3.1 day 1

Friday, September 1, 2017 11:18 AM

pg. 107 #1, 5, 7, 9, 12–17, 36–38

1. $f(x) = \frac{1}{x}$

$$f'(2) = \lim_{h \to 0} \frac{\frac{1}{2+h} - \frac{1}{2}}{h}$$

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

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

$$= \frac{1}{4}$$

THE SAME!

5. $f(x) = \frac{1}{x}$

$$f'(2) = \lim_{x \to 2} \frac{\frac{1}{x} - \frac{1}{2}}{x-2}$$

$$= \lim_{x \to 2} \frac{\frac{2-x}{2x}}{x-2}$$

$$= \lim_{x \to 2} \frac{2-x}{2x} \cdot \frac{1}{x-2}$$

$$= \lim_{x \to 2} \frac{-1(\cancel{-2+x})}{2x} \cdot \cancel{\frac{1}{x-2}}$$

$$= \frac{-1}{4}$$

7. $f(x) = \sqrt{x+1}$

$$f'(3) = {}_{x \to 3} \frac{\sqrt{x+1} - 2}{x-3} \cdot \frac{\sqrt{x+1} + 2}{\sqrt{x+1} + 2}$$

$$= \lim_{x \to 3} \frac{x+1-4}{(x-3)(\sqrt{x+1}+2)}$$

$$= \lim_{x \to 3} \frac{x-3}{(x-3)(\sqrt{x+1}+2)}$$

$$= \lim_{x \to 3} \frac{1}{\sqrt{x+1}+2}$$

$$= \frac{1}{}$$

4

9. $f(x) = 3x - 12$

No work needed! $f'(x) = 3$ because $f(x)$ is a line

12. $f(x) = 3x^2$

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

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

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

$$= \lim_{h \to 0} \frac{3x^2 + 6hx + 3h^2 - 3x^2}{h}$$

$$= \lim_{h \to 0} \frac{6hx + 3h^2}{h}$$

$$= \lim_{h \to 0} 6x + 3h$$

$$= 6x$$

$f'(x) = 6x$

13. B negative slopes 0 positive slopes
14. A positive slopes 0 positive slopes
15. D positive slope 0 negative slope 0 positive slope Repeats
16. C negative slope 0 little positive 0 little negative 0 positive slope

17. A. $y - 3 = 5(x - 2)$

B. $y - 3 = \frac{-1}{5}(x - 2)$

36. $f(x) = x^2 + x$

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

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

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

$$= \lim_{h \to 0} 2x + h + 1 \qquad \text{(careful!)}$$

$$= 2x + 1$$ ← This works for all real x values

37. False. The left and right derivatives must be the same for the derivative to exist. A function could have a left derivative of 4 and a right derivative of 2. Both EXIST, but are not the same.

38. C NO work needed! The line $y = 4 - 3x$ has slope -3 EVERYwhere!