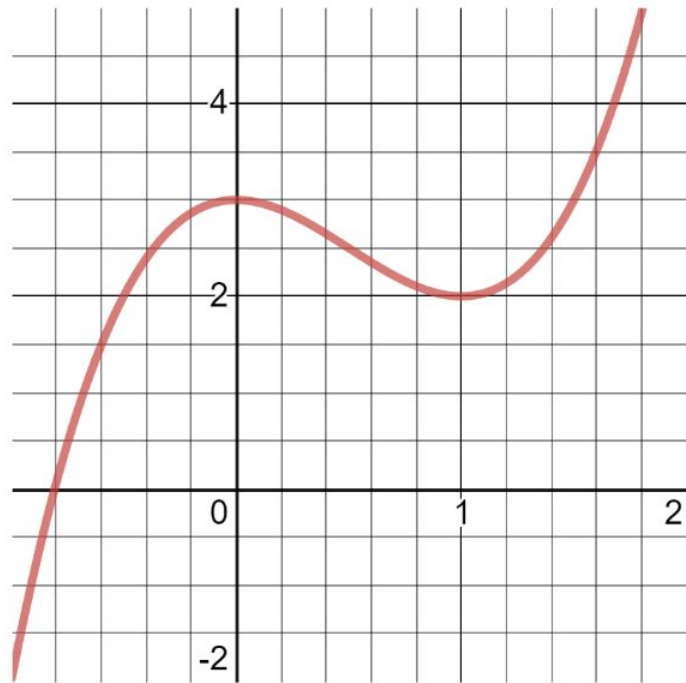


Concavity

MTH 201 – Module 3B

Retrieval practice

The graph of a function $f(x)$ is shown. The *derivative* of $f(x)$ (that is, $f'(x)$) is positive on the interval



$(1, \infty)$

$(-0.8, \infty)$

$(0.5, \infty)$

$(-\infty, 0) \cup (1, \infty)$

None of the above



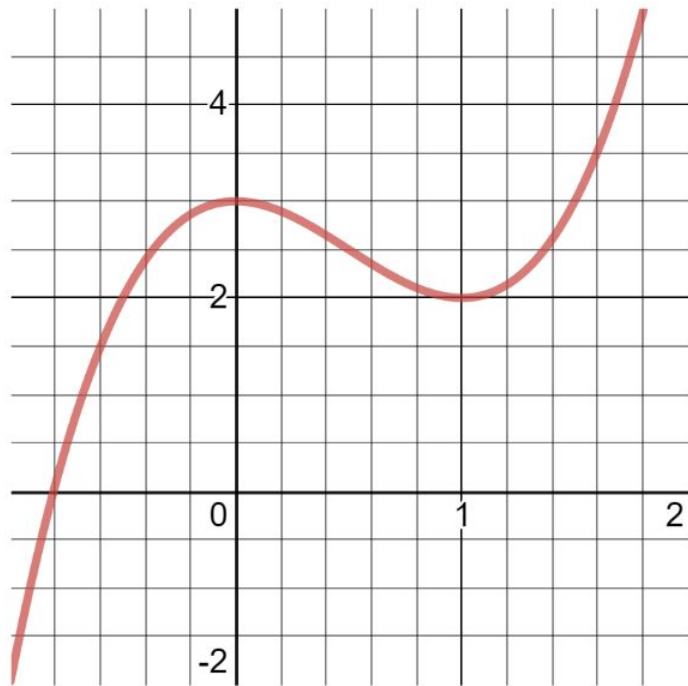
To 0

$f'(x) > 0$ means $f(x)$ is increasing

$f'(x) < 0$ means $f(x)$ is decreasing

$f'(x) = 0$ means... we'll discuss later

The graph of a function $f(x)$ is shown. The function is *concave up* on the interval



$(1, \infty)$

$(-0.8, \infty)$

$(0.5, \infty)$

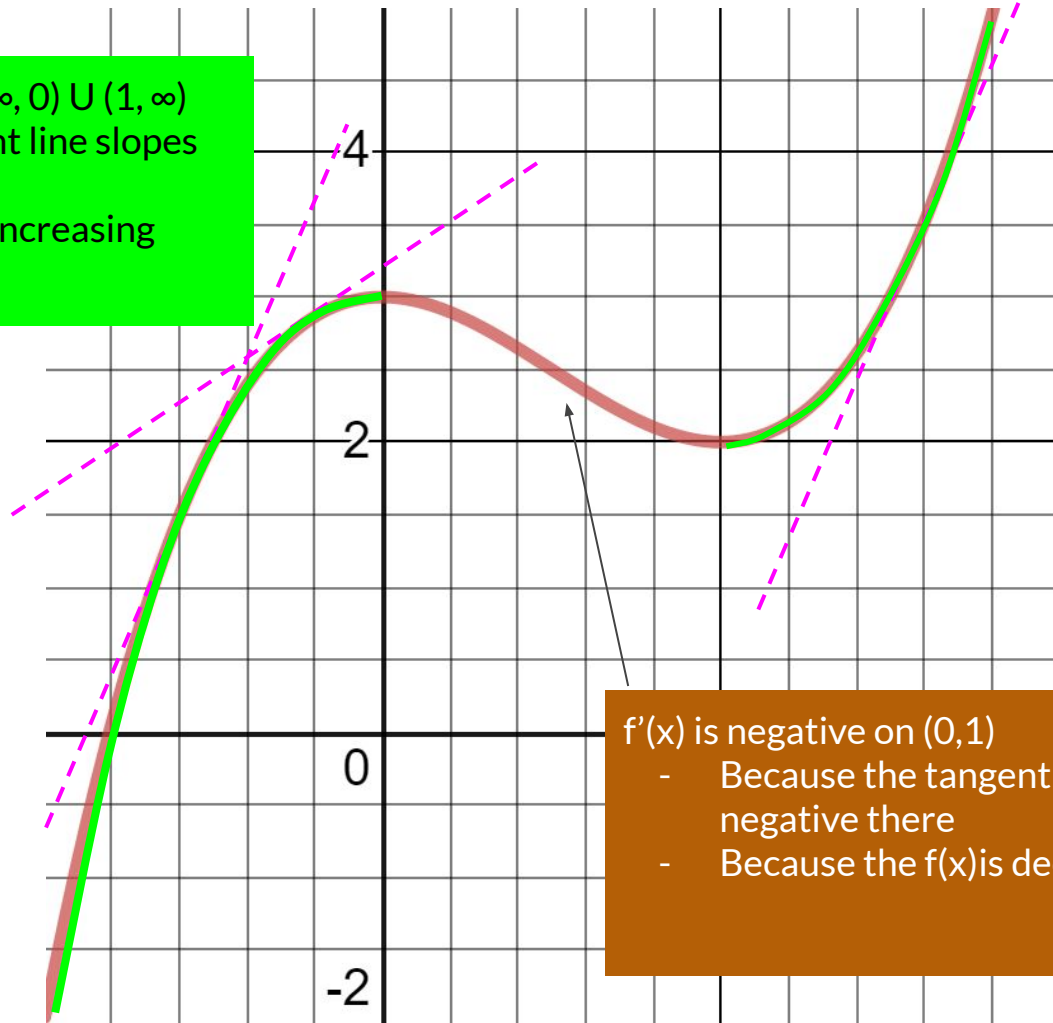
$(-\infty, 0) \cup (1, \infty)$

None of the above



$f'(x)$ is positive on $(-\infty, 0) \cup (1, \infty)$

- Because the tangent line slopes are all positive there
- Because the $f(x)$ is increasing there

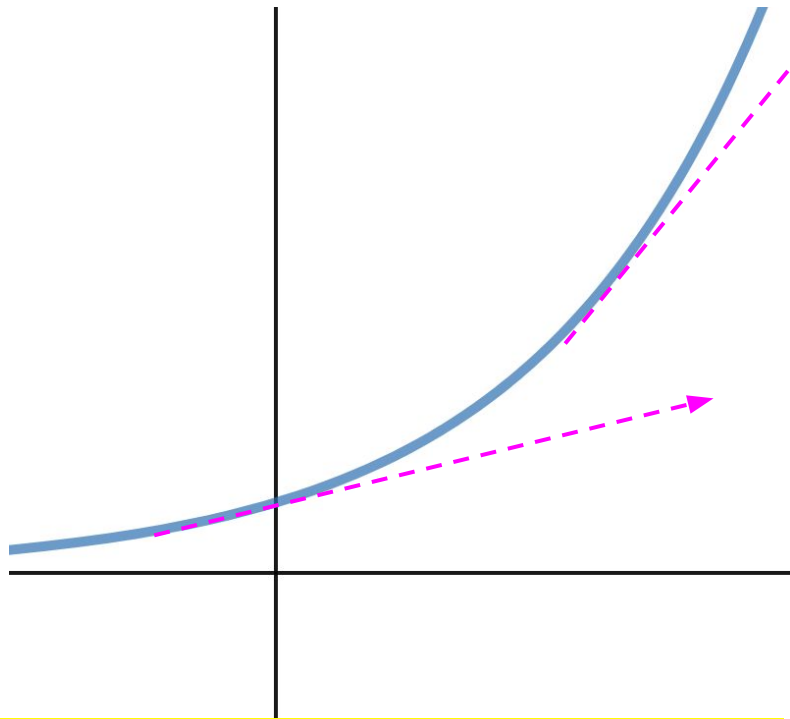


$f'(x)$ is negative on $(0, 1)$

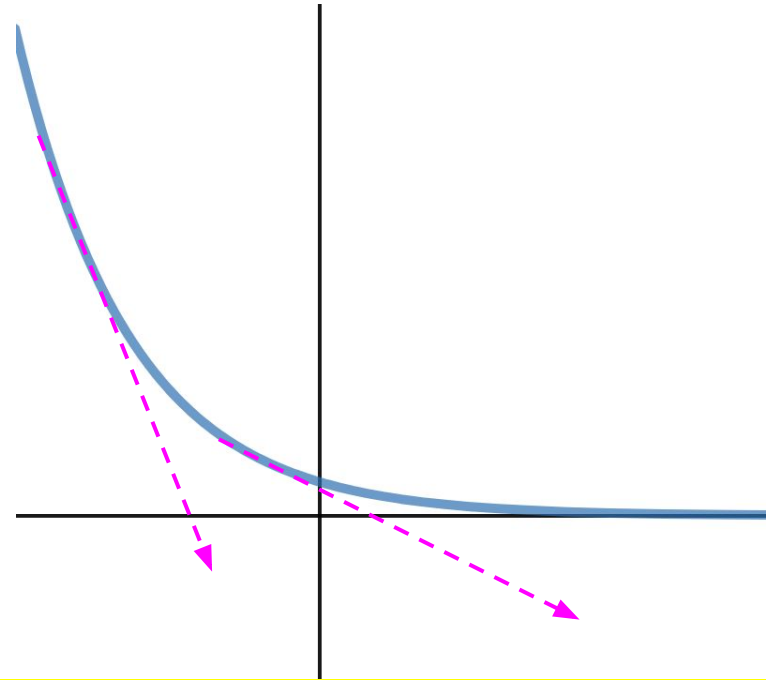
- Because the tangent line slopes are all negative there
- Because the $f(x)$ is decreasing there



What is concavity?

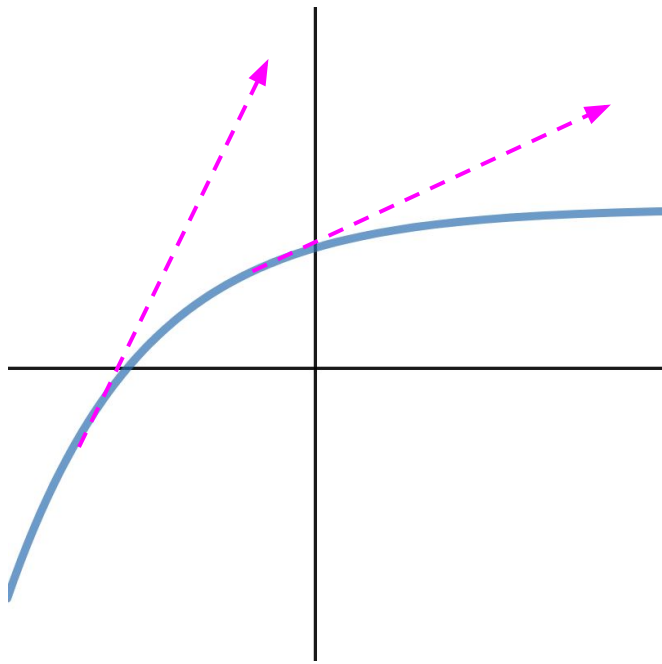


Increasing and concave up

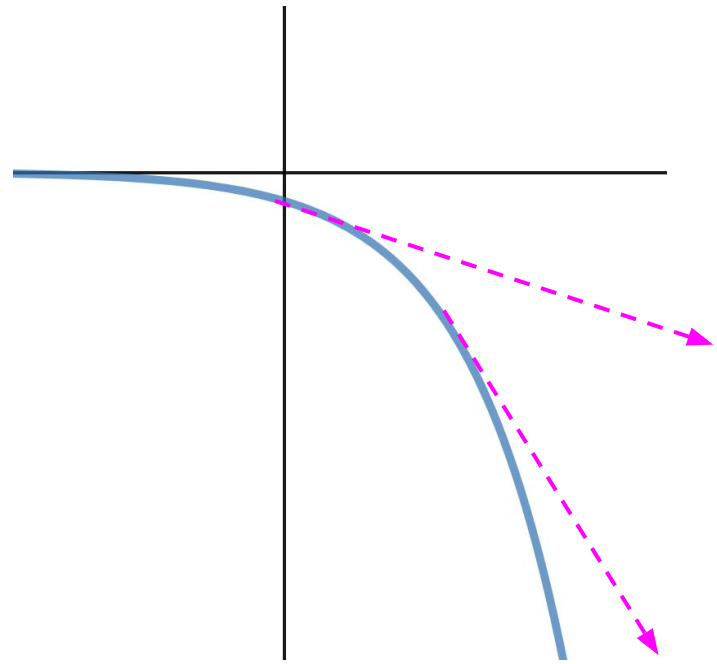


Decreasing and concave up

In both cases: Tangent line slopes are increasing



**Increasing and concave
down**



**Decreasing and concave
down**

In both cases: Tangent line slopes are decreasing

Concave Up, Decreasing



Concave Up, Increasing



Concave Down, Decreasing



Concave Down, Increasing



Concave Up, Decreasing



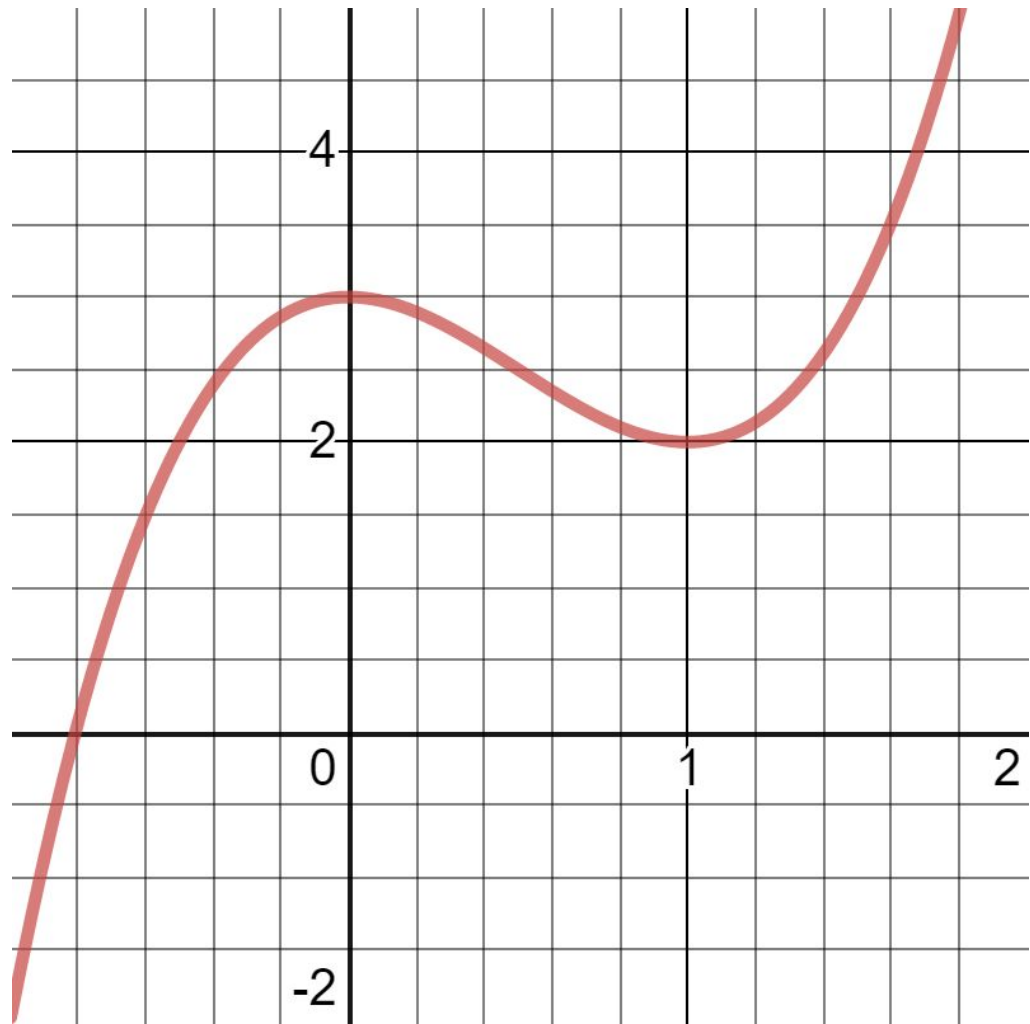
Concave Up, Increasing



Concave Down, Decreasing



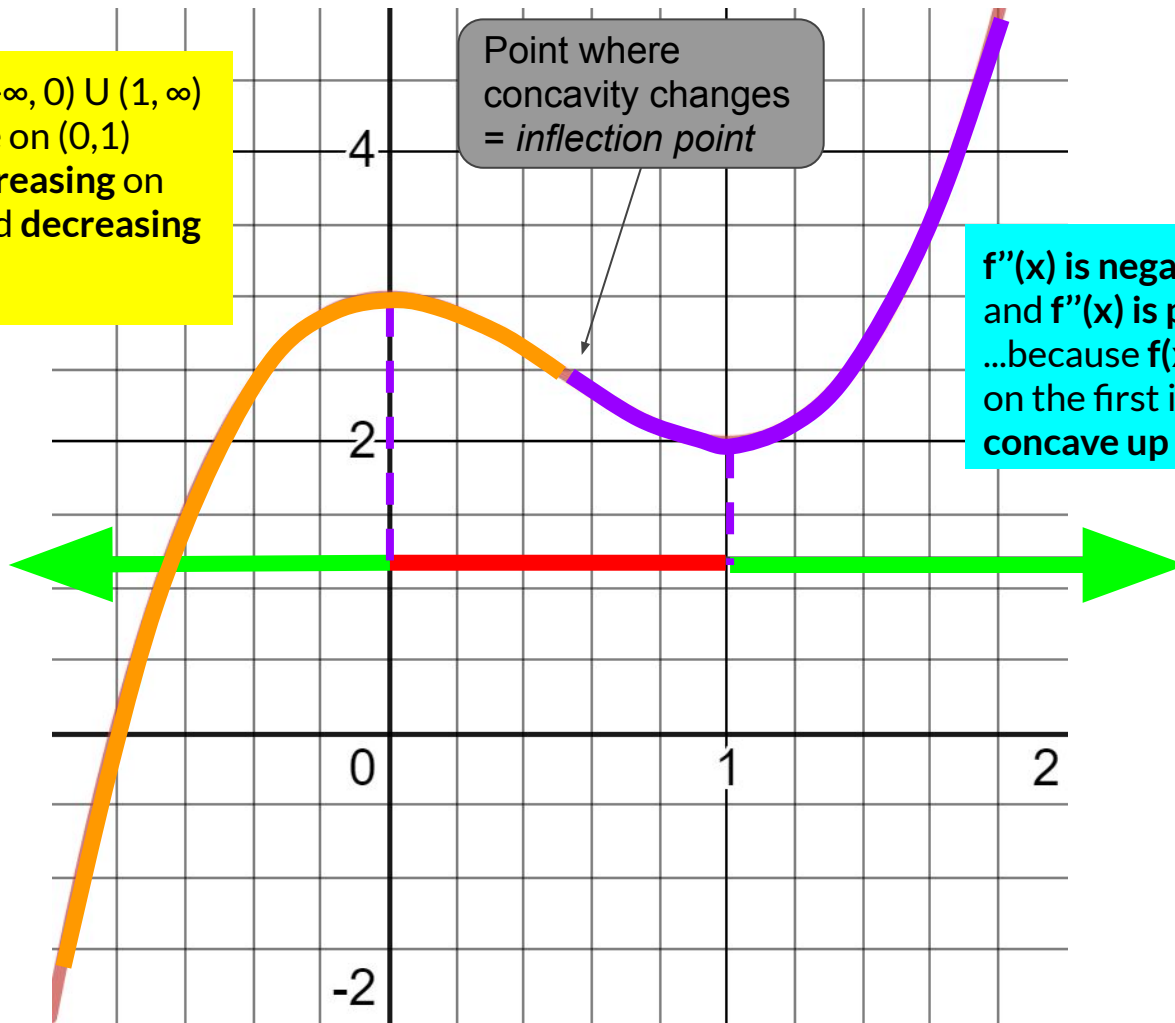
Concave Down, Increasing



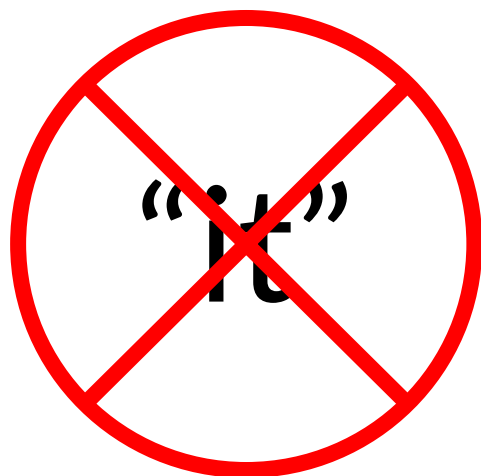
$f'(x)$ is **positive** on $(-\infty, 0) \cup (1, \infty)$
and $f'(x)$ is **negative** on $(0, 1)$
...because $f(x)$ is **increasing** on
the first interval and **decreasing**
on the second one

Point where
concavity changes
= *inflection point*

$f''(x)$ is **negative** on $(-\infty, 0.5)$
and $f''(x)$ is **positive** on $(0.5, \infty)$
...because $f(x)$ is **concave down**
on the first interval and
concave up on the second one.



Activity: Sorting out f , f' , and f''
→ Desmos



"The function
is increasing
because it's
positive"...

"It's negative,
so it's concave down"



"The function
is increasing because
its derivative is positive"...

"The second derivative
 $f''(x)$ is negative,
so $f(x)$ is concave down"

Feedback:

<http://gvsu.edu/s/1zJ>