Math 131 - Homework 2

September 22, 2021

Name key Score

The following problems are from the suggested homework. Show all work to receive full credit. Supply explanations when necessary. This assignment is due September 29.

1. (2 points) Use the limit definition of the derivative to determine $f'(1)$ when $f(x) = x^2 + x$.

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

$$= \lim_{h\to 0} \frac{\cancel{x^2} + 2xh + h^2 + \cancel{x} + h - \cancel{x^2} - \cancel{x}}{h} = \lim_{h\to 0} \frac{\cancel{h}(2x+h+1)}{\cancel{h}} = 2x+1$$

$$\boxed{f'(1) = 3}$$

2. (2.5 points) Use the limit definition of the derivative to determine $f'(4)$ when $f(x) = \sqrt{x}$.

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

$$= \frac{1}{\sqrt{x} + \sqrt{x}} = \frac{1}{2\sqrt{x}}$$

$$\boxed{f'(4) = \frac{1}{4}}$$

3. (2 points) Use the limit definition of the derivative to determine $f'(x)$ when $f(x) = 5x - x^2$.

$$f'(x) = \lim_{h\to 0} \frac{[5(x+h) - (x+h)^2] - [5x - x^2]}{h} = \lim_{h\to 0} \frac{\cancel{5x} + 5h - \cancel{x^2} - 2xh - h^2 - \cancel{5x} + \cancel{x^2}}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{h}(5 - 2x - h)}{\cancel{h}} = 5 - 2x$$

Turn over.

$$\boxed{f'(x) = 5 - 2x}$$

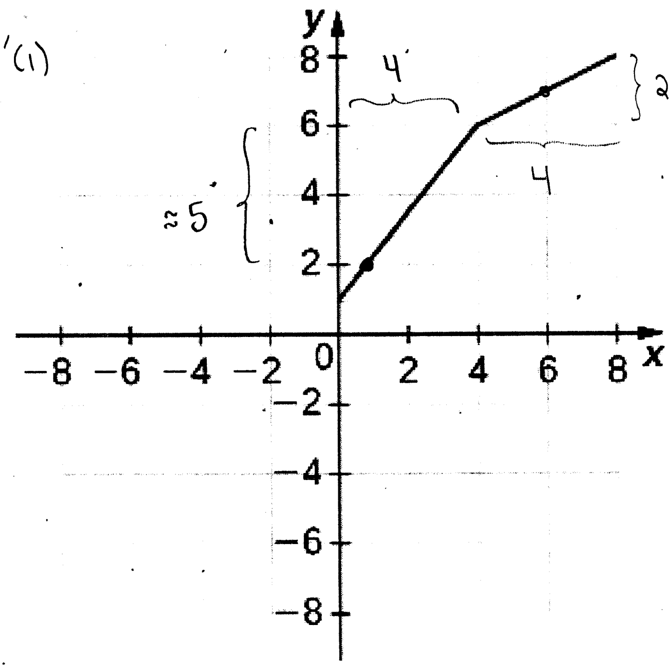
4. (1 point) The graph of f is shown below. Use the graph to determine (a) $f'(1)$ and (b) $f'(6)$.

a) SLOPE AT $X = 1 = f'(1)$

$\approx \dfrac{5}{4}$

b) SLOPE AT $X = 6$

$= f'(6) \approx \dfrac{2}{4} = \dfrac{1}{2}$



5. (2.5 points) The graph of f is shown below. Use the graph to determine (a) $f'(-0.5)$, (b) $f'(0)$, (c) $f'(1)$, (d) $f'(2)$, and (e) $f'(3)$.

USE SLOPES!

a) $f'(-0.5) = \dfrac{3}{3} = \boxed{1}$

b) $f'(0)$ $\boxed{\text{DNE}}$ (SHARP PT)

c) $f'(1) = -\dfrac{2}{2} = \boxed{-1}$

d) $f'(2)$ $\boxed{\text{DNE}}$ (SHARP PT)

e) $f'(3) = \dfrac{4}{2} = \boxed{2}$