

Good afternoon

assessments are being passed back

look over them with your partners, ask and answer q's

D-GR! Not on Friday's  
test

we will go over the mult. choice AP q's in DS Weds  
so hang on to those til then

Last Q2 assess

Friday

(will get back Monday,  
can retake in class Monday)

# Friendship ended with RELATIVE EX

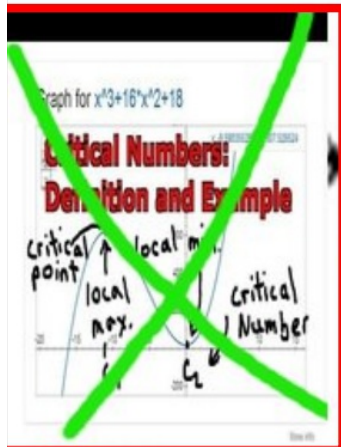
Inflection Point  
Now

INFLECTION POINT

is my best friend

Inflection Point

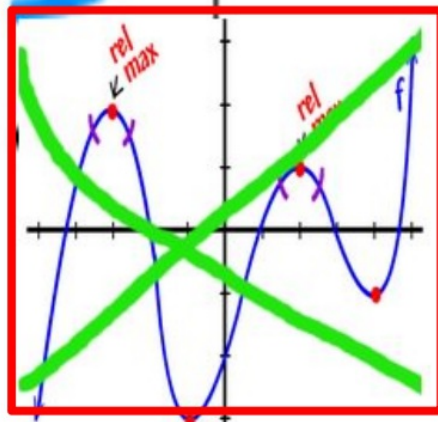
Inflection Point



Concave Upward

Concave Upward

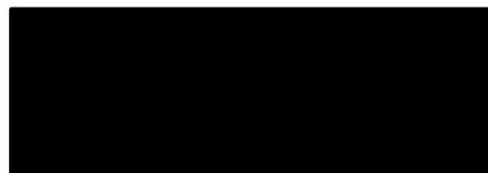
Concave Downward



## Concavity and the 4 kinds of curvature

*NOTES*

concave up: holds water  $f'$  increasing  
concave down: doesn't  $f'$  decreasing



f' inc  
C.U.  
dec.  
f' neg.

Concave  
up:  
 $f'' > 0$

f' inc  
C.U.  
inc.  
f' pos.

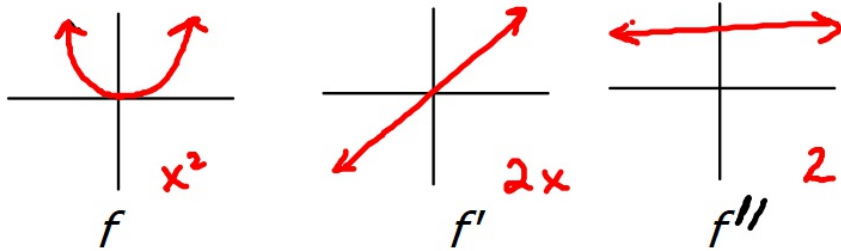
f' dec.  
C.D.  
Inc  
f' pos

Concave  
down  
 $f'' < 0$

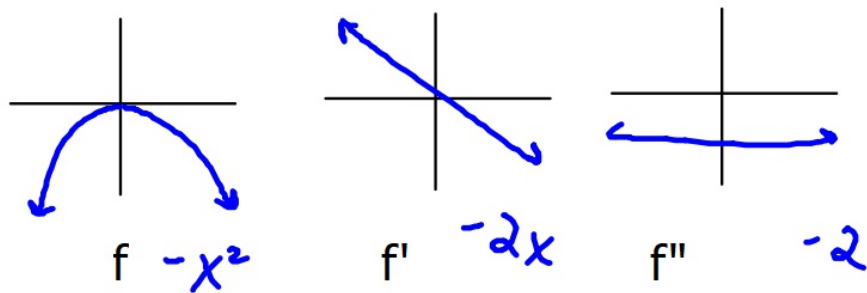
f' dec  
C.D.  
dec.  
f' neg.



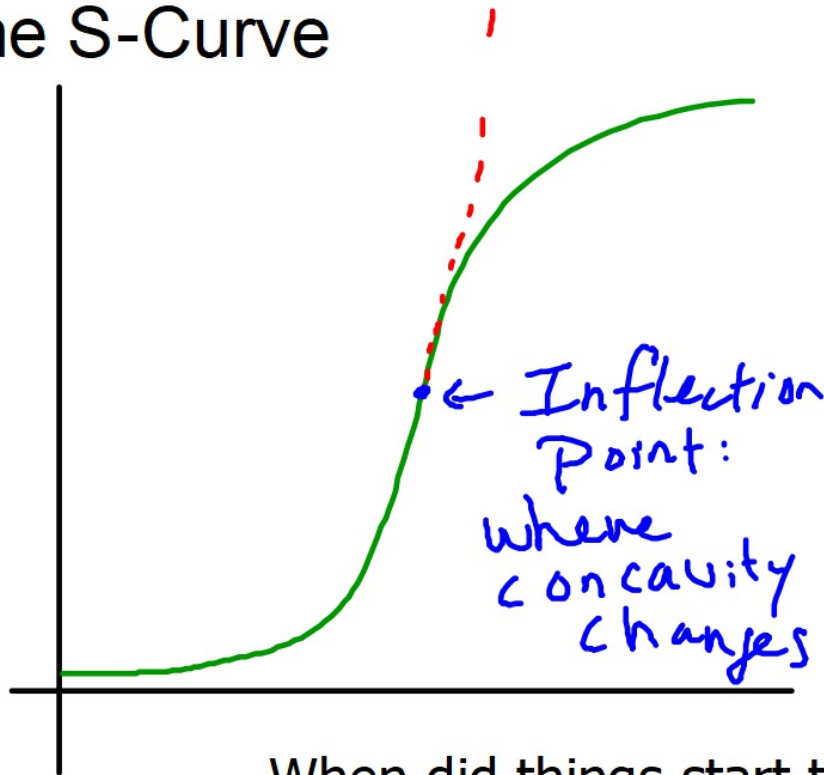
Concave up



Concave down



## The S-Curve

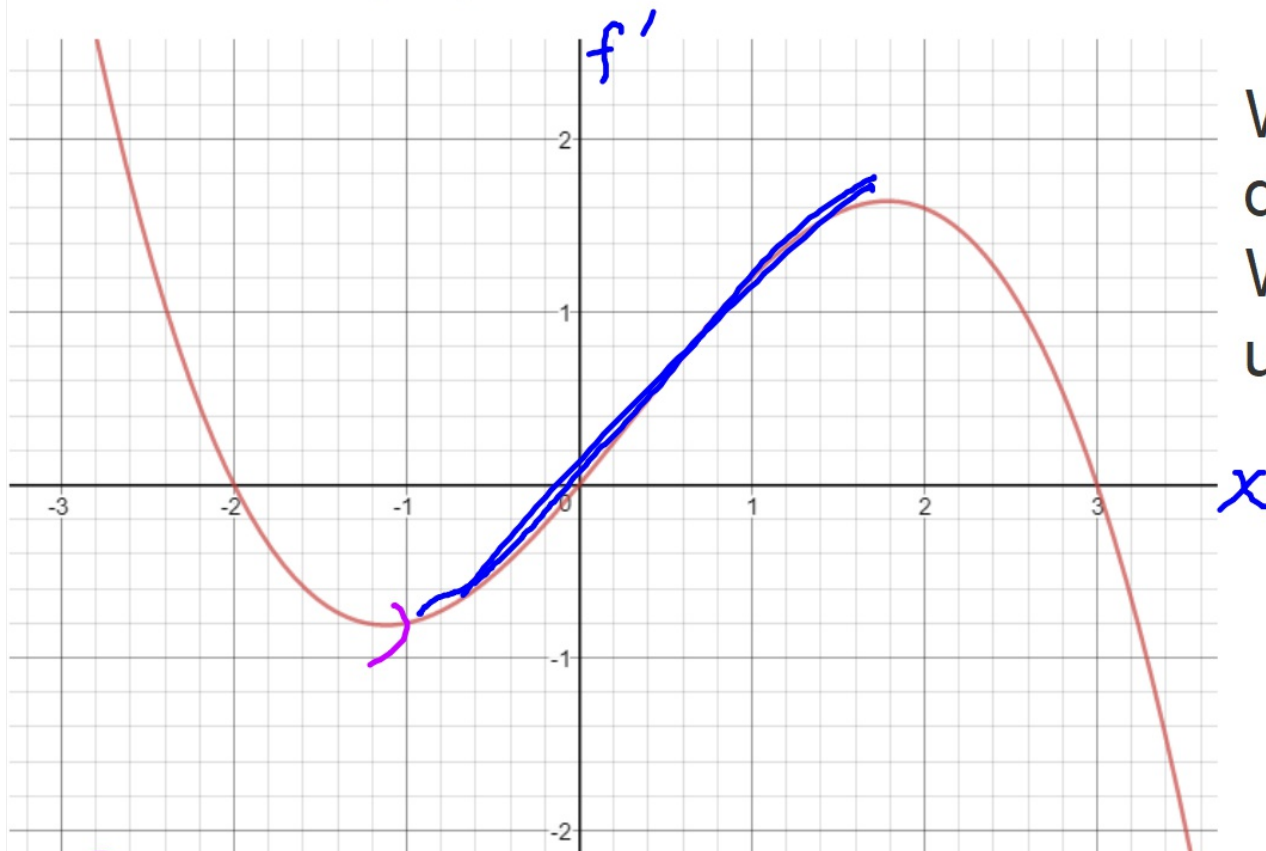


What might this model?

- new toy demand
- bacteria growth
- Mozart's symphony production
- airline traffic
- ???

When did things start to go wrong

Here is a graph of  $f'$



Where is  $f$  increasing?  
decreasing?

Where is  $f$  concave  
up? concave down?

$f$  Inc:  $(-\infty, -2)$   
 $(0, 3)$   
b/c  $f' > 0$

$f$  is C.D. on  $(-\infty, -1)$   $(2, \infty)$  |  $f$  is C.U.  $(-1, 2)$   
b/c  $f'$  decreasing  $(f'' < 0)$  | b/c  $f'$  inc.  $(f'' > 0)$

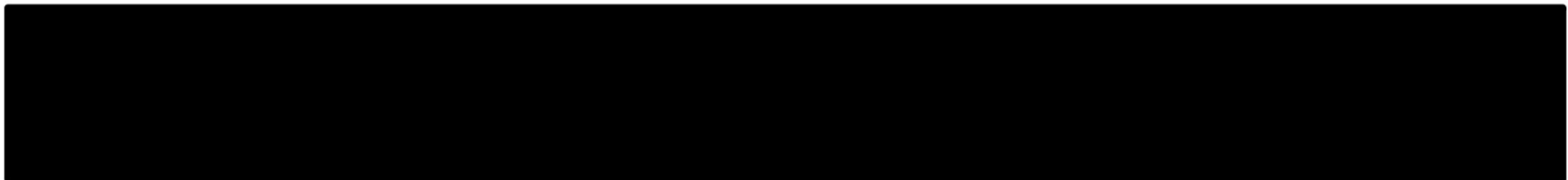
Precise Language

$$\rightarrow f' = 0$$

Relative extrema: find critical numbers, make number line, plug test values into  $f'$ , find sign change

$$\rightarrow f'' = 0$$

Inflection Points: find terrace points, make number line, plug test values into  $f''$ , find sign change





## How to find inflection points

Find terrace points:  $f'' = 0$  or  $f''$  undefined

Plot on number line, make bunny hops

Plug test values into second derivative and note signage

Sign change implies inflection point



## Model

Find the location of all inflection points for  $f(x) = x^3 - x^2 - 1$   
Justify your answer.

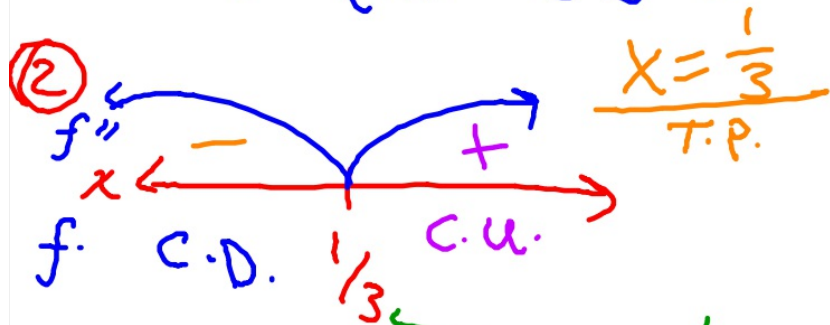
① Find T.P.

$$f(x) = x^3 - x^2 - 1$$

$$f'(x) = 3x^2 - 2x$$

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

②



$x = \frac{1}{3}$  is an I.P. b/c  $f''(x) = 0$   
and  $f''$  changes sign.

The exact same work can be used to find intervals of concavity!

Find the location of all inflection points for  $f(x) = x^3 - x^2 - 1$   
Justify your answer.

HW

p. 192 #15-24

finish the 11 AP problems on extrema if needed