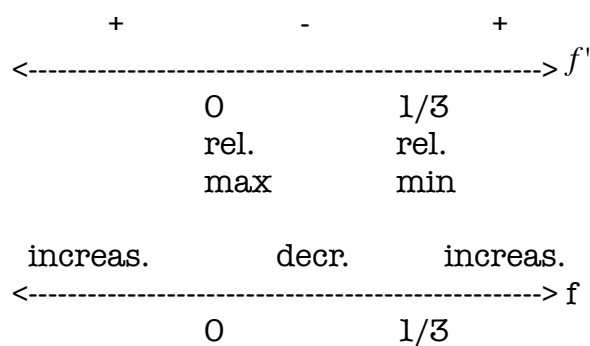
1st derivative and Test for Concavity Explanations

$$f(x) = 4x^3 - 2x^2$$

1st derivative test: to find relative maximums and/or minimums and intervals where $f(x)$ is increasing or decreasing.

$$f'(x) = 12x^2 - 4x \quad \text{Find the derivative}$$

$$0 = 4x(3x - 1) \quad \text{Find where the derivative is zero or undefined.}$$



f is increasing on $(-\infty, 0)$ and $(1/3, \infty)$ because $f' > 0$ on these intervals.

f is decreasing on $(0, 1/3)$ because $f' < 0$ on these intervals.

There is a relative maximum at $(0, 0)$ because the sign of f' is changing from positive to negative at this point.

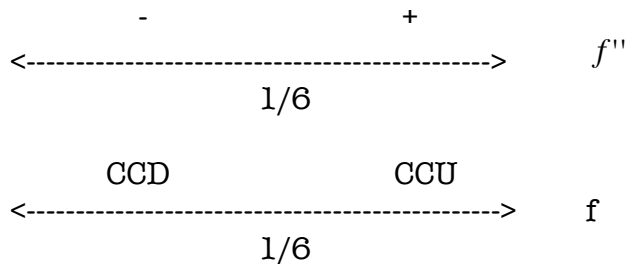
There is a relative minimum at $(1/3, -.074)$ because the sign of f' is changing from negative to positive at this point.

Test for concavity and P.O.I.: to find where $f(x)$ is concave up and/or down and finding the points of inflection

$$f''(x) = 24x - 4 \quad \text{Find the second derivative}$$

$$0 = 24x - 4 \quad \text{Find where the second derivative is zero or undefined.}$$

$$0 = 4(6x - 1)$$



The function is concave down on the interval $(-\infty, 1/6)$ because $f'' < 0$ on this interval.

The function is concave up on the interval $(1/6, \infty)$ because $f'' > 0$ on this interval.

There is a point of inflection at $(1/6, -.037)$ because f'' changes signs at this point.