

## § 4.3 - First Derivatives + Graphs

Important relationship:

$f'(x) > 0$  on an Interval  $\Leftrightarrow f$  increasing on Interval.

$f'(x) < 0$  on an Interval  $\Leftrightarrow f$  decreasing on Interval.

Example: Where is  $f(x) = 3x^4 - 4x^3 - 12x^2 + 5$  increasing + where is it decreasing?

$$f'(x) = 12x^3 - 12x^2 - 24x = 0$$

$$12x(x^2 - x - 2) = 0$$

$$12x(x-2)(x+1) = 0$$

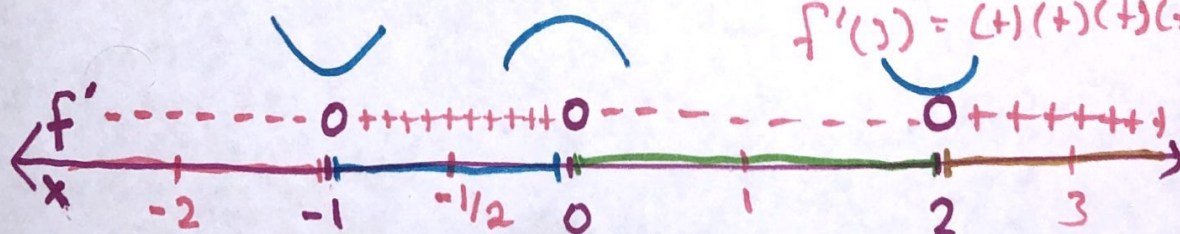
$$x = 0, 2, -1$$

$$f'(-2) = 12(-2)(-4)(-1) = -$$

$$f'(-1/2) = 12(-1/2)(-5/2)(1/2) = +$$

$$f'(1) = 12(1)(-1)(2) = -$$

$$f'(3) = 12(3)(2)(4) = +$$



$f(x)$  is increasing for  $-1 < x < 0$  and  $2 < x$

$f(x)$  is decreasing for  $x < -1$  and  $0 < x < 2$

