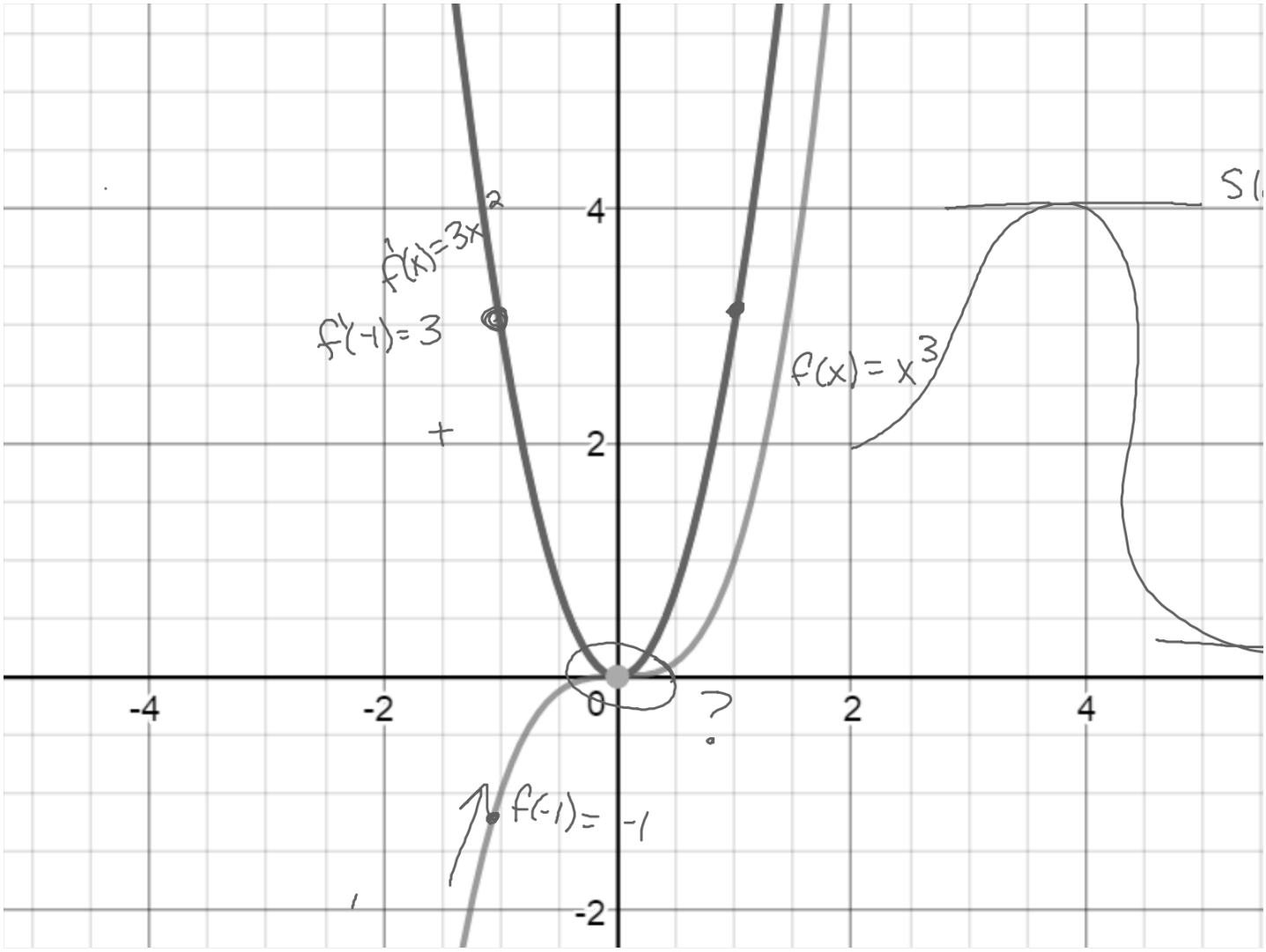
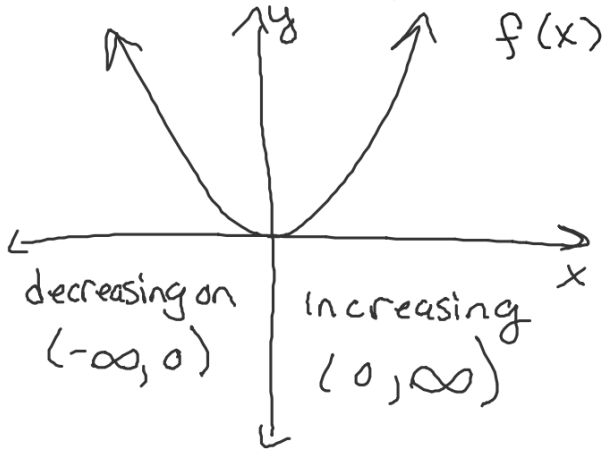

f'(x)=3x²
f'(-1)=3
f(x)=x³
f(-1)= -1
?
4
2
0
-2
-4
-2
2
4

Obtaining the slope of a graph from its derivative

A FUNCTION IS INCREASING ON AN INTERVAL IF AN INCREASE IN X RESULTS IN AN INCREASE IN Y. (AND VICE VERSA X ↓ and y ↓ f(x) IS DECREASING)



BUT, WHAT DOES $f'(x)$ TELL US ABOUT THE GRAPH OF $f(x)$?

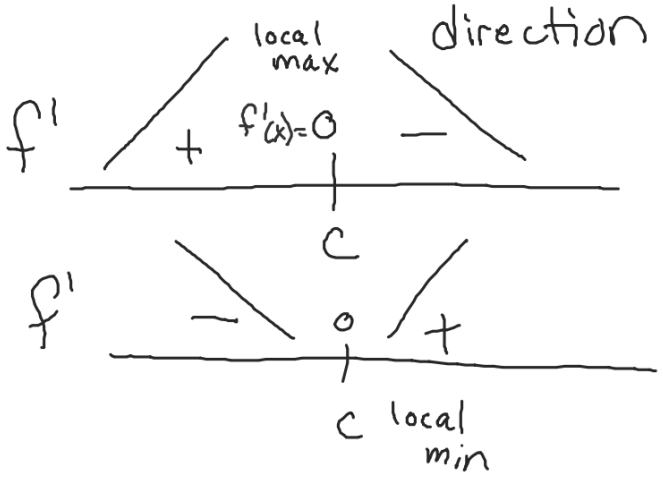
if $f'(x) > 0$, f IS INCREASING (POSITVE SLOPE)

if $f'(x) < 0$, f IS DECREASING (NEGATIVE SLOPE)

CRITICAL NUMBERS (CN), call the # c

if $f'(x) = 0$, (most likely) f is changing direction.

EX



Sign diagram

Ex Use the derivative of the function to find the intervals on which f is increasing or decreasing

a) $f(x) = 2x^3 - 3x^2 - 12x$

Find critical #s first

$$f'(x) = 6x^2 - 6x - 12 = 0$$

$$6(x^2 - x - 2) = 0$$

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

CNs at $x = 2, x = -1$

$(-\infty, -1)$ increasing

$(-1, 2)$ decreasing

$(2, \infty)$ increasing

choose -2, plug into $f'(x)$

$f'(-2) = 24$

$f'(0) = -12$

$f'(3) = 24$

2. $f(x) = \frac{\ln(4x)}{x}$

$$f'(x) = \frac{x \cdot \frac{1}{4x}(4) - \ln(4x)(1)}{x^2}$$

$$= \frac{1 - \ln(4x)}{x^2}$$

$\frac{1}{4}$

$P(0.25, 0)$

$$f'\left(\frac{1}{4}\right) = \frac{1 - \ln\left(4\left(\frac{1}{4}\right)\right)}{\left(\frac{1}{4}\right)^2} = \frac{1 - \ln(1)}{\frac{1}{16}}$$

slope $= \frac{1}{16}$

$y - 0 = -\frac{1}{16}\left(x - \frac{1}{4}\right)$ $= \frac{1 - 0}{\frac{1}{16}} = \frac{1}{\frac{1}{16}} = \frac{16}{1} = 16$

$$f(x) = e^{2x}$$

$$f'(x) = e^{2x}(2) = 2e^{2x}$$

6. average acceleration

a) code for slope original function

use $t=0$ and $t=5$

$$AROC = \frac{v(5)-v(0)}{5-0}$$

b) instantaneous

$f'(t)$ at $t=3$

$$\lim_{h \to 0} \frac{x^3 + 3hx^2 + 3h^2x + h^3 - 4x - 4h + 4x^3 + 4x - 4}{h}$$