Day 14 (Wed Feb 8) MATH 2301 (Barsamian)

Sit in Pairs

Exam X1 on Friday Covers through Section 2.2

Today: Continuing Section 2.2 The Derivative as a function

[Example] Let $f(x) = x^2 - 2x - 3$

Find $f'(x)$ using the Definition of the Derivative

Solution: We need to build this limit

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

and find its value

Get Parts $f(x) = x^2 - 2x - 3$

$f(\quad) = (\quad)^2 - 2(\quad) - 3$ empty version

$f(x+h) = (x+h)^2 - 2(x+h) - 3$

$= x^2 + 2xh + h^2 - 2x - 2h - 3$

Build the limit & find its value

$$f'(x) = \lim_{h\to 0} \frac{x^2+2xh+h^2-2x-2h-3-(x^2-2x-3)}{h}$$

$$= \lim_{h\to 0} \frac{2xh+h^2-2h}{h}$$

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

indeterminate

Since $h\to 0$, we know $h\neq 0$, so we can cancel $\frac{h}{h}$

$$= \lim_{h\to 0} 2x+h-2$$

no longer indeterminate

$$= 2x+(0)-2$$

$$= 2x-2$$

(4)

MATH 2301 (Barsamian) Class Activity

The goal: Given the graph of f on the top axes on the next page, make a graph of f' on the bottom axes.

On the graph of f', the input will be x and the output will be $f'(x)$. Remember the graphical interpretation of $f'(x)$:

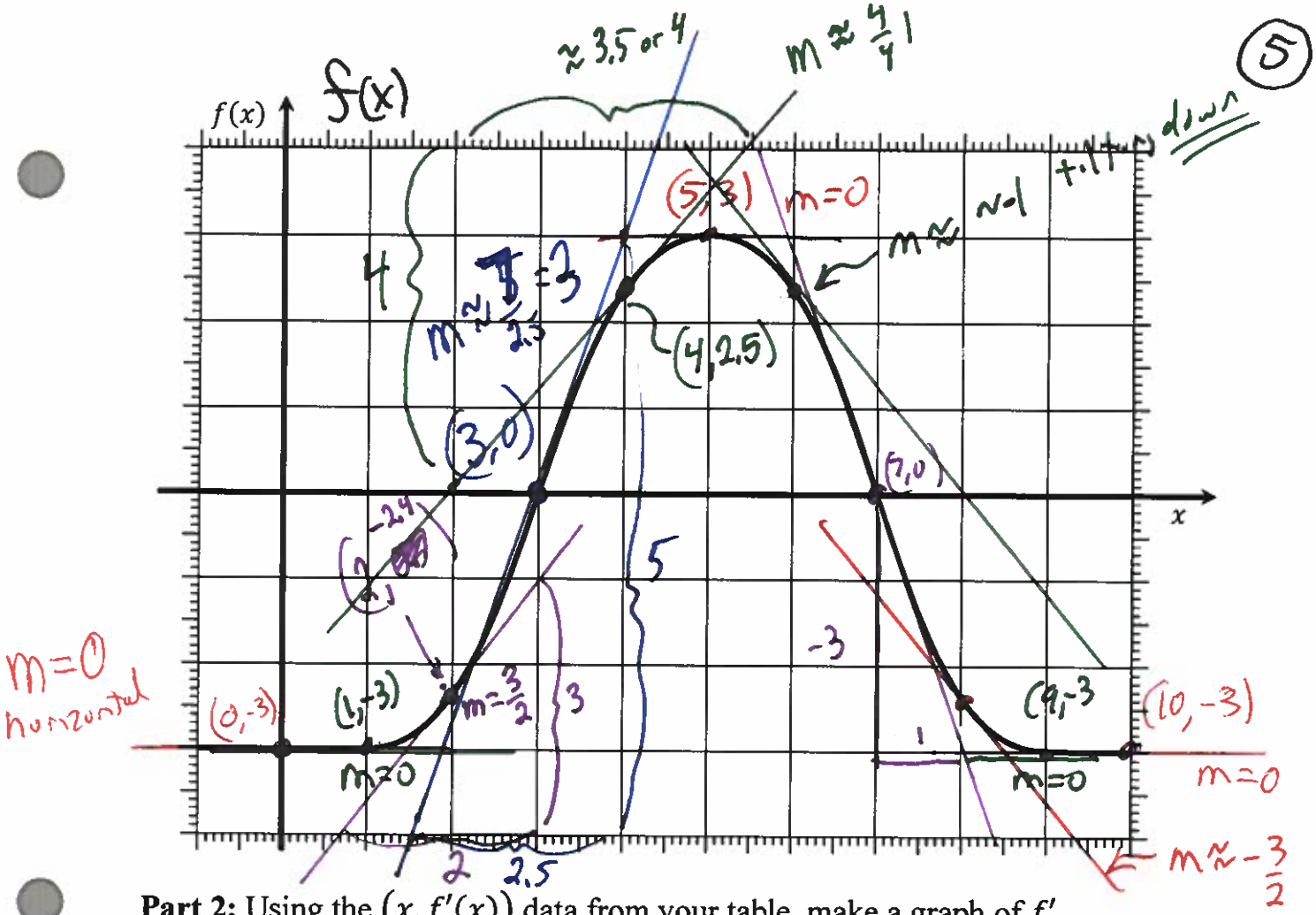
Definition of the *Derivative*

- **symbol:** $f'(a)$
- **graphical interpretation:** $f'(a)$ is the number that is the slope of the line tangent to the graph of f at the point where $x = a$.

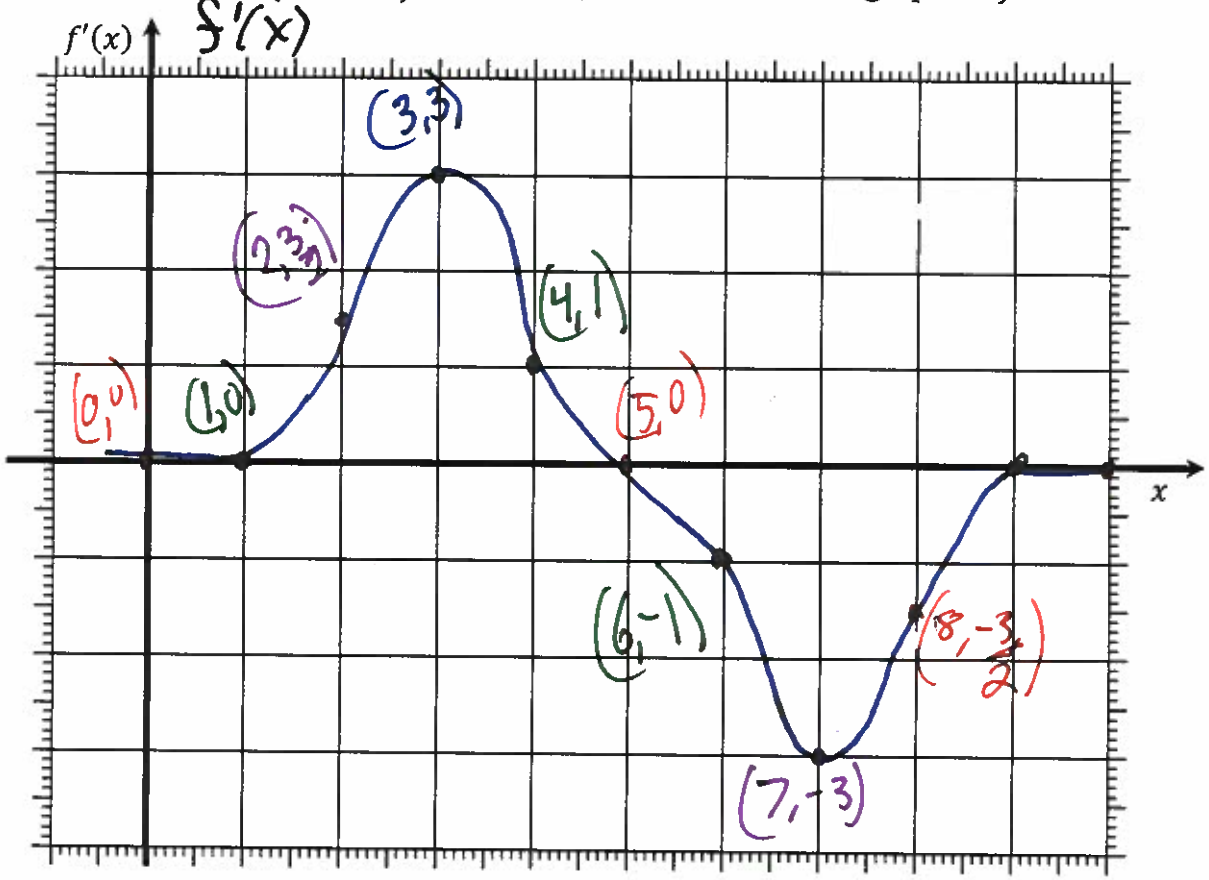
Part 1: Prepare the data for your graph of f' by filling out the following table.

x	what to do on the graph of f	$f'(x)$
0	Draw the line tangent to the graph of f at the point where $x = 0$ and find its slope m. This slope m will be the value of $f'(0)$.	0
1	Draw the line tangent to the graph of f at the point where $x = 1$ and find its slope m. This slope m will be the value of $f'(1)$.	0
2	Draw the line tangent to the graph of f at the point where $x = 2$ and find its slope m. This slope m will be the value of $f'(2)$.	$\frac{3}{2}$
3	Draw the line tangent to the graph of f at the point where $x = 3$ and find its slope m. This slope m will be the value of $f'(3)$.	3
4	Draw the line tangent to the graph of f at the point where $x = 4$ and find its slope m. This slope m will be the value of $f'(4)$.	1
5	Draw the line tangent to the graph of f at the point where $x = 5$ and find its slope m. This slope m will be the value of $f'(5)$.	0
6	Draw the line tangent to the graph of f at the point where $x = 6$ and find its slope m. This slope m will be the value of $f'(6)$.	-1
7	Draw the line tangent to the graph of f at the point where $x = 7$ and find its slope m. This slope m will be the value of $f'(7)$.	-3
8	Draw the line tangent to the graph of f at the point where $x = 8$ and find its slope m. This slope m will be the value of $f'(8)$.	$-\frac{3}{2}$
9	Draw the line tangent to the graph of f at the point where $x = 9$ and find its slope m. This slope m will be the value of $f'(9)$.	0
10	Draw the line tangent to the graph of f at the point where $x = 10$ and find its slope m. This slope m will be the value of $f'(10)$.	0

Part 2 is on the next page.



Part 2: Using the $(x, f'(x))$ data from your table, make a graph of f'.



MATH 2301 (Barsamian) Class Activity Which is the Function; Which is the Derivative?

In each drawing, one curve is f; the other is f'. Label them.