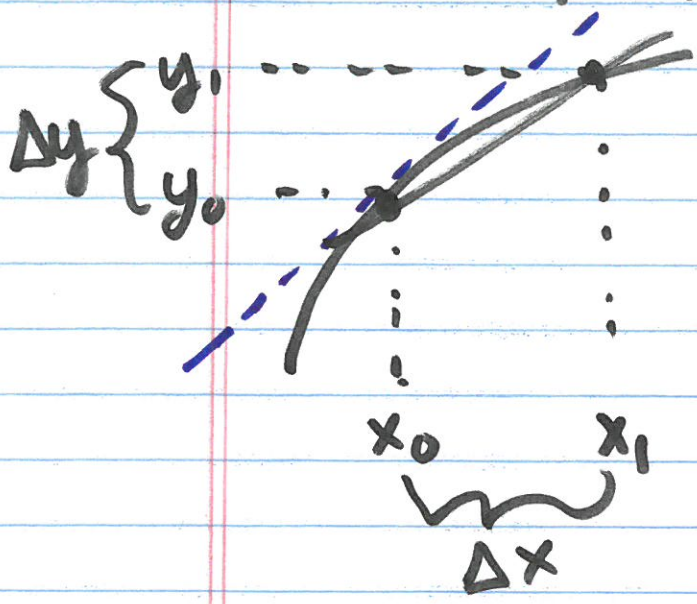
Formal definition of derivative



$$f'(x_0) = \lim_{x_1 \to x_0} \frac{\Delta y}{\Delta x}$$

$$= \lim_{x_1 \to x_0} \frac{f(x_1) - f(x_0)}{x_1 - x_0}$$

2.1 Describing graphs of functions

1. where function is defined, where continuous, differentiable
2. x-intercepts, y-intercept
3. intervals where function is increasing, decreasing, concave up/ concave down

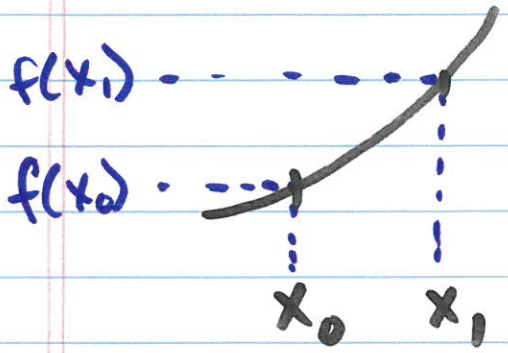
today

4. asymptotes

Note: Read graph from left to right.

Definitions:

f is increasing if for any two values of the independent variable, the function value is larger for the larger value of the independent variable



f is increasing if $f(x_1) > f(x_0)$ whenever $x_1 > x_0$

f is increasing on an interval whenever this is true for all x values in that interval.

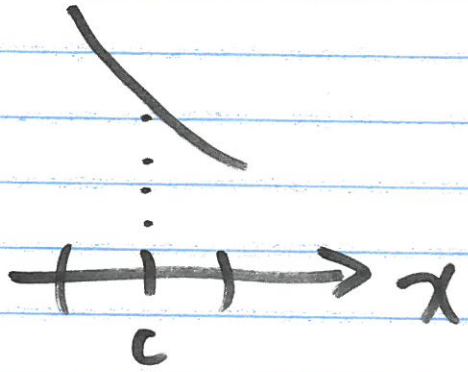
f is increasing at $x=c$ if it is increasing on some interval around c.

f is decreasing if for any two values of the independent variable, the function value is smaller when the value of the independent variable is larger.

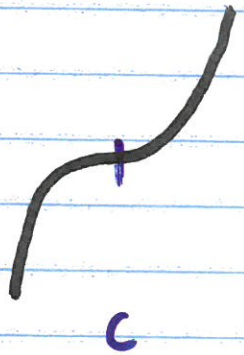
Describing how the function value changes

f increasing at $x=c$ (on some interval around $x=c$)

f is decreasing at $x=c$

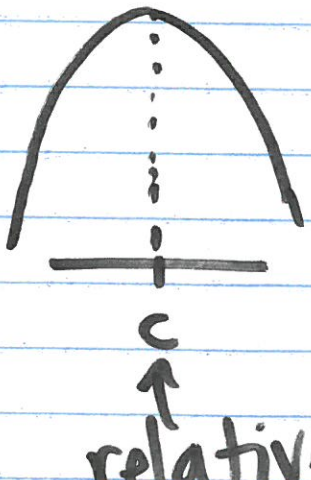


f increasing (even though slope is 0 at c)



$f(x)=x^3$

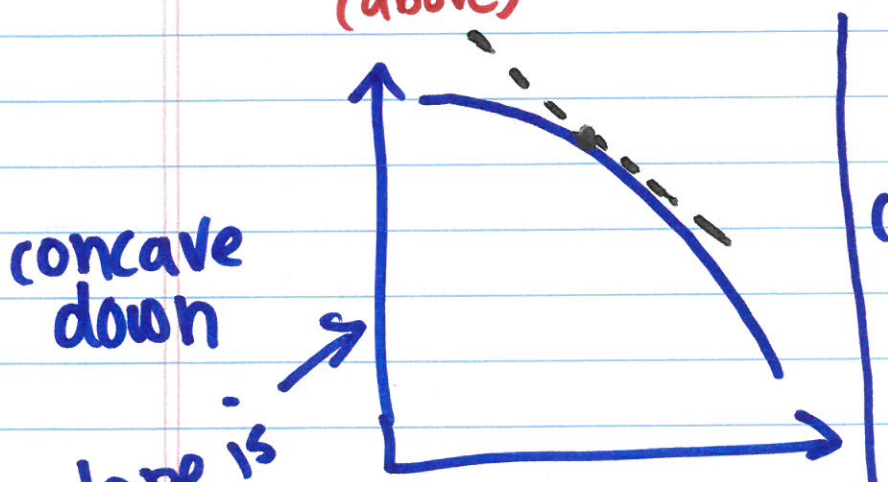
relative maximum: a point where f changes from increasing to decreasing

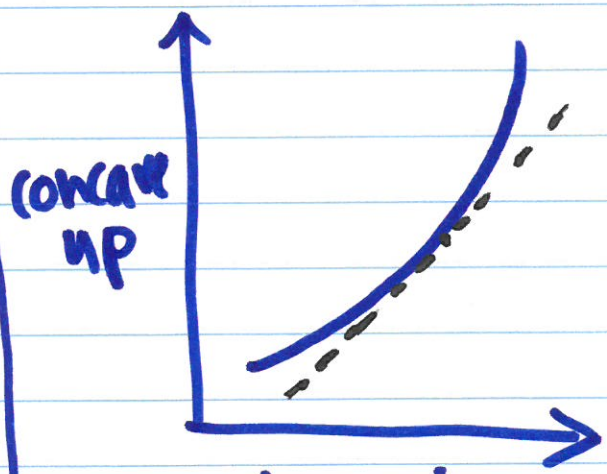


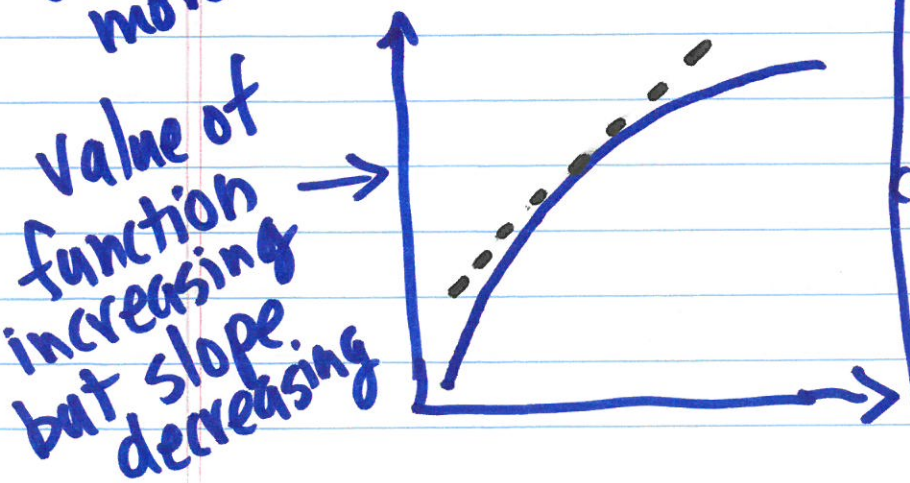
Describing how the slope changes

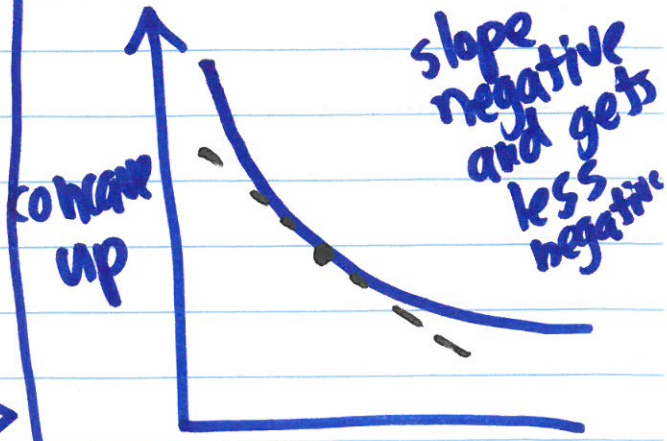
f is concave up (down) at $x=a$ if the slope is increasing (decreasing) at $x=a$ (there is an interval around a where the slope is increasing)

Equivalently, f is concave up (down) if the tangent line at a is below (above) the graph on some interval.



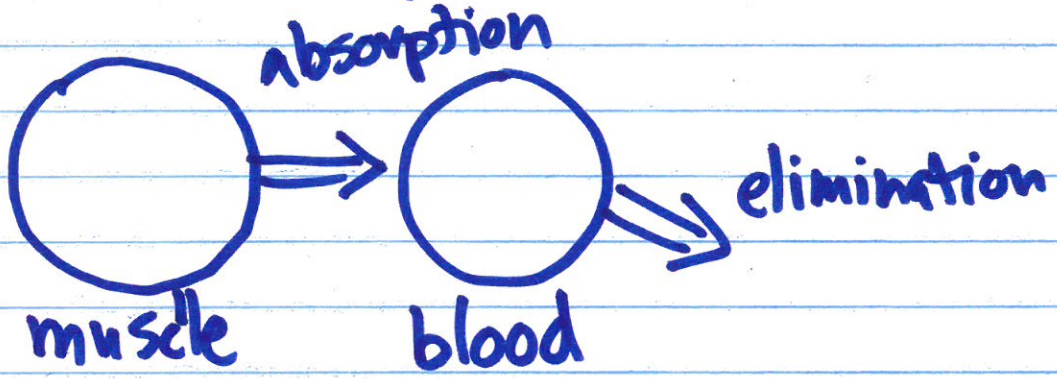




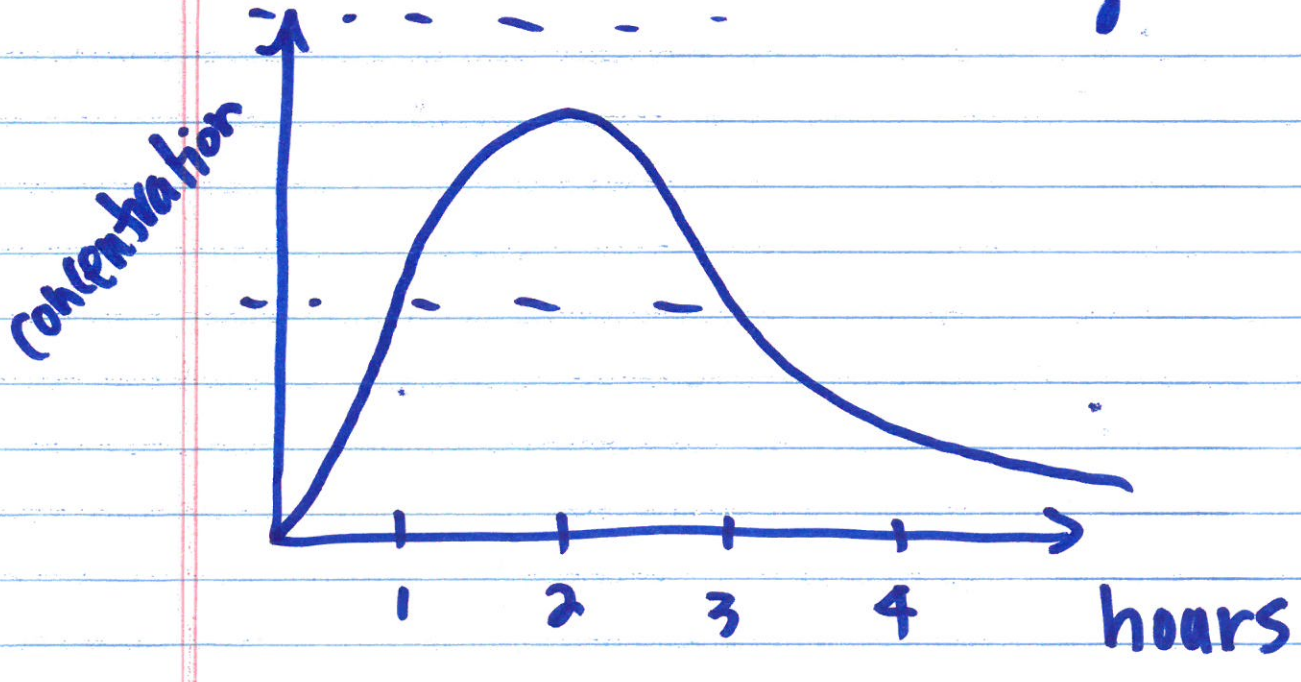


Concentration of a drug in the bloodstream

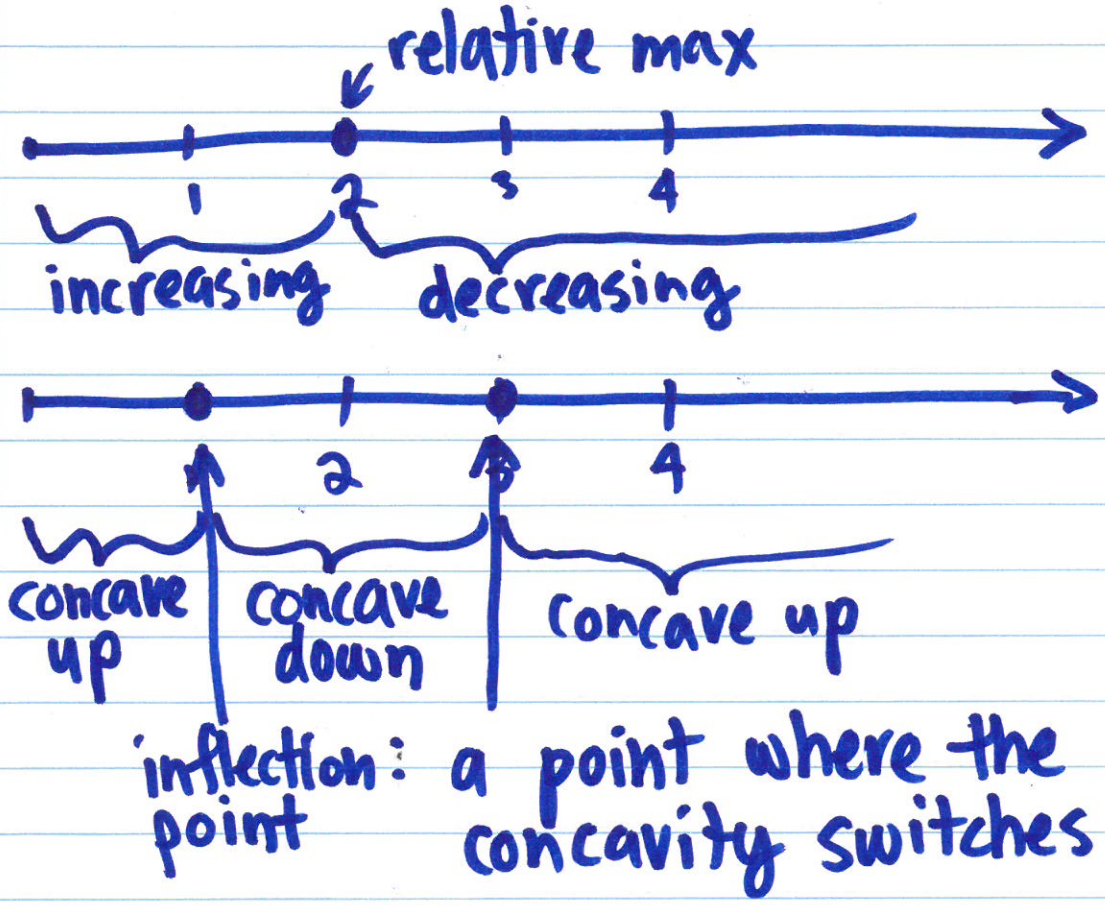
After a drug injected intramuscularly the concentration in the blood varies as a result of absorption, distribution, elimination.



Suppose the concentration over time looks like the following



Where is this function increasing, decreasing, concave up/down, and locations of relative max, mins



inflection: a point where the concavity switches

2.1 Check for understanding