**First Derivative Test** Let f(x) be continuous on the interval $[a, b]$ and c a critical point of f(x) on the open interval $(a, b)$, then

1) $f(c)$ is a *local maximum* if

$f'(x) > 0$ for all x in $(a, c)$ and $f'(x) < 0$ for all x in $(c, b)$.

2) $f(c)$ is a *local minimum* if

$f'(x) < 0$ for all x in $(a, c)$ and $f'(x) > 0$ for all x in $(c, b)$.

3) $f(c)$ is not a local extremum if $f'(x)$ has the same sign on $(a, c)$ and $(c, b)$.

**Example** Find where the function $F(x) = 3x^4 - 4x^3 - 12x^2 + 5$ is increasing and decreasing and classify the critical points of F.

We have to first find the critical points. Since F(x) is a polynomial the derivative does not exist case is not a possibility. So we will only explore $F'(x) = 0$ one.

$F'(x) = 0 \Rightarrow 12x^3 - 12x^2 - 24x = 0 \Rightarrow 12x(x^2 - x - 2) = 0 \Rightarrow 12x(x+1)(x-2) = 0$

So the critical values are $x = 0$, and $x = -1$ and $x = 2$. To classify these critical points we'll use the First Derivative Test. It is much easier to observe the test in action on a sign chart.