

Name: Solution

_____ / 25

Please circle your instructor's name: Leah Berman Jill Faudree James Gossell

There are 25 points possible on this quiz. Any outside materials (textbook, course notes, calculator) are not allowed. **For full credit, show all work in a way someone else can follow it.**

1. (12 points) Let $f(x) = 5x + x^2$.

(a) Find $f'(x)$ using the derivative rules from Section 3.3.

$$f'(x) = 5 + 2x$$

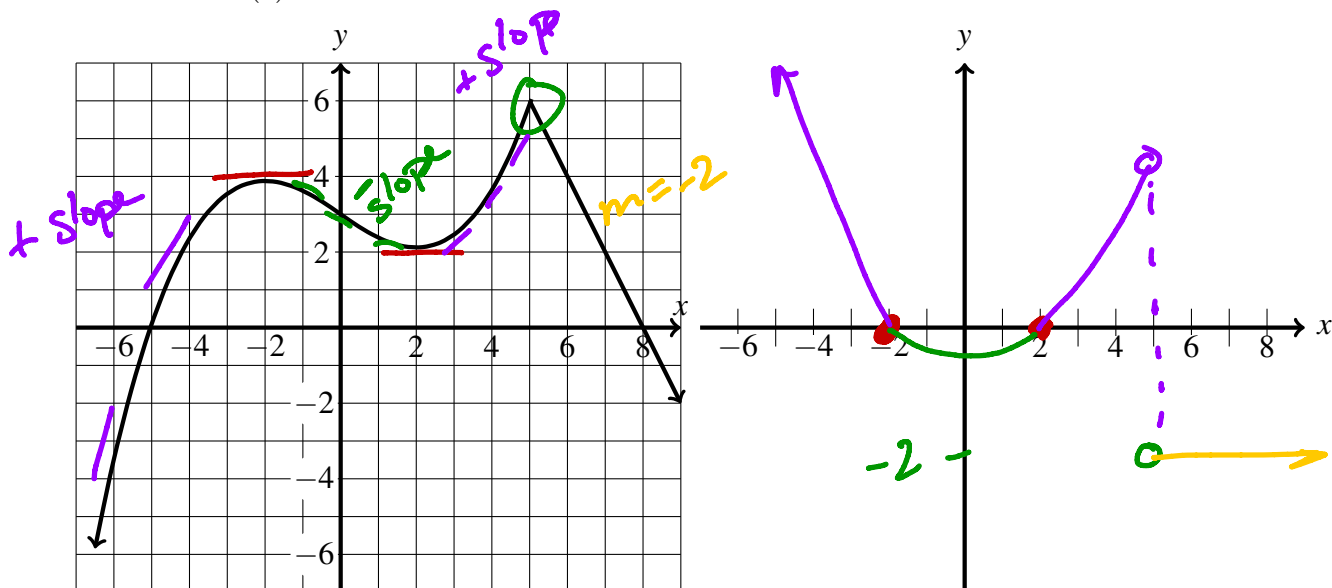
(b) Use the definition of the derivative of $f(x)$ (copied below), to confirm that your answer in part (a) is correct.

$$\begin{aligned}
 f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} = \lim_{h \rightarrow 0} \frac{(5(x+h) + (x+h)^2) - (5x + x^2)}{h} \\
 &= \lim_{h \rightarrow 0} \frac{5x + 5h + x^2 + 2xh + h^2 - 5x - x^2}{h} \\
 &= \lim_{h \rightarrow 0} \frac{5h + 2xh + h^2}{h} = \lim_{h \rightarrow 0} \frac{h(5 + 2x + h)}{h} = \lim_{h \rightarrow 0} 5 + 2x + h \\
 &= 5 + 2x
 \end{aligned}$$

(c) Write an equation of the tangent line to $f(x)$ at $x = 1$.

$$\begin{aligned}
 f(1) &= 5(1) + 1^2 = 6 & y - 6 &= 7(x - 1) \text{ or} \\
 f'(1) &= 5 + 2(1) = 7 & y &= 6 + 7(x - 1) \text{ or } y = 7x - 1
 \end{aligned}$$

2. (6 points) The graph of $G(x)$ is shown below on the left. On the right axes, sketch $G'(x)$, the derivative of $G(x)$.



3. (4 points) Suppose $V(d)$ gives the number of voles on day d where V is measured in 1000's of voles. Interpret each of the expressions below using complete sentences. Be sure to include units.

(a) $V(15) = 25$.

On day 15, there are 25,000 voles in the population.

(b) $V'(15) = 0.54$.

On day 15, the number of voles is increasing at a rate of 540 voles per day.
Yikes!

4. (3 points) Use the Product Rule to find the derivative of $f(x) = \sqrt{x^{1/2}} \sin(x)$.

$$f(x) = x^{1/2} \sin(x)$$

$$f'(x) = \frac{1}{2} x^{-1/2} \sin(x) + x^{1/2} \cos(x)$$

$$= \frac{\sin x}{2\sqrt{x}} + \sqrt{x} \cos(x)$$