

Friday, Oct. 14 - Fall '22
Lecture #20

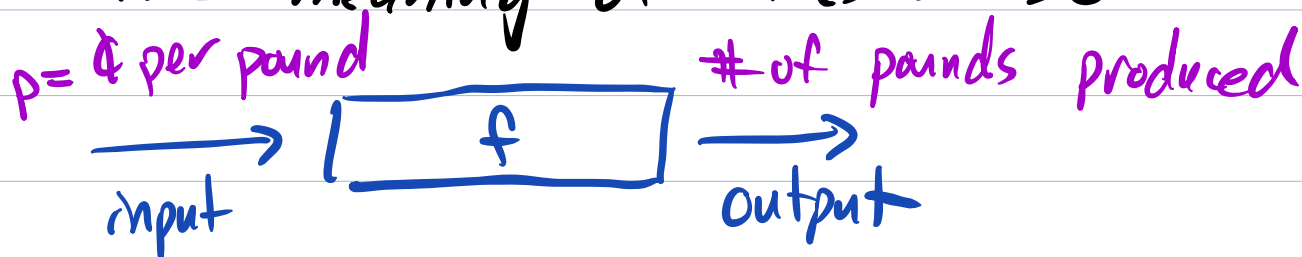
(1)

Announcements / Reminders

- * Wiley Plus #7 due next Wed (2.3, 2.4, 2.5)
- * No discussion next Thurs, no lecture next Fri!
(so no quiz next week)
- * Exam 2 is Wed, Oct 26 (not next week)
covers material from Fri, Sept 30
to Monday, Oct 24

$f'(x)$ vs. $\frac{dy}{dx}$

Ex: If $q = f(p)$ is the # of pounds of sugar produced by a manufacturer when the price per pound is p cents, then what are the units and the meaning of $f'(30) = 50$.



Lagrange $f'(30) = \left. \frac{dq}{dp} \right|_{p=30} = 50$ $\frac{\text{pounds}}{\text{cent per pound}}$ ②

Leibniz \rightarrow cents per pound

the derivative at $p=30$

"When the price of sugar is 30 cents, if the price goes up by 1 cent per pound, the production will go up by ≈ 50 pounds"

Section 2.5 - The Second Derivative

When you start with a function $f(x)$ and take a derivative, you get a new function: $f'(x)$.

Since $f'(x)$ is a function, I can take its derivative and get another new function: $\frac{dy}{dx}$ second derivative

$f''(x)$ "f double prime" $\frac{d^2 y}{dx^2}$

Third derivative: $f'''(x)$ or $\frac{d^3 y}{dx^3}$ (3)

Fourth derivative: $f^{(4)}(x)$ or

$$\frac{d^4 y}{dx^4}$$

n^{th} derivative: $f^{(n)}(x)$

or $\frac{d^n y}{dx^n}$

What does $f''(x)$ tell you about $f(x)$?

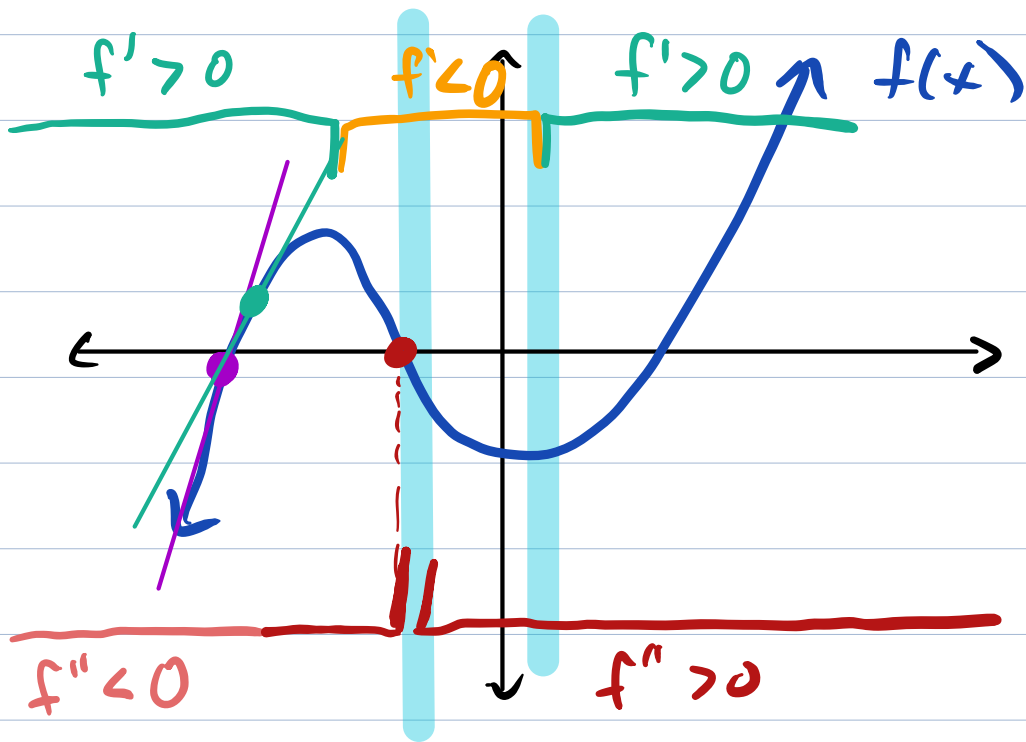
Recall: { If $f' > 0$, then f is increasing.
If $f' < 0$, then f is decreasing.



steepness or slope
of the roller coaster

→ If $f'' > 0$, then f' is increasing.
If $f'' < 0$, then f' is decreasing.

4

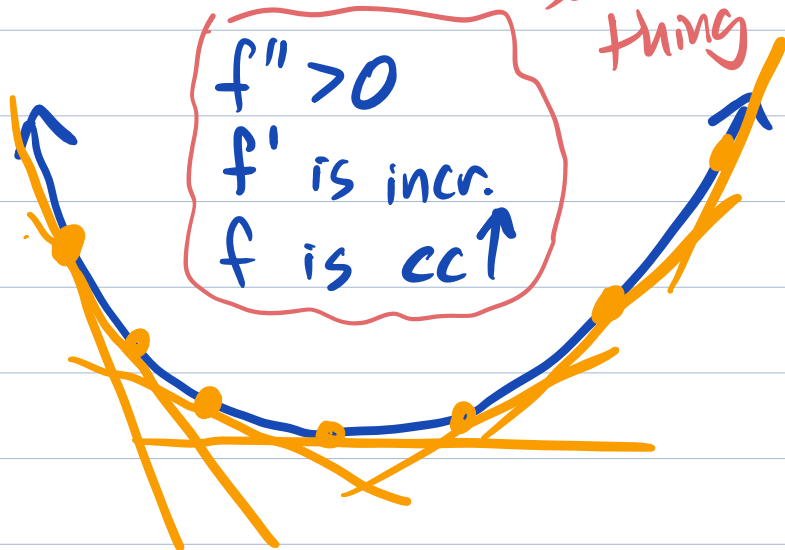


$f'' > 0 \Rightarrow$ bending upward \Rightarrow "concave up"

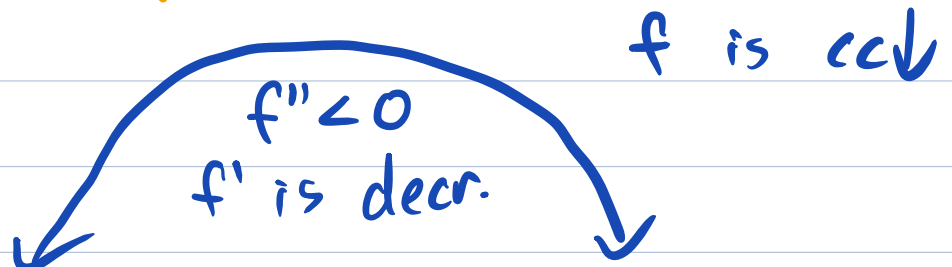
$f'' < 0 \Rightarrow$ bending downward \Rightarrow "concave down"

Three ways to say the same thing

Concave up:



Concave down:



The signs (+ or -) of f , f' , and f'' (5)
can have any combination.

Ex: $f < 0$, $f' > 0$, $f'' < 0$
 $r'(t)$

"The rate of increase of rent prices
is slowing." $r''(t) < 0$

$r(t)$ = average rent at time t
↳ tells us if the price of rent is
pos. or neg.

$r'(t)$ tells us if rents are going
up or down
"100"

$r''(t)$ tells us if rents are trending
higher or lower (this is vague)
"-10"



$r'''(t)$ tells us if r'' is increasing
or decreasing

Richard Nixon:

$$c''(x) > 0$$

$$c'(x) > 0$$

(6)

"The rate of increase of inflation is slowing."

$$c'''(x) < 0$$

the derivative
of average
costs

$c(x)$ = average costs

Second derivative demo

