Today...

- Demo WeBWorK tricks
- A Hill function clicker question.
- From secant line to tangent line.
- The Definition of the Derivative.

OSH

OSH

- uM and um

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Metric prefixes in everyday use		
Text	**Symbol**	**Factor**
tera	T	1 000 000 000 000
giga	G	1 000 000 000
mega	M	1 000 000
kilo	k	1 000
hecto	h	100
deca	da	10
(none)	(none)	1
deci	d	0.1
centi	c	0.01
milli	m	0.001
micro	µ	0.000 001
nano	n	0.000 000 001
pico	p	0.000 000 000 001
V • T • E		

OSH

- uM and um
- How much to write for “Describe in words”.

OSH

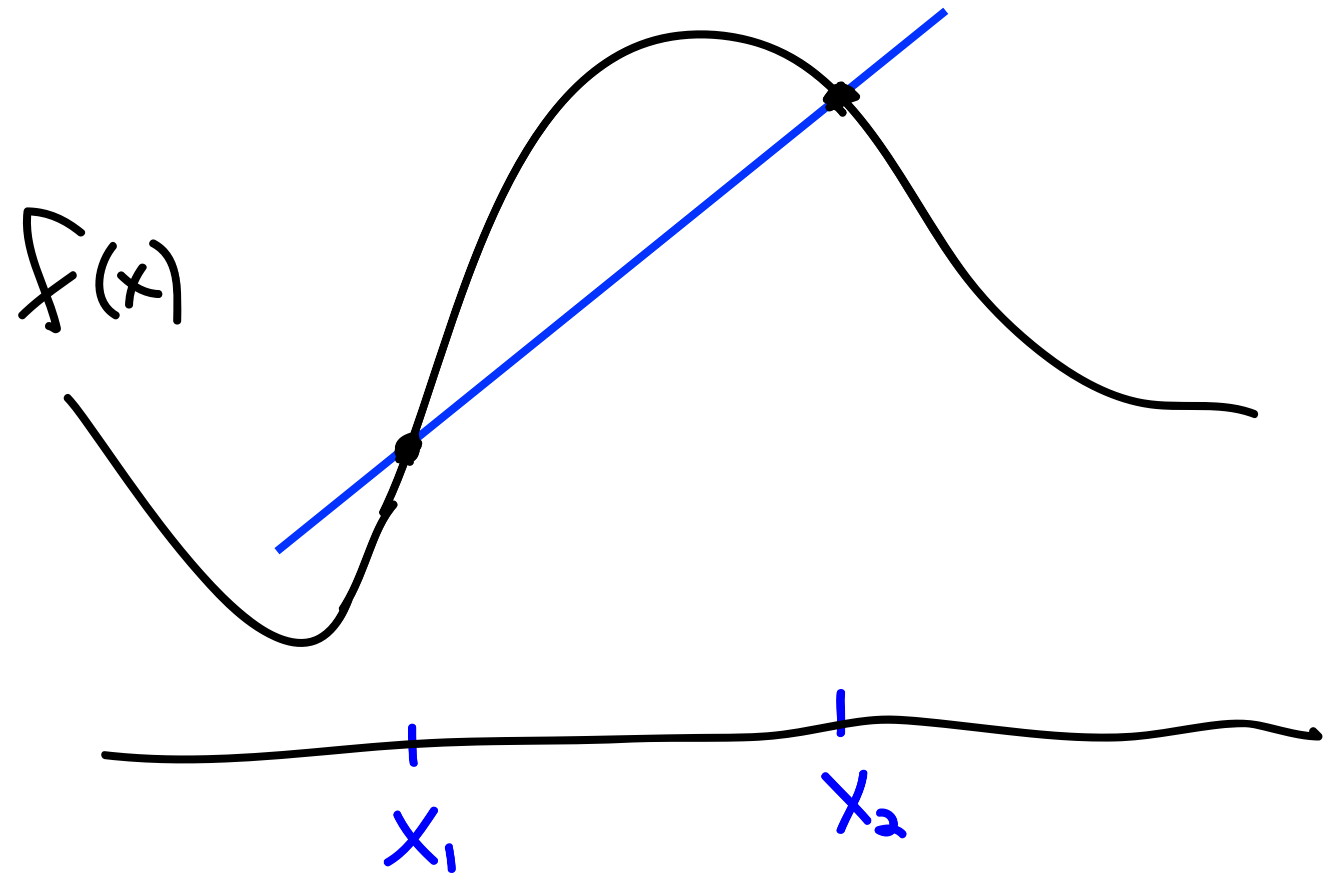
- uM and um
- How much to write for “Describe in words”.
    - I read through the example solutions carefully:

      (A) Yes

      (B) No

What if you want the rate of change AT x_1?

(instantaneous instead of average)



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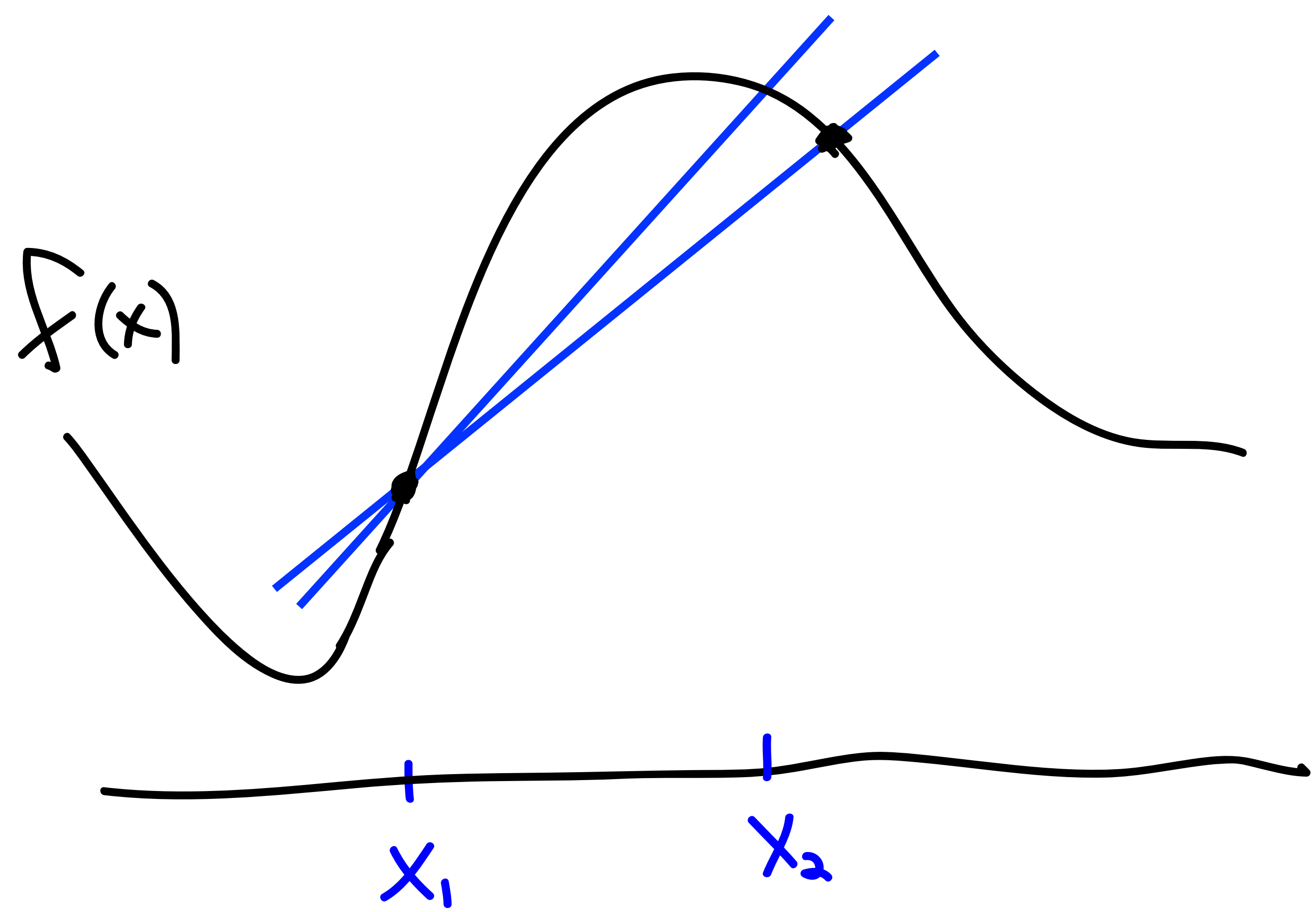

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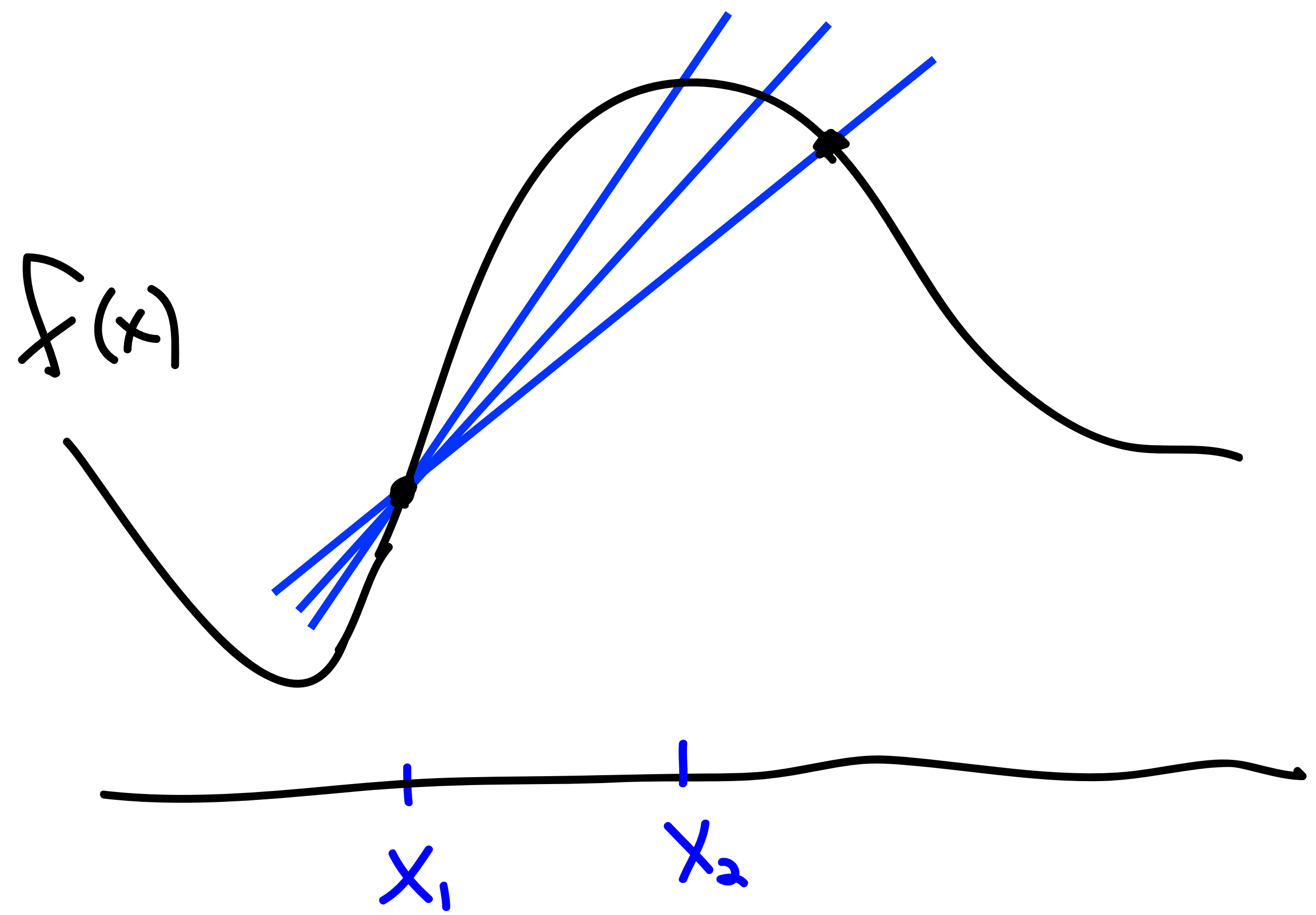

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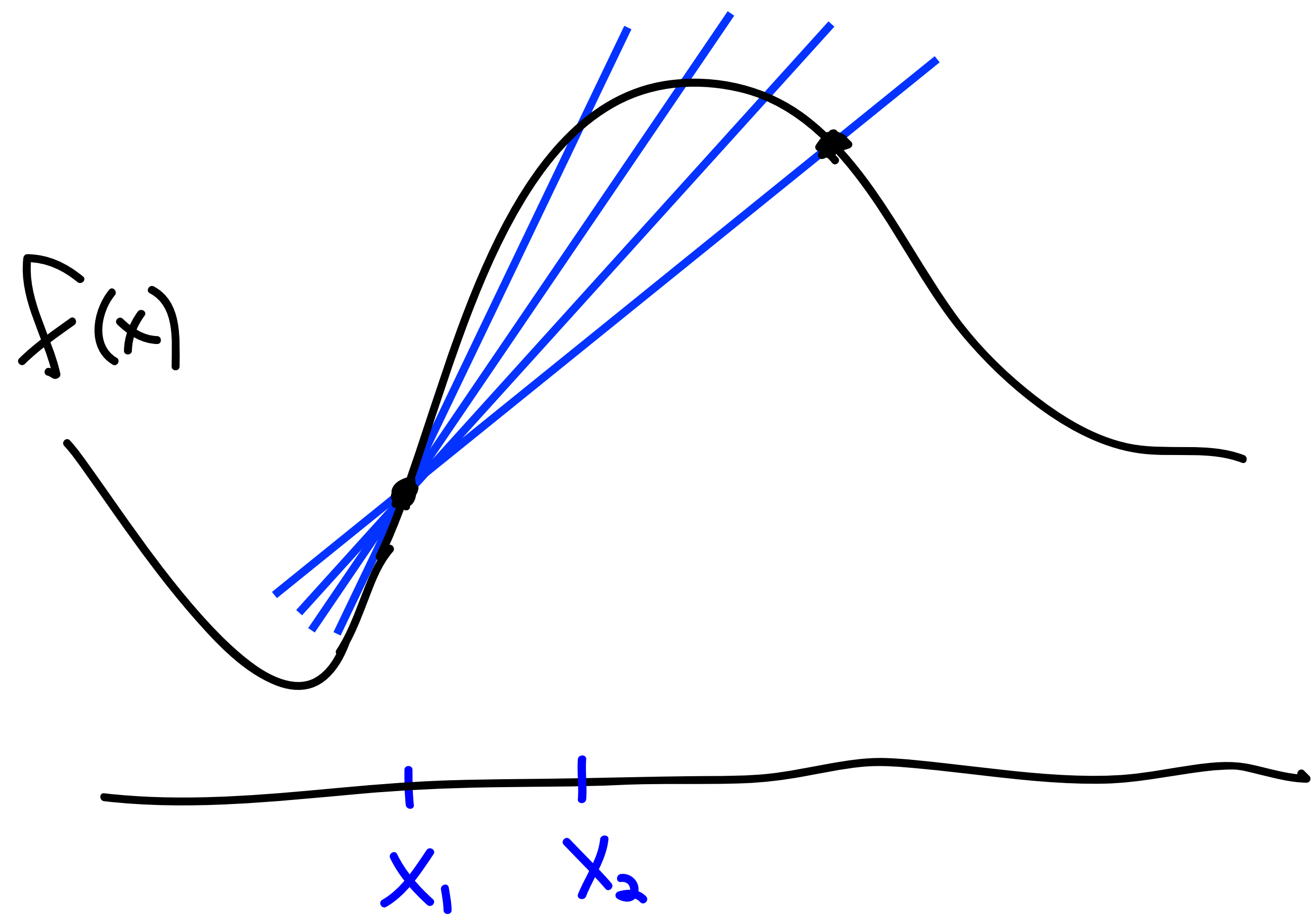

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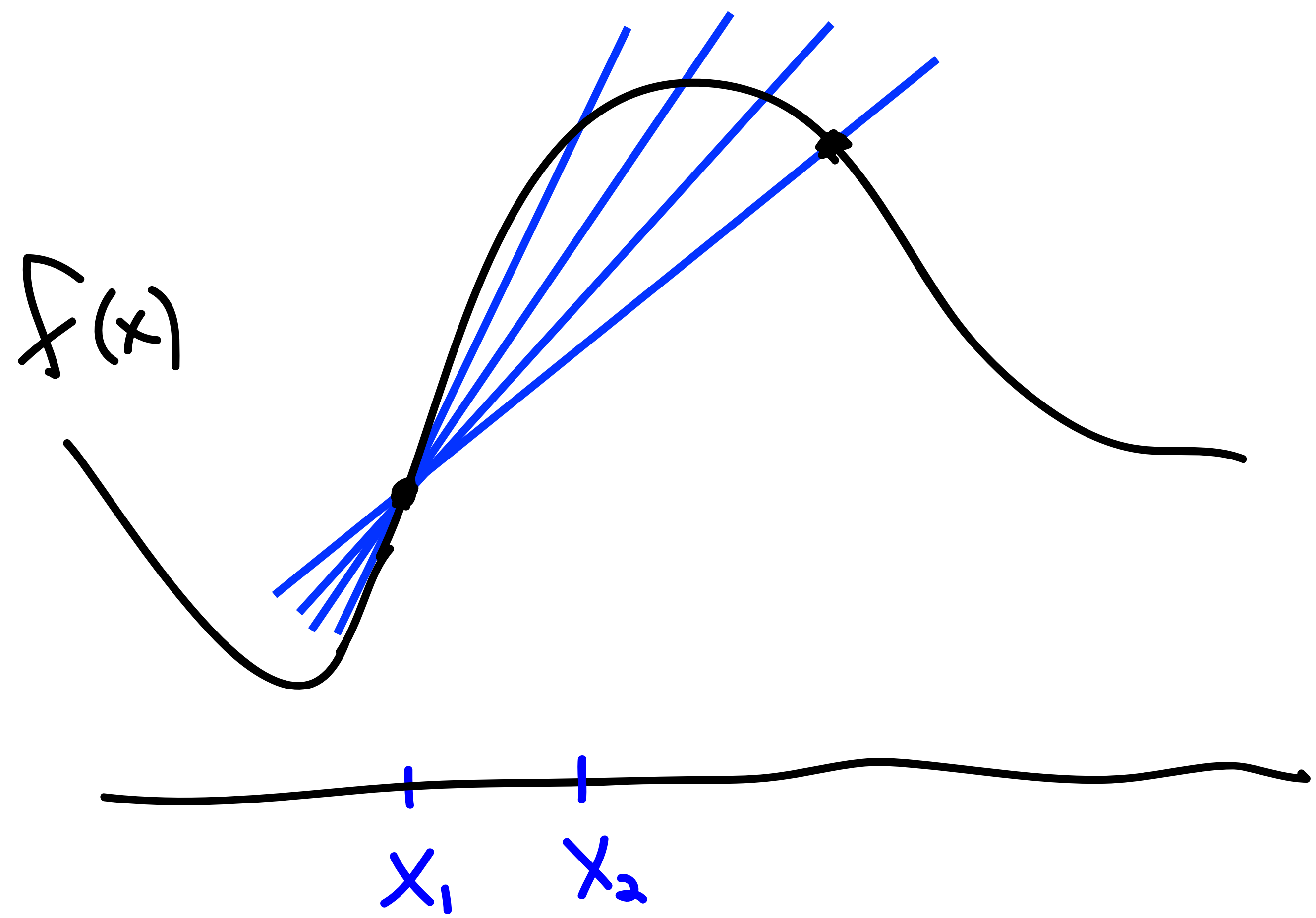

Alternate notation: let $x_2 = x_1+h$ so that

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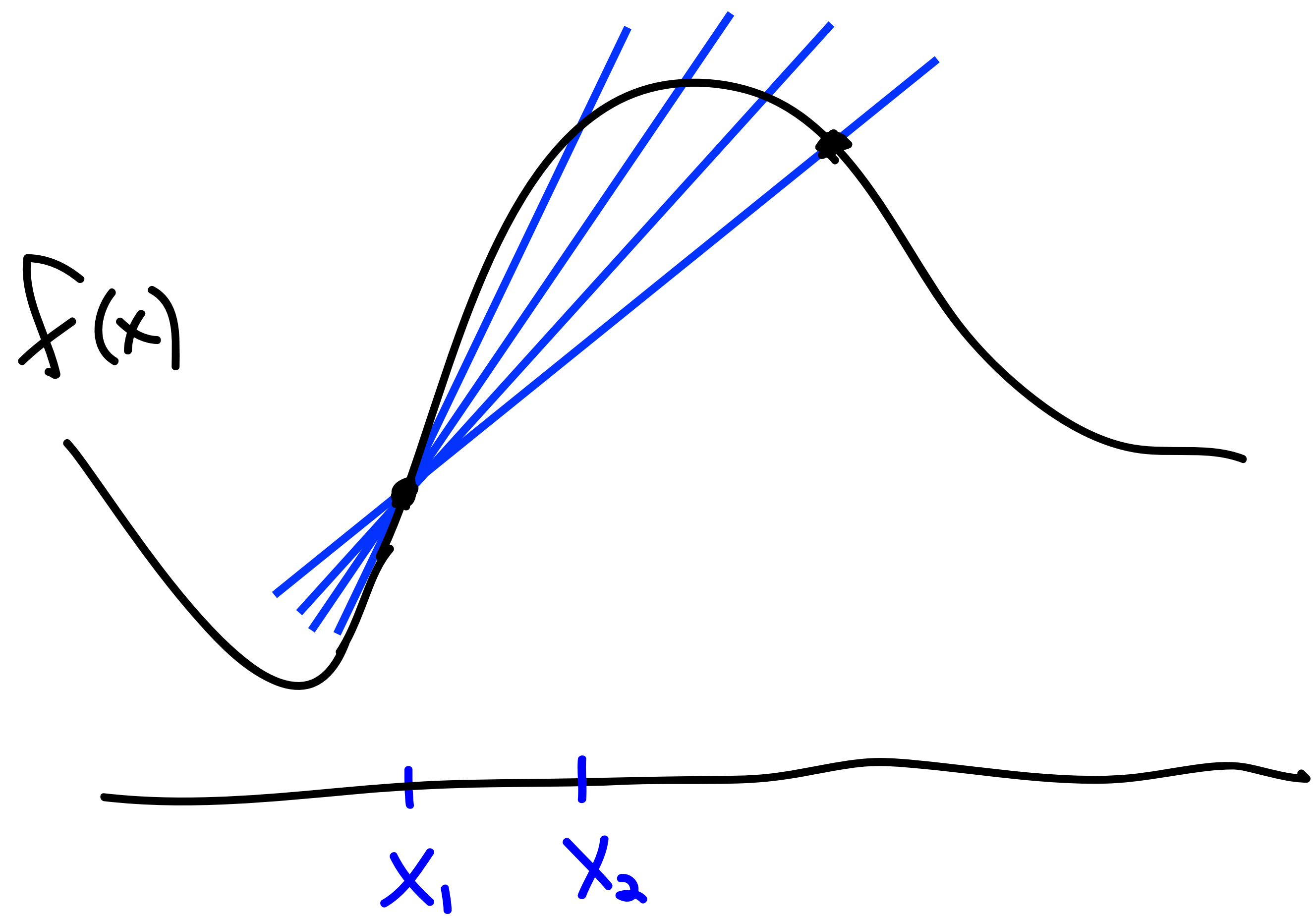

Alternate notation: let $x_2 = x_1 + h$ so that

$$m = \frac{f(x_2) - f(x_1)}{x_2 - x_1} = \frac{f(x_1 + h) - f(x_1)}{x_1 + h - x_1}$$

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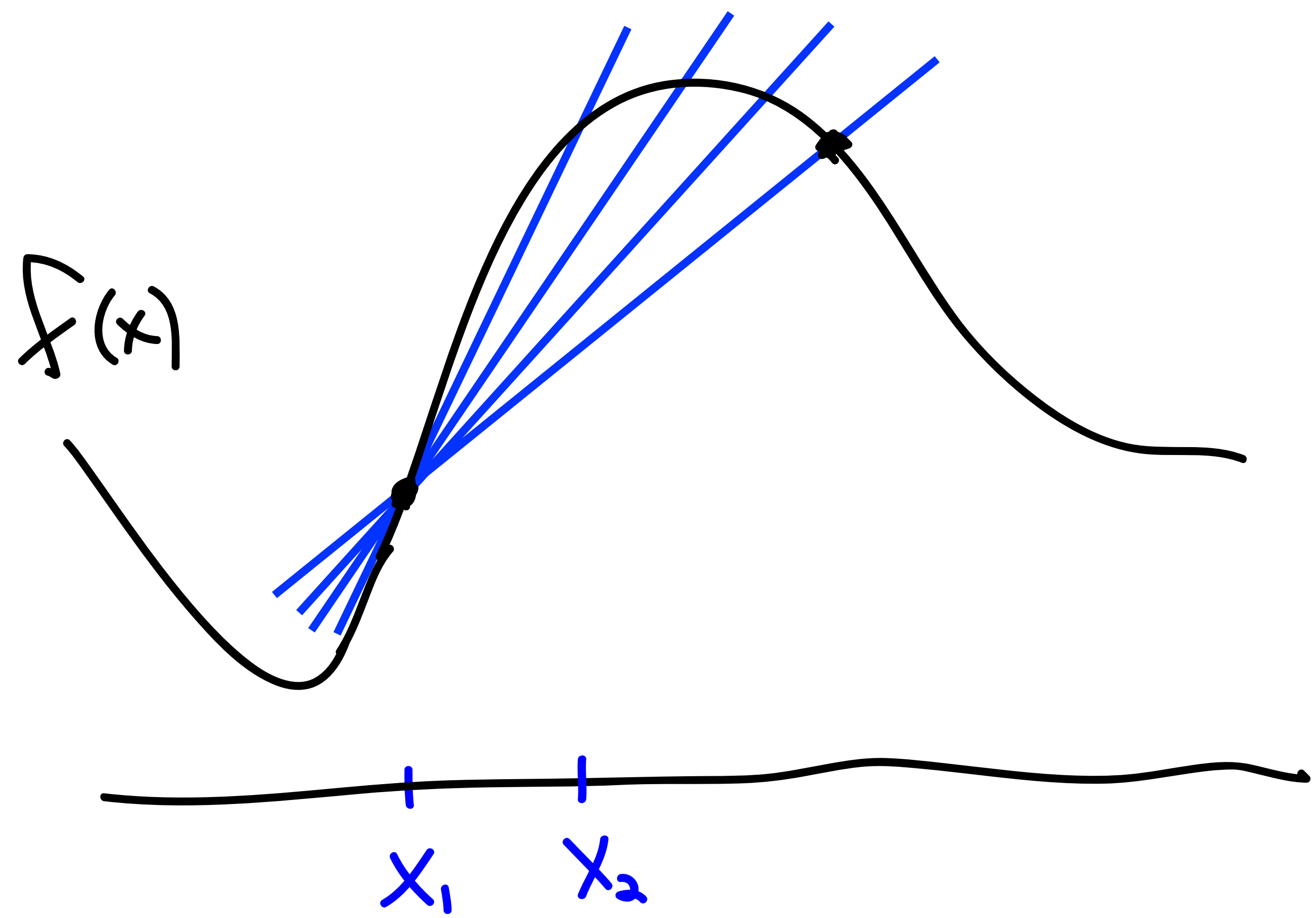

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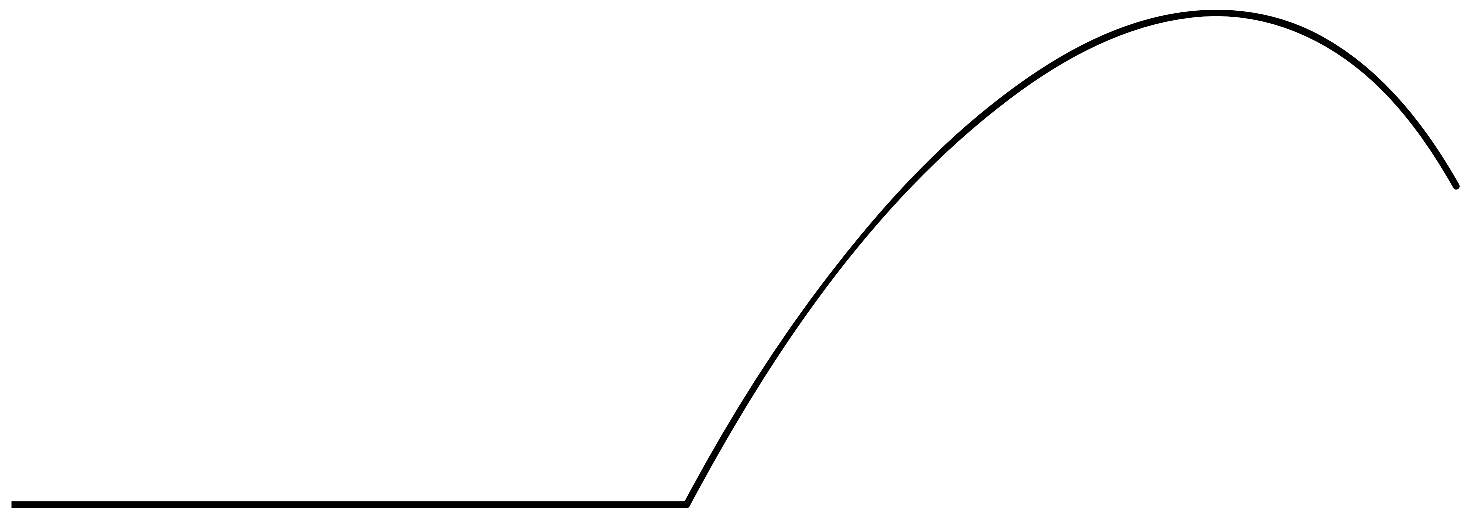
$$\text{slope at } x_1 = f'(x_1) = \lim_{h \to 0} \frac{f(x_1 + h) - f(x_1)}{h}$$

Another example



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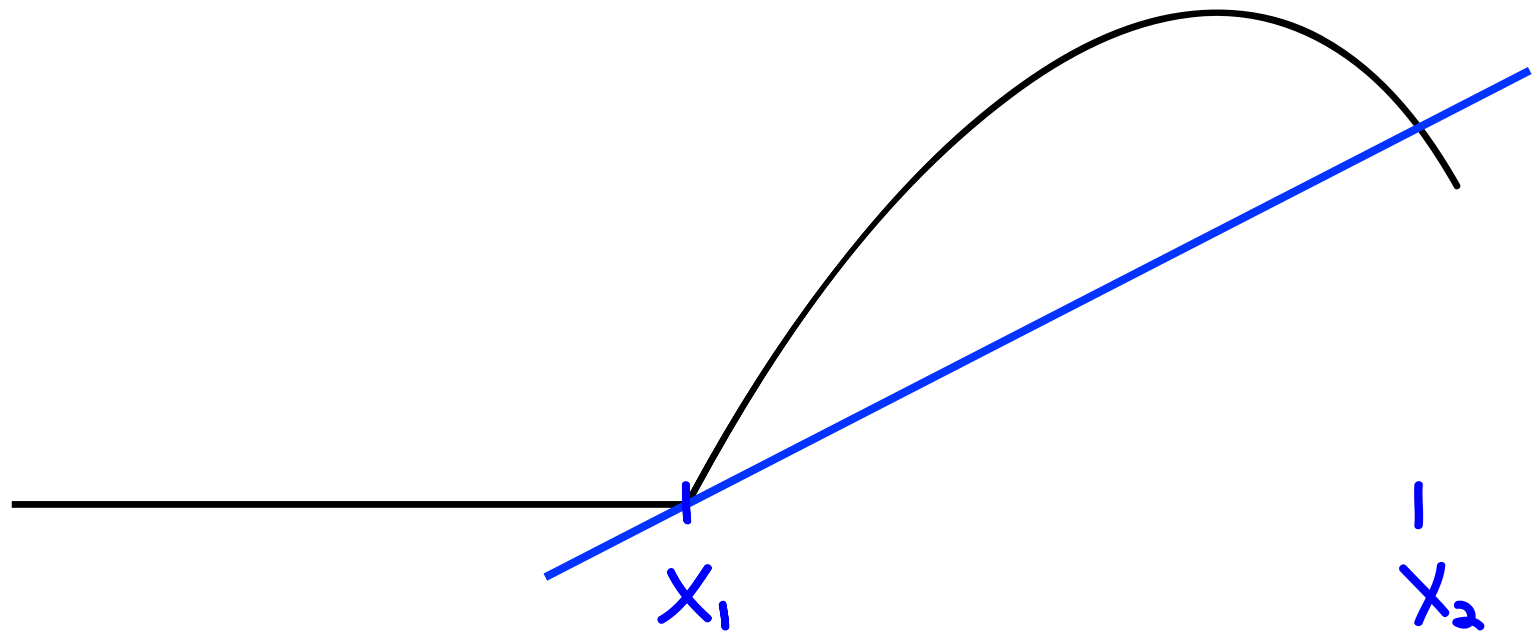

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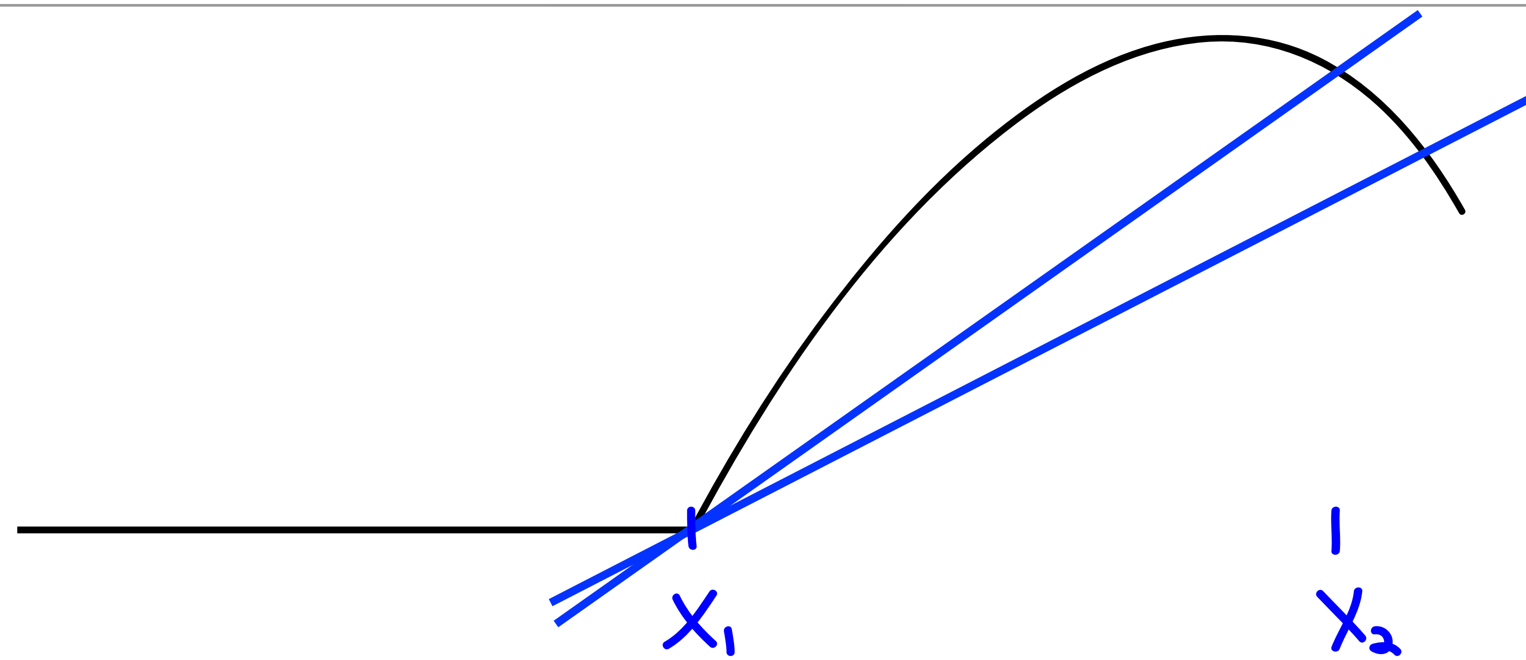

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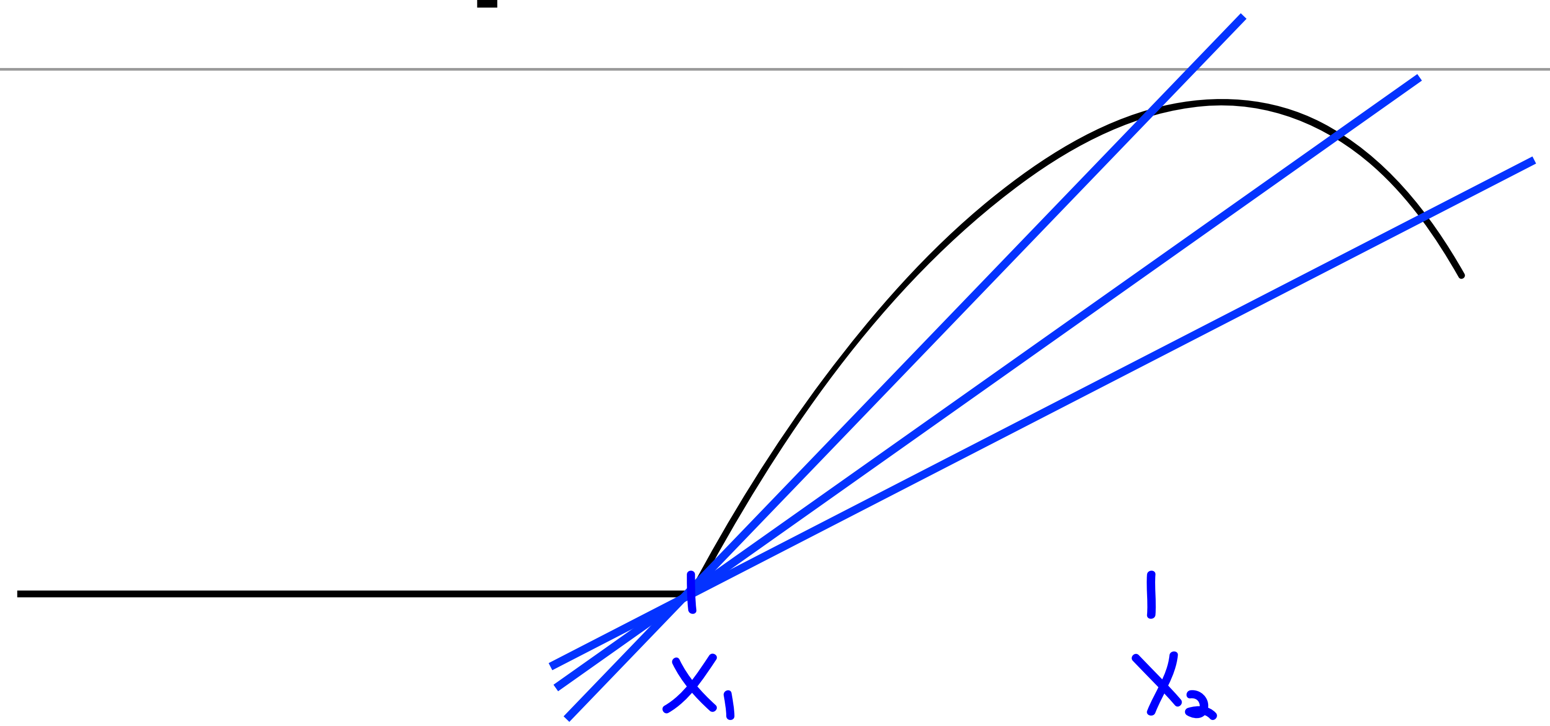

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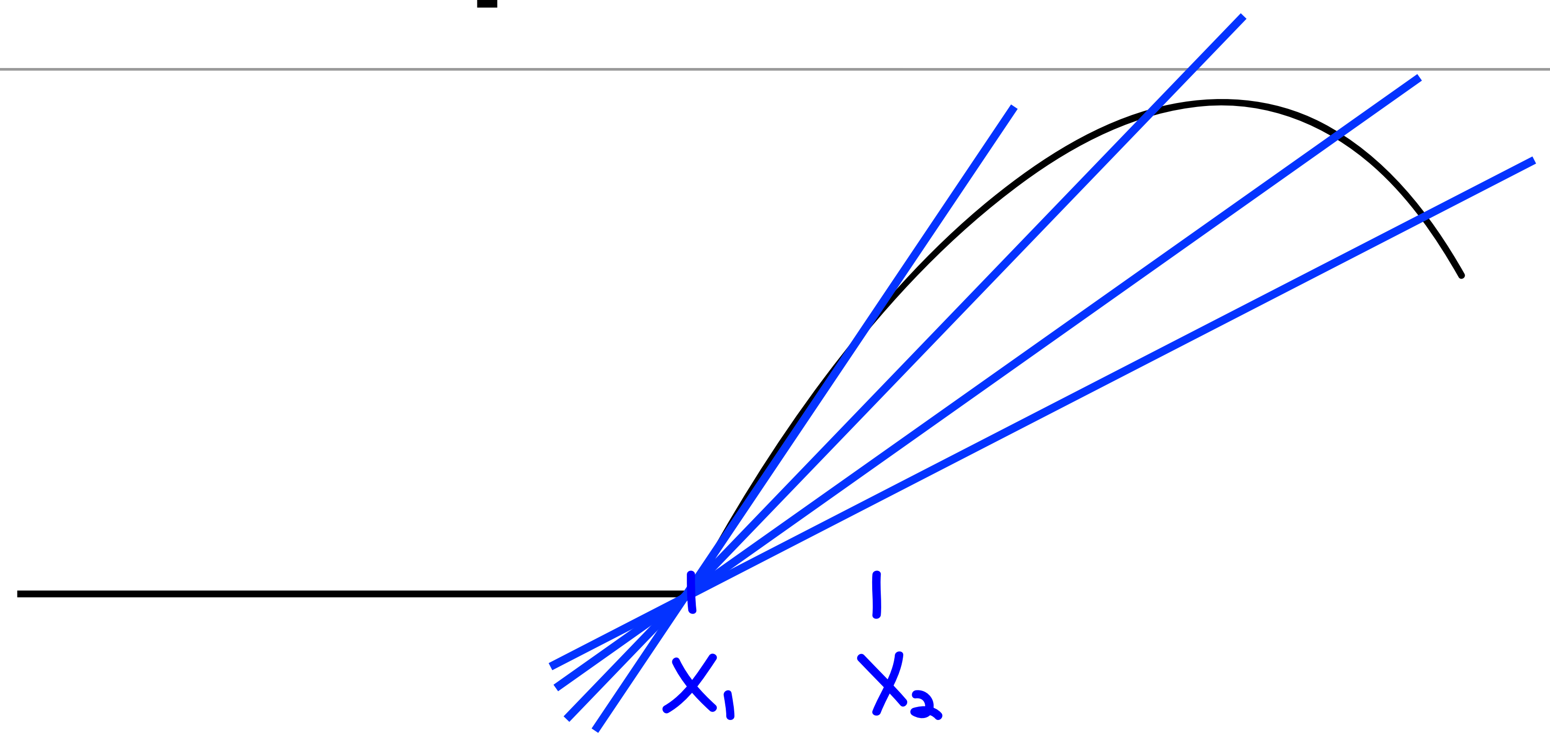

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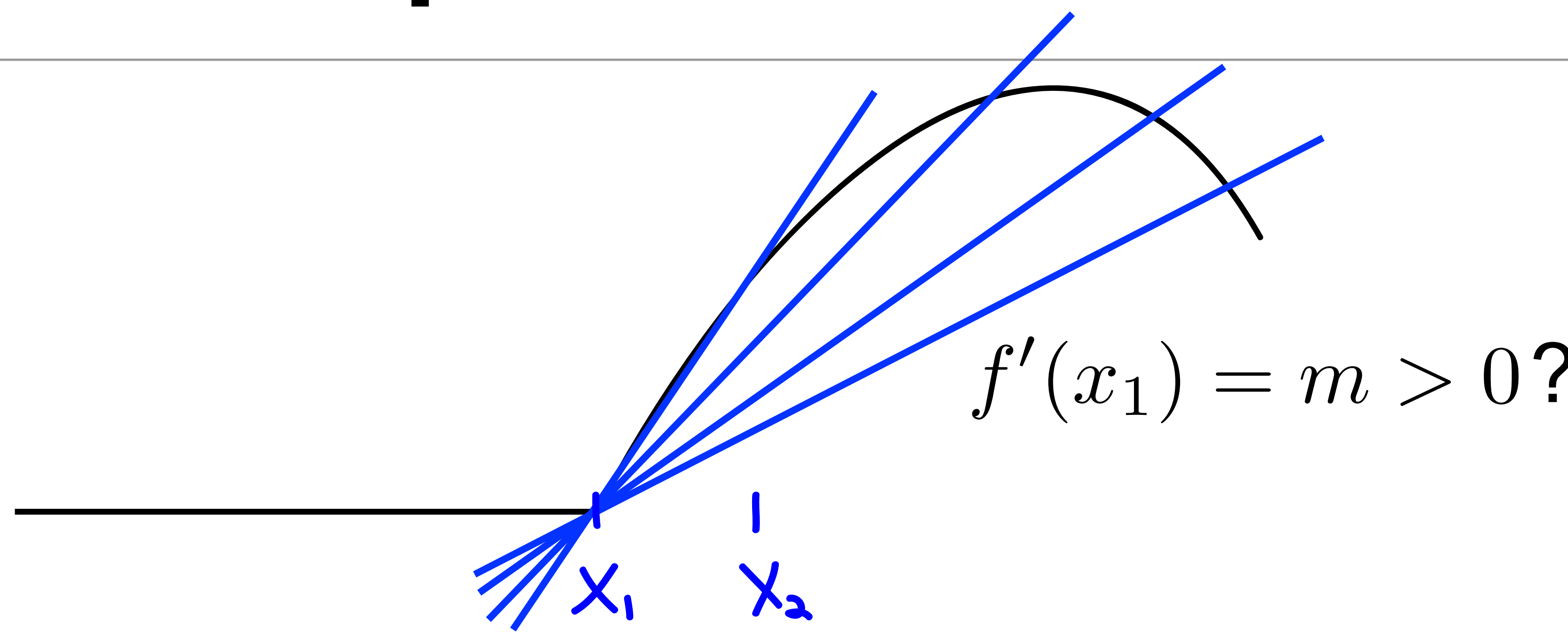

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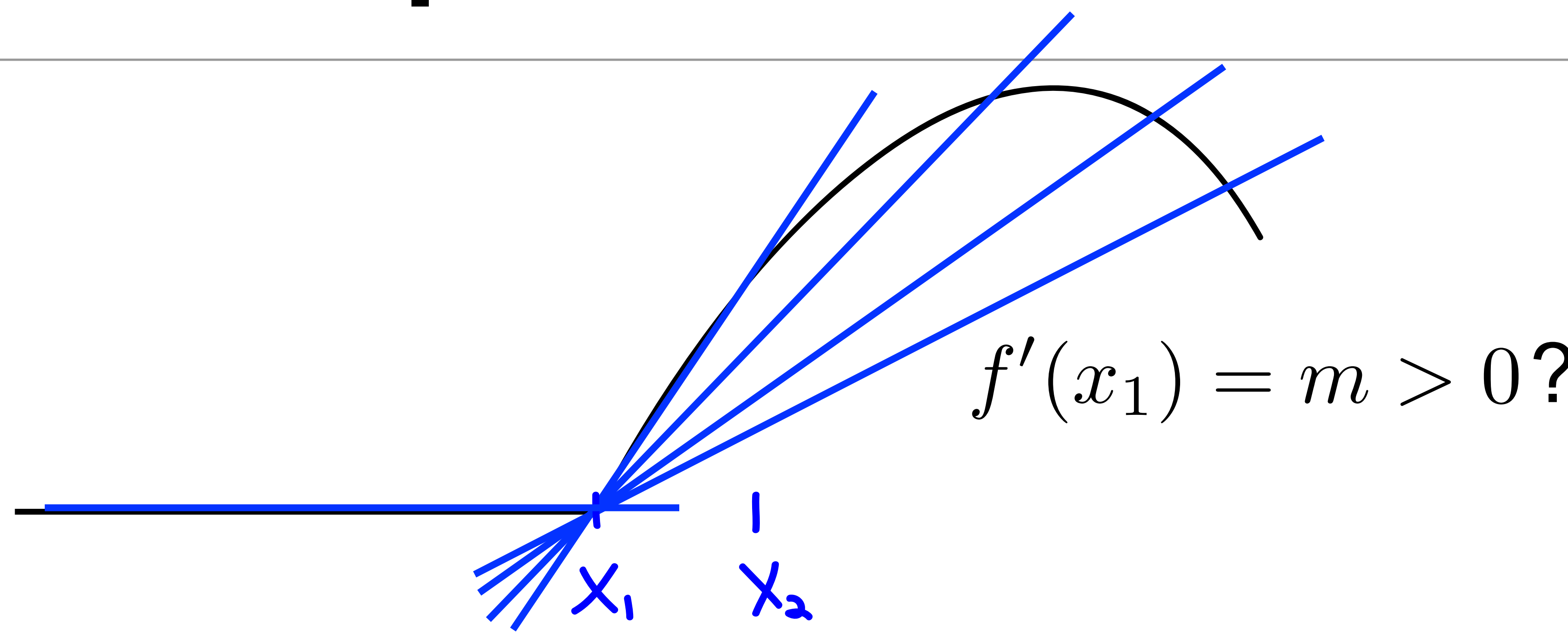

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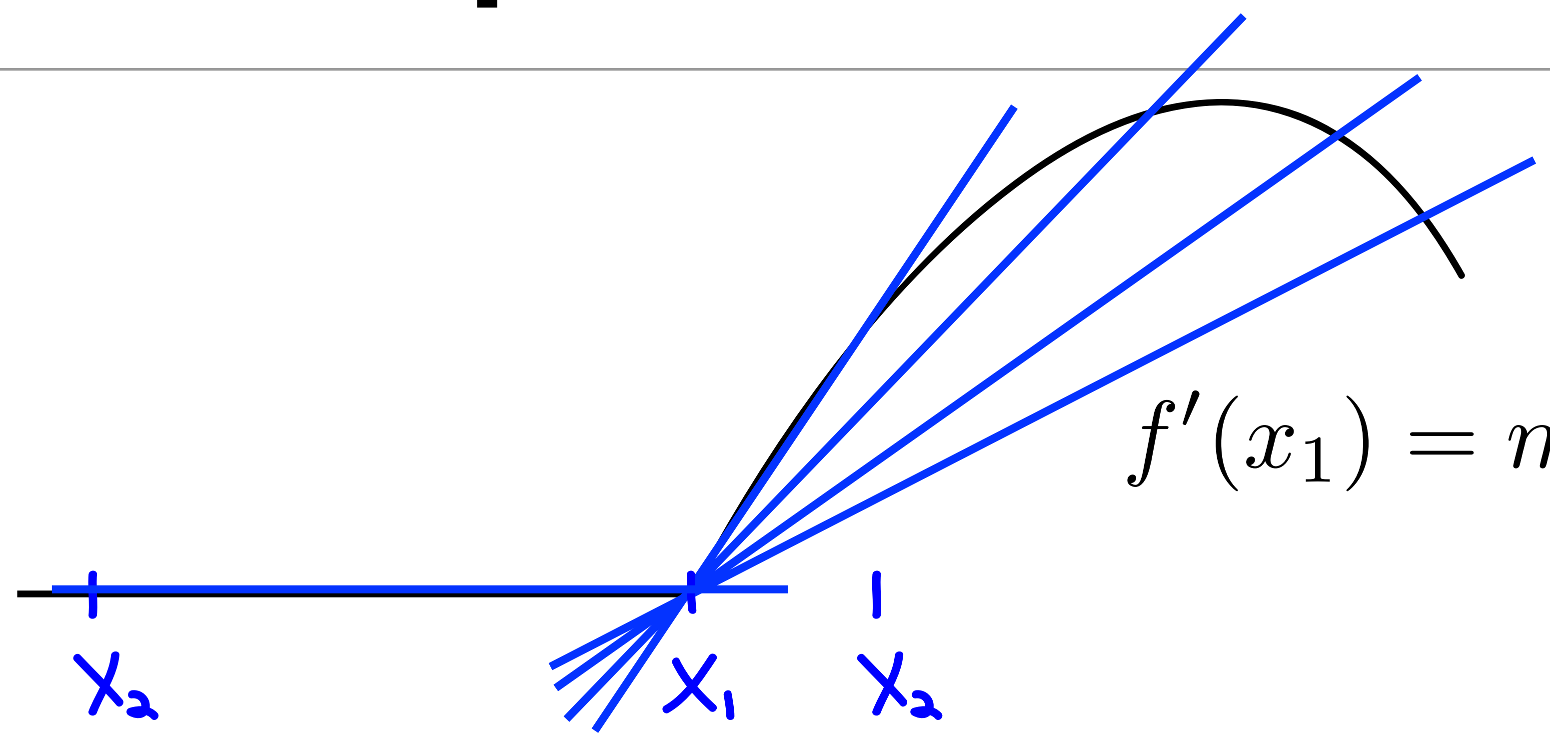

$f'(x_1) = m > 0$?

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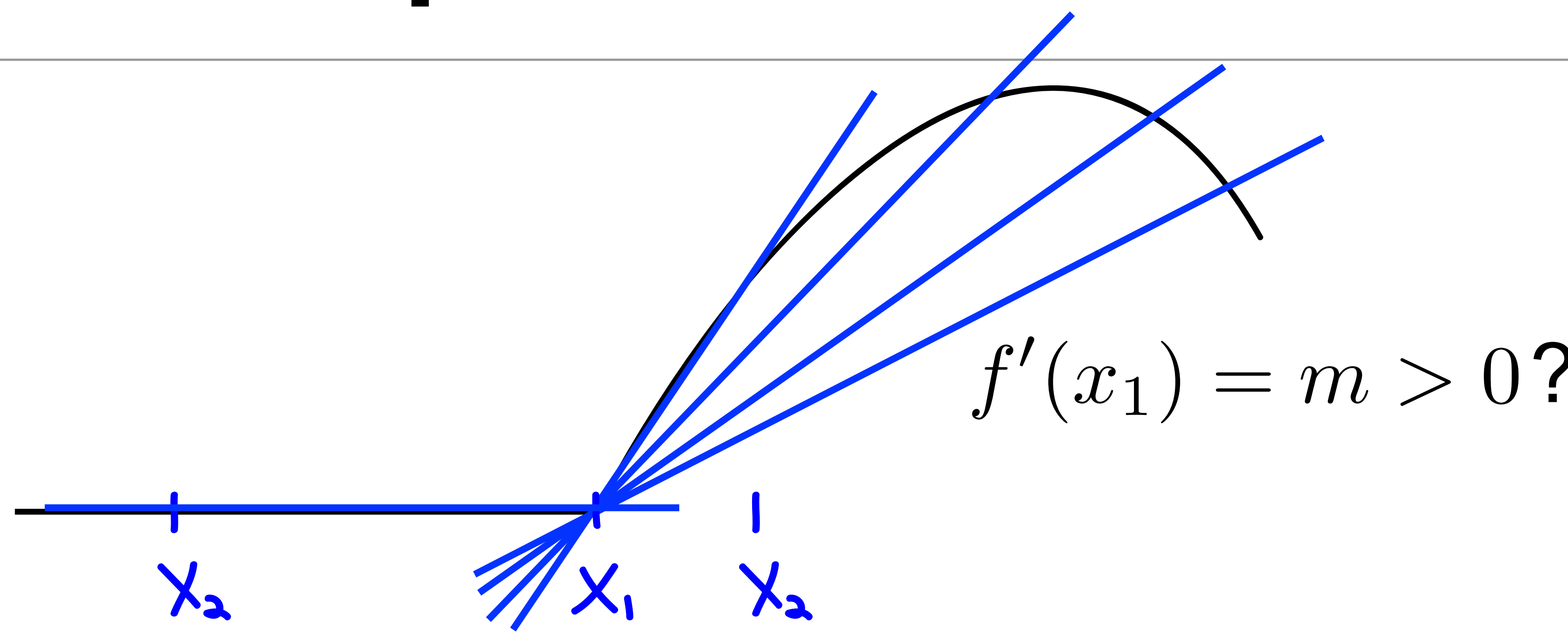

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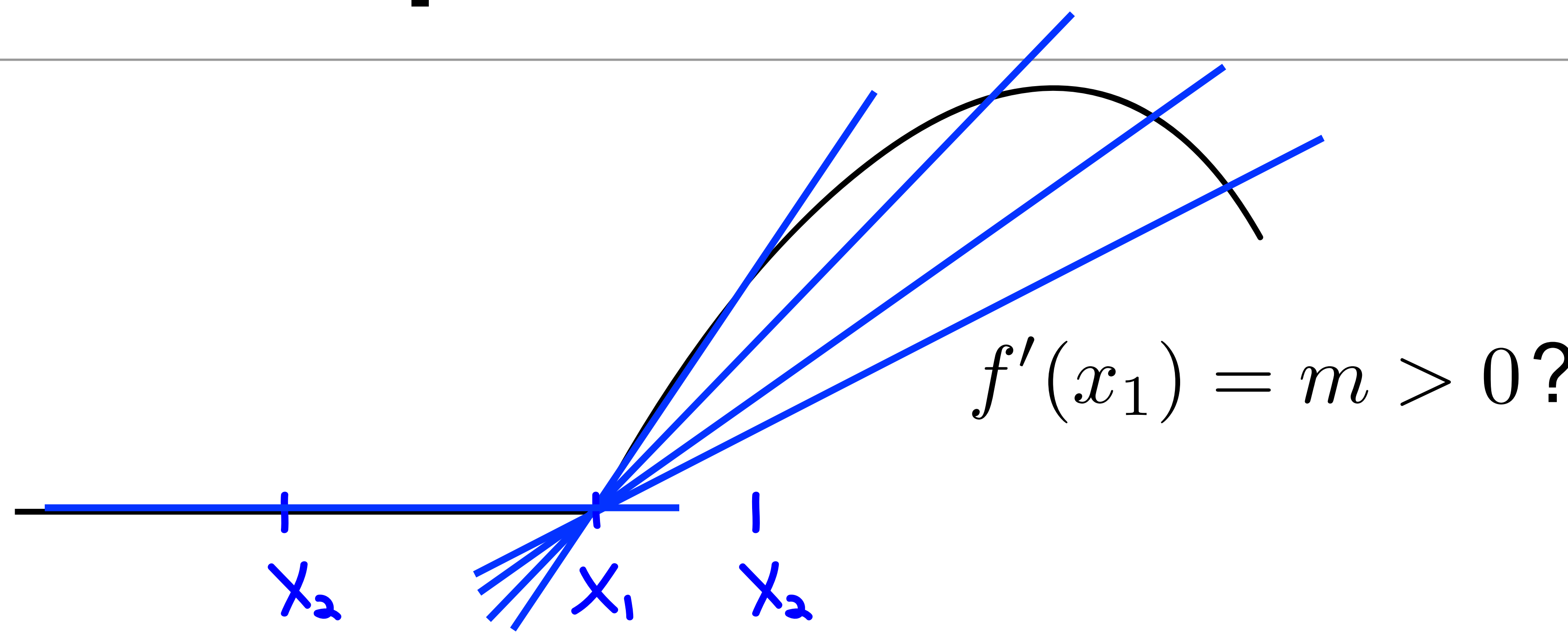

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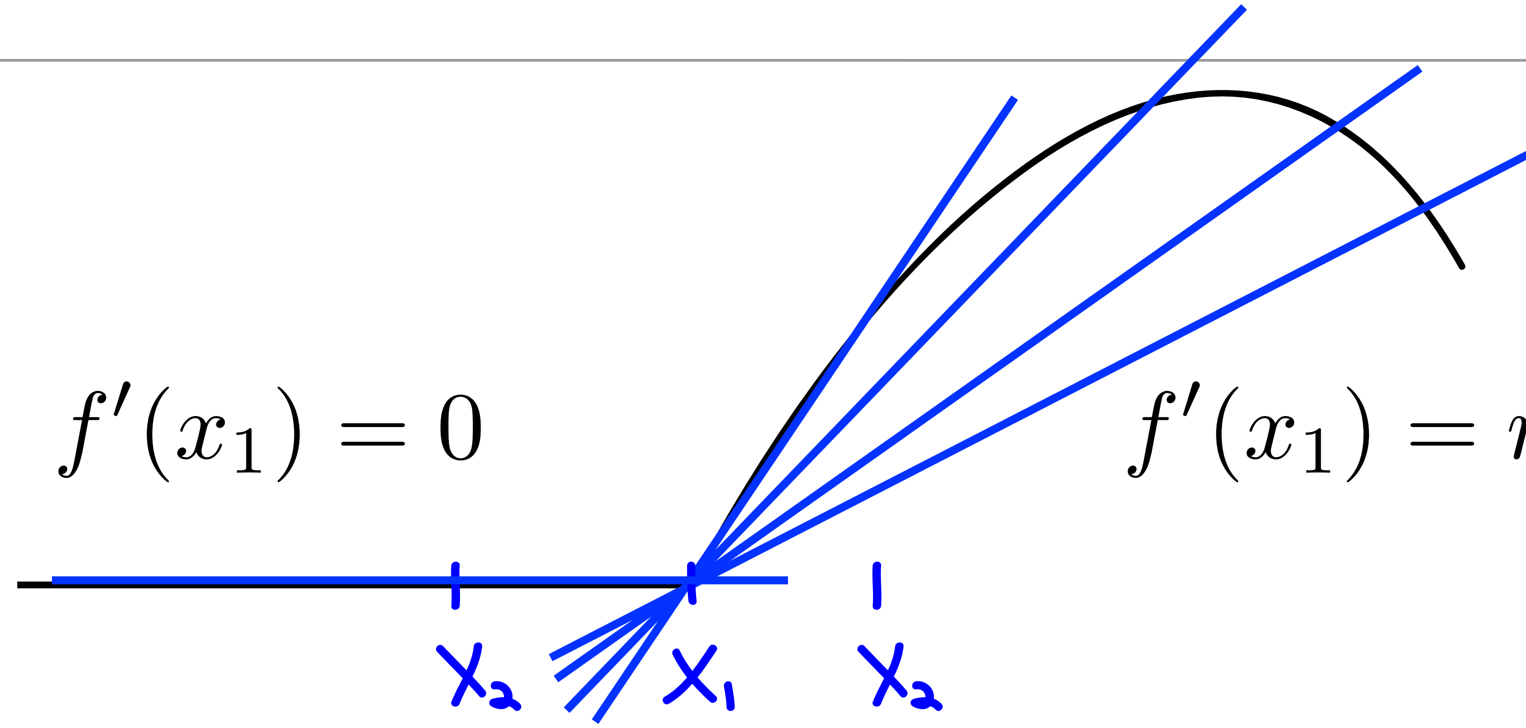

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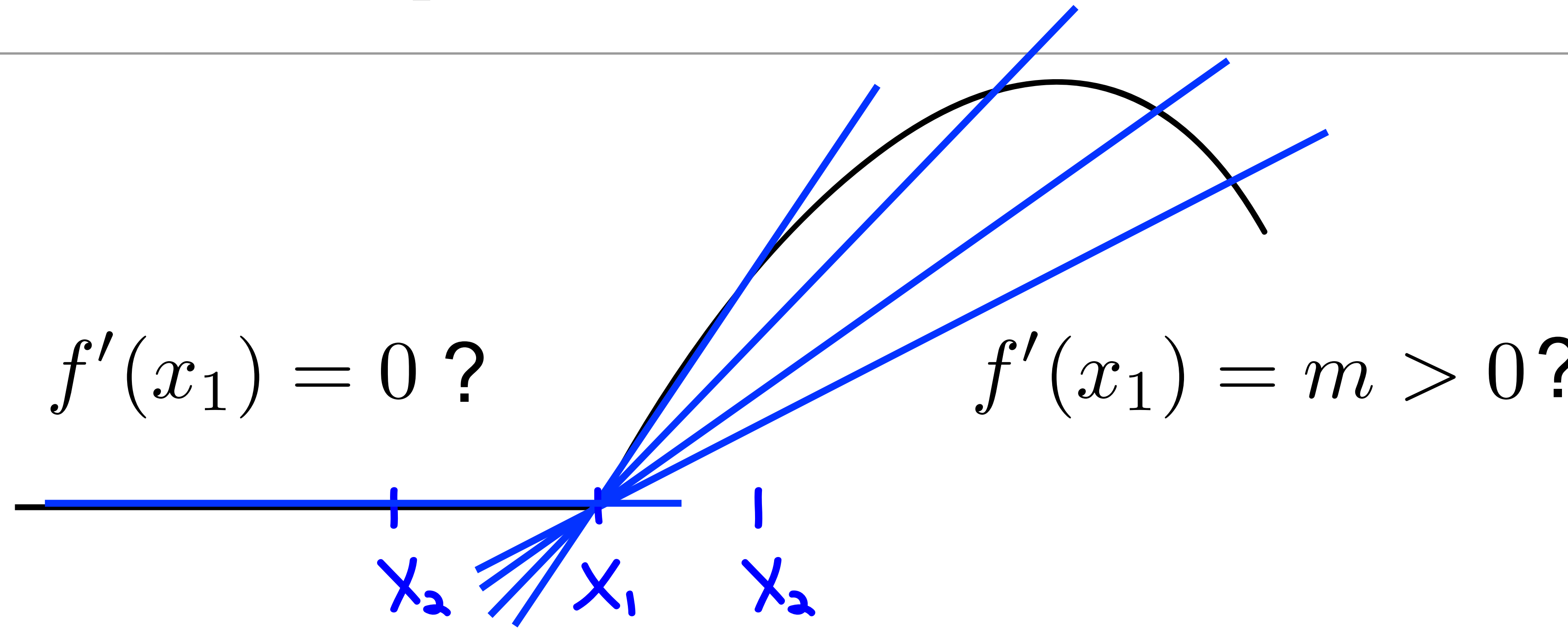

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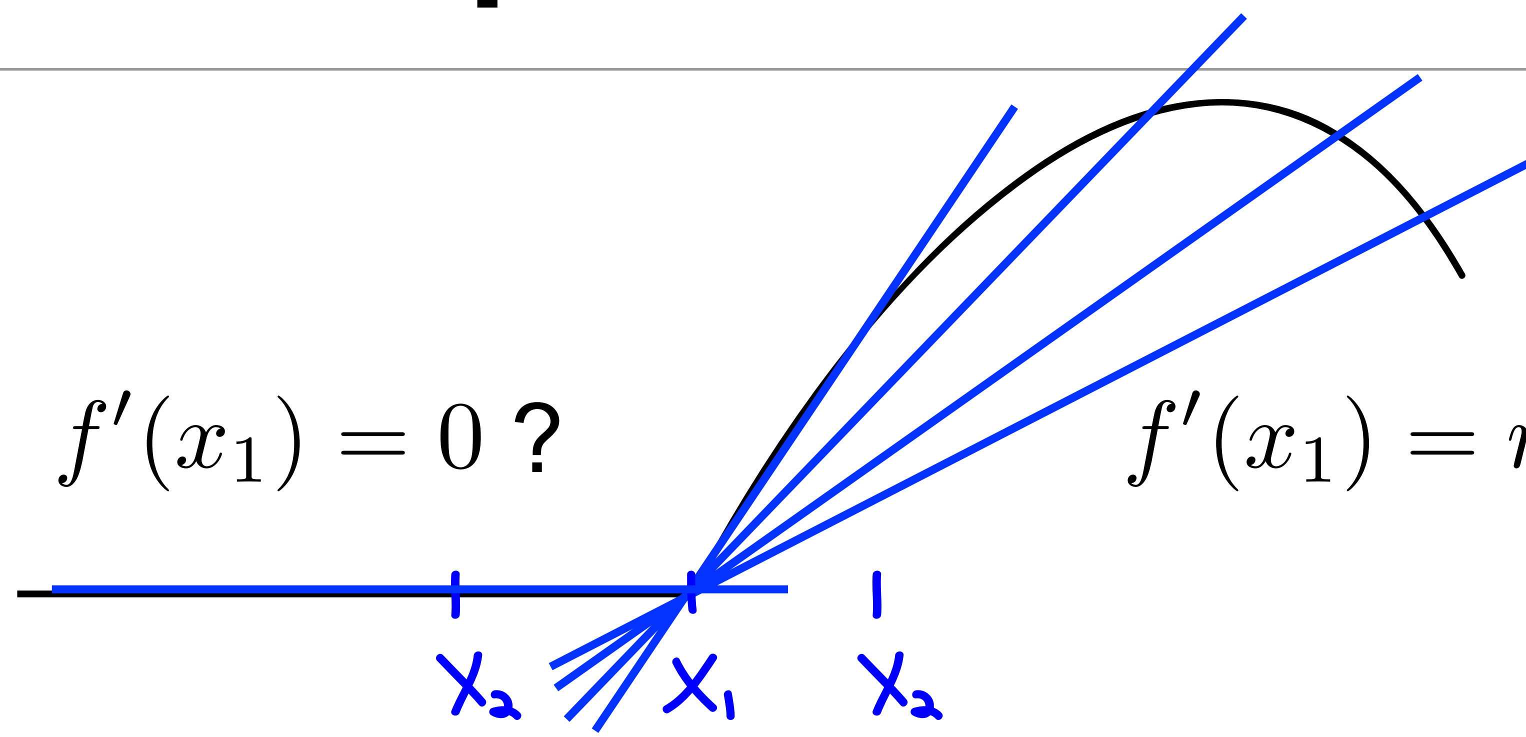

(A) $\displaystyle\lim_{h\to 0} \frac{f(x_1+h)-f(x_1)}{h} = m > 0$

(B) $\displaystyle\lim_{h\to 0} \frac{f(x_1+h)-f(x_1)}{h} = 0$

(C) Both (A) and (B)

(D) The limit does not exist.

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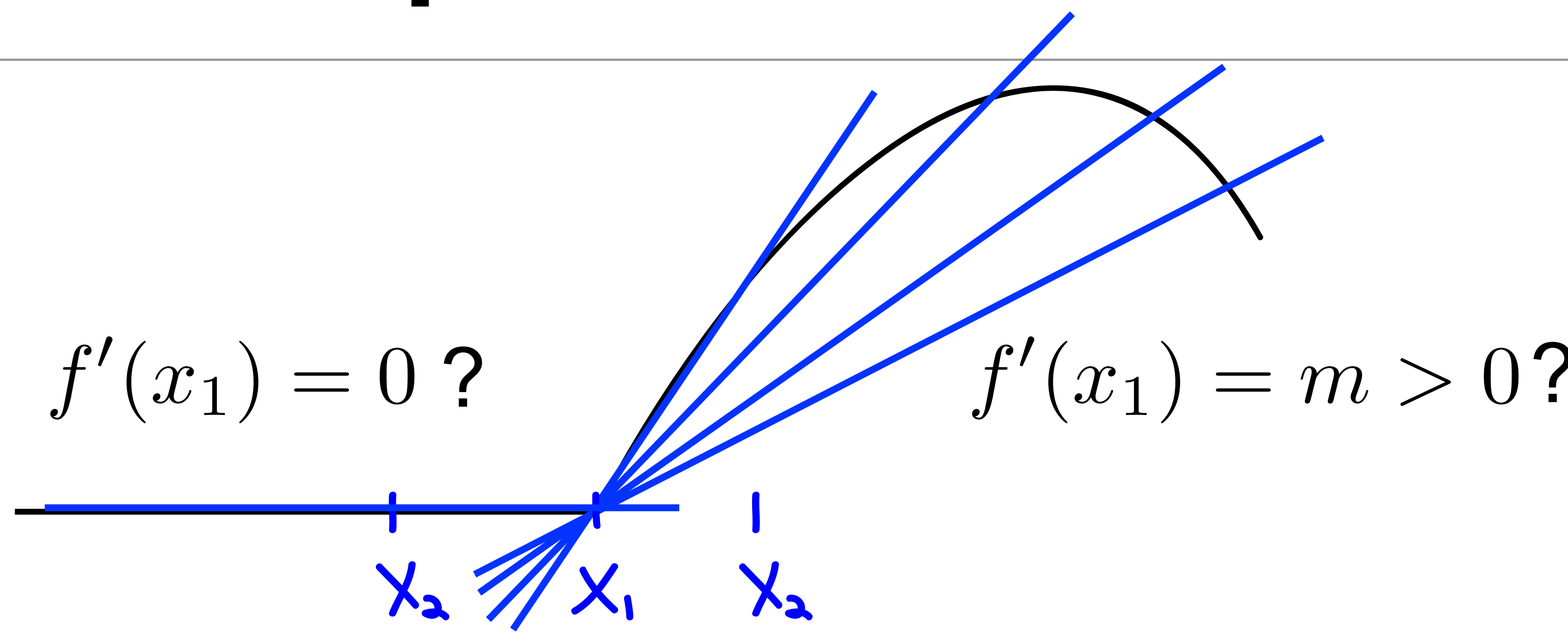

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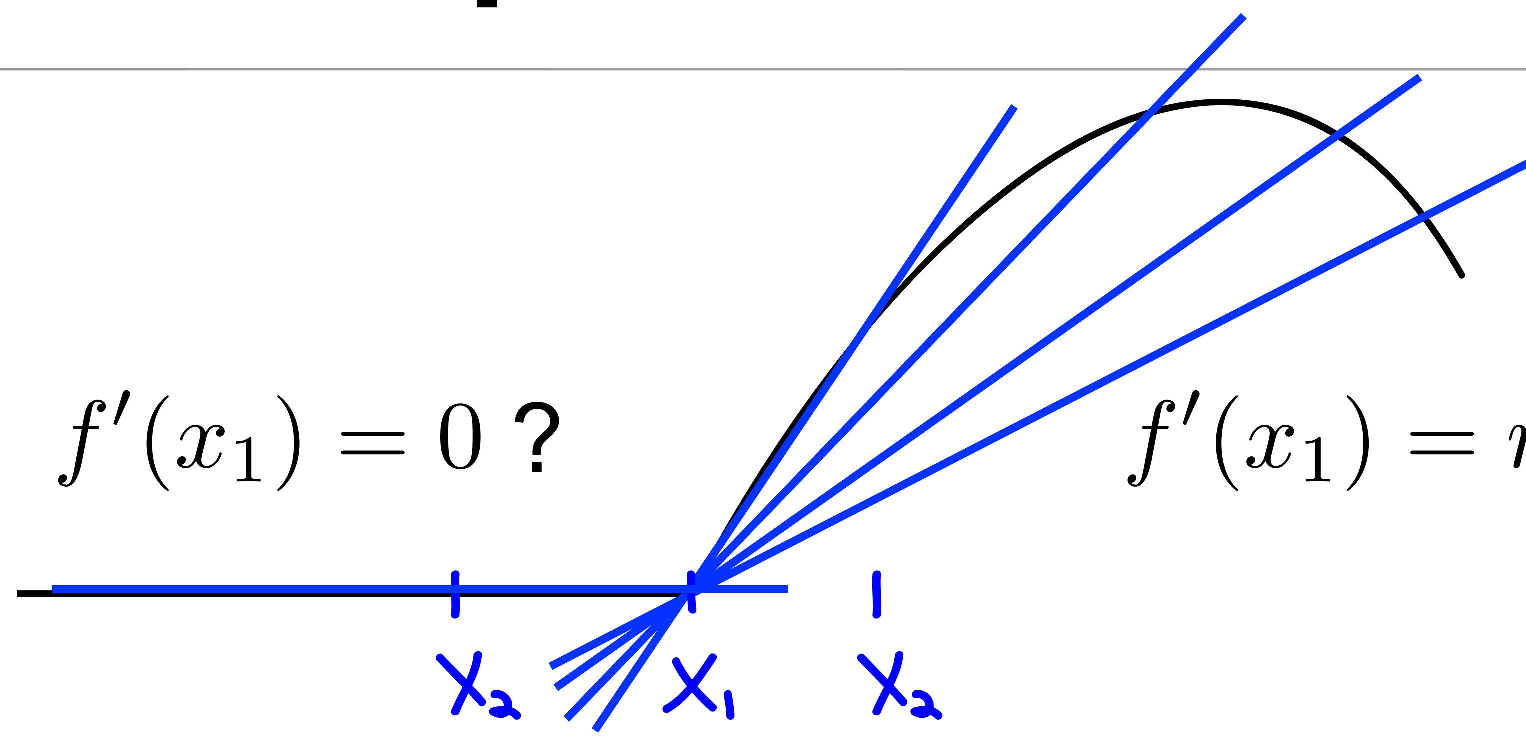

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Limits from left and right must agree for the limit to exist.

(D) The limit does not exist.

The derivative of f(x) at x=a...

(A) ...touches the function at x=**a** but does not cross it.

(B) ...looks more and more like the function as you zoom in around x=**a**.

(C) ... only exists when the function looks like a straight line close to x=**a**.

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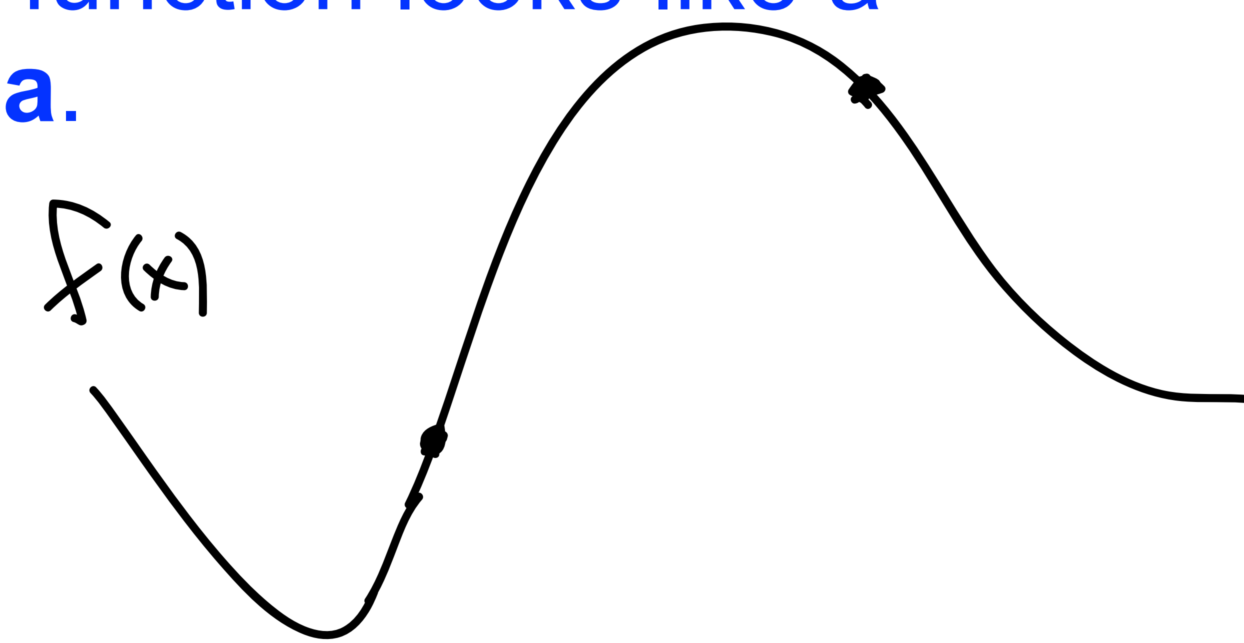

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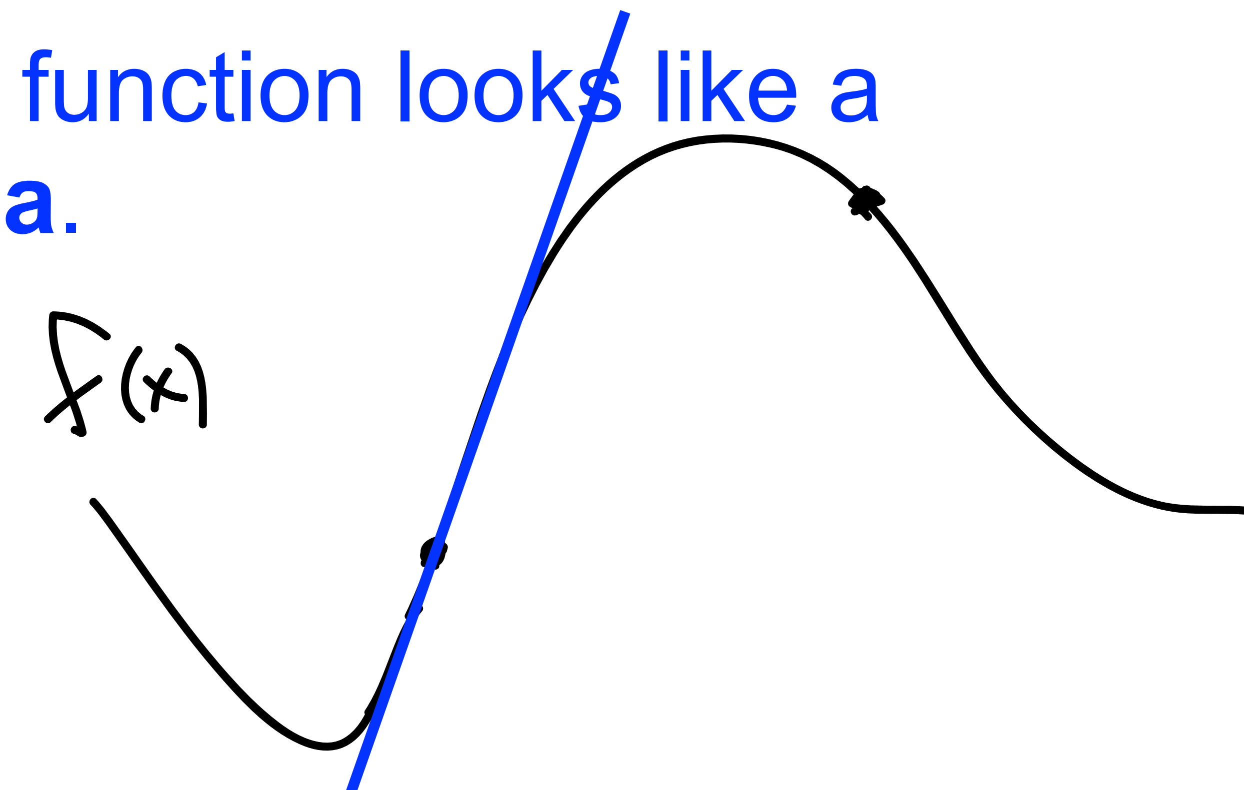

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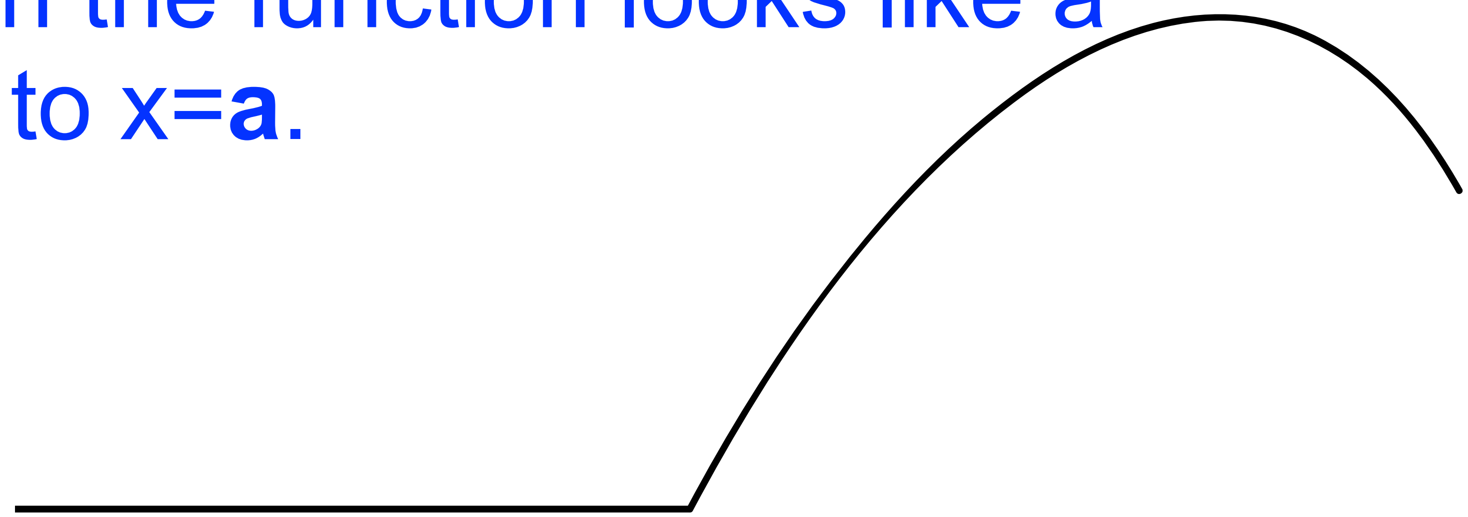

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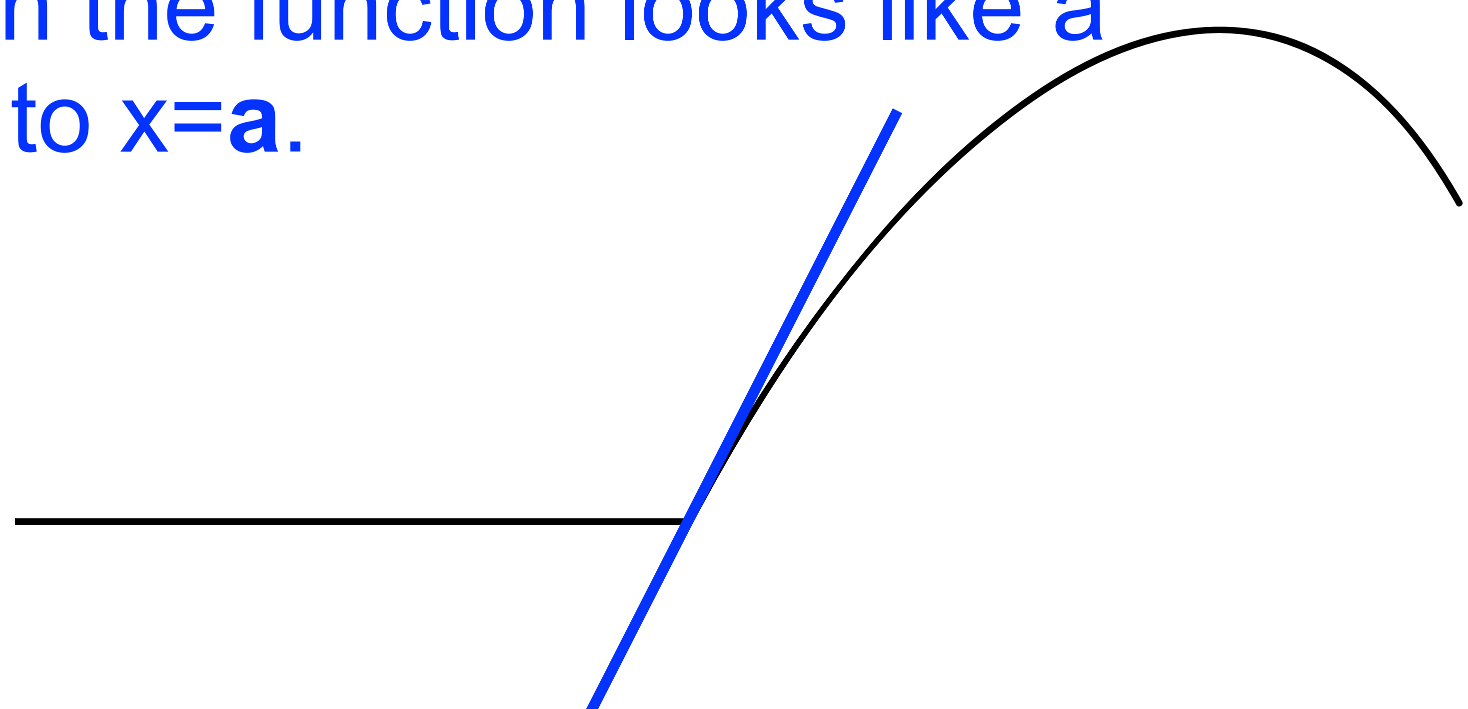

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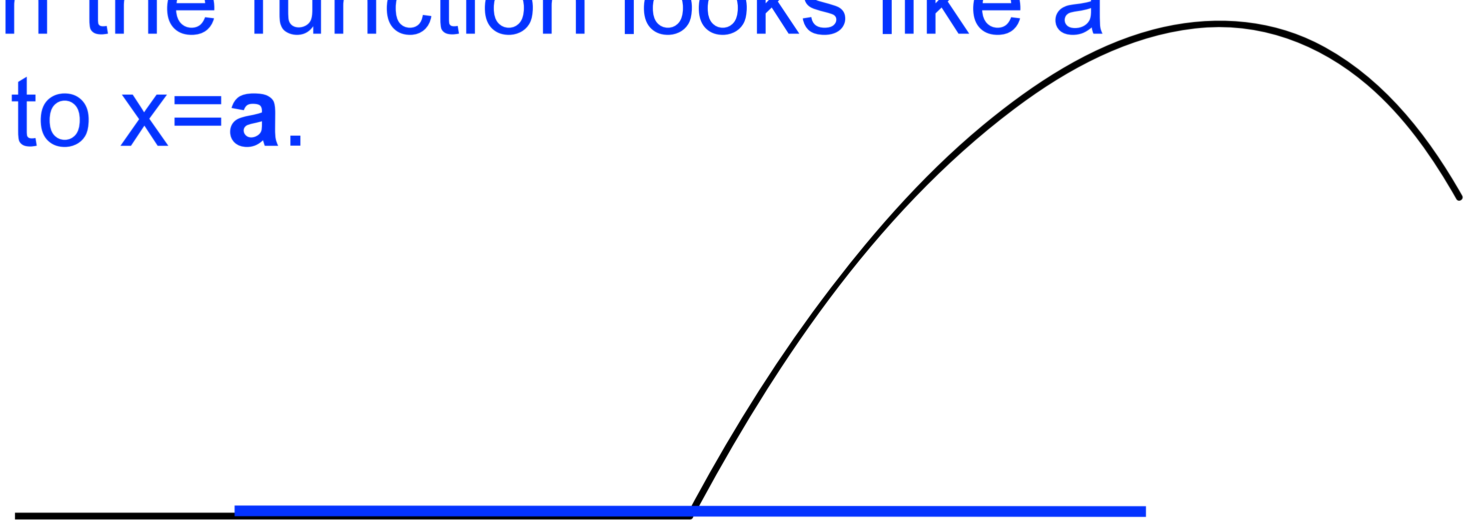

To evaluate a limit

To evaluate $\lim_{x \to a} f(x)$, you plug in values closer and closer to ***a*** but you never get to ***a***. In fact, ***f(a)*** may not even be defined. If you always get the same number no matter how you approach **a**, then the limit exists.

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Note: the limit involved in the derivative is only one special case. The limit above is concerned with the **value** of the function. When a limit has the form

$$\lim_{h \to 0} \frac{f(2+h) - f(2)}{h}$$

we're talking about the slope of f (in this case, at x=2).

A WeBWorK limit example

Guess the value of the limit (if it exists) by evaluating the function at values close to where the limit is to be done. If it does not exist, enter DNE below.

$$\lim_{h \to 0} \frac{\sin(\frac{\pi}{4} + h) - \sin(\frac{\pi}{4})}{h}$$

Limit:

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Limit:

Go over f'(2) where f(x) = 1/x on the board.

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Do not drop the "lim" along the way!