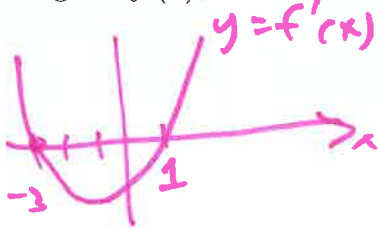
MAT 136 (Calculus I) Prof. Swift

In-Class Worksheet: The First Derivative Test to Classify Critical Points

Consider the function $f(x) = \frac{1}{3}x^3 + x^2 - 3x + 4$.

1. Compute the derivative $f'(x)$. $f'(x) = x^2 + 2x - 3 = (x+3)(x-1)$
2. Find all of the critical points of f. $f'(x) = 0$ has solutions $c_1 = -3$ and $c_2 = 1$
3. Sketch $y = f'(x)$. Only worry about the x-intercepts, and the sign of $f'(x)$.
4. Apply the first derivative test to each critical point of f.
5. Do steps 1-4 for $g(x) = \frac{1}{3}x^3 - x^2 + x + 2$.



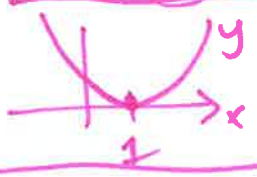
f has a local max at -3.
Since $f'(x) > 0$ for $x < -3$ and $f'(x) < 0$ for $x > -3$ (and $x < 1$).

f has a local min at 1.
Since $f'(x) < 0$ for $x < 1$ (and $x > -3$), and $f'(x) > 0$ for $x > 1$.

5. $g(x) = \frac{1}{3}x^3 - x^2 + x + 2$

$g'(x) = x^2 - 2x + 1 = (x-1)^2$

The only critical point is 1. (i.e., $x = 1$).



g does not have a local extremum because $g'(x)$ has the same sign (positive) for $x < 1$ and for $x > 1$.