HW 2.1 Definition of a Derivative

Pg. 103 #'s 13, 25, 28, 39, 42, 45

13) $f(x) = -10x$

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

$$\lim_{h\to 0} \frac{-10(x+h) - (-10x)}{h}$$

$$\lim_{h\to 0} \frac{-10x - 10h + 10x}{h}$$

$$\lim_{h\to 0} \frac{-10h}{h} = -10$$

$f'(x) = -10$

25) $f(x) = x^2 + 3 \quad (-1, 4)$

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

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

$$\lim_{h\to 0} \frac{x^2 + 2xh + h^2 + 3 - x^2 - 3}{h}$$

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

$f'(x) = 2x$

$f'(-1) = 2(-1) = -2$

$y - y_1 = m(x - x_1)$

$y - 4 = -2(x+1)$

28) $f(x) = x^3 + 1 \quad (-1, 0)$

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

$$\lim_{h\to 0} \frac{(x+h)^3 + 1 - (x^3+1)}{h}$$

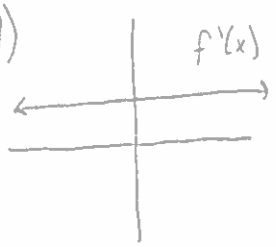
$$\lim_{h\to 0} \frac{x^3 + 3x^2h + 3xh^2 + h^3 + 1 - x^3 - 1}{h}$$

$$\lim_{h\to 0} \frac{3x^2h + 3xh^2 + h^3}{h} = 3x^2 + 3xh + h^2 = 3x^2$$

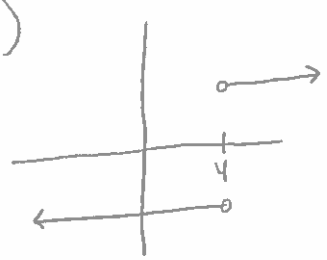
$f'(x) = 3x^2$

$f'(-1) = 3(-1)^2 = 3$

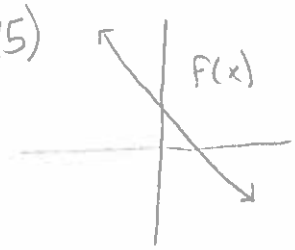
$y - 0 = 3(x+1)$

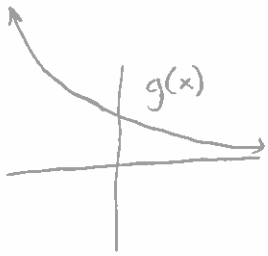
39) 

$f(x)$ is a linear function whose slope is always positive 1. The graph of $f'(x)$ is the horizontal line $y=1$.

42) 

$f(x)$ has a slope of -1 for $x<4$ and the slope is $+1$ for $x>4$. The derivative does not exist at $x=4$ because the slope from the left $\neq$ the slope from the right.

45) 

or 

The graph of the function is always decreasing so the slopes are all negative.