Honors Pre-Calc Name________________
10.3 Derivatives Date____________ Block ______

Find the derivative using limits. If the equation is given as y=, use Leibniz Notation: $\frac{dy}{dx}$.

If the equation is given as f(x)=, use Lagrange Notation: $f'(x)$.

1.) $y = 5x + 1$

$\lim_{h\to 0} \frac{5(x+h)\cancel{+1} \cancel{-5x-1}}{h} = 5$

$\frac{dy}{dx} = 5$

2.) $f(x) = 2 + 10x - x^2$

$\lim_{h\to 0} 2+10(x+h)-(x+h)^2 - (2+10x-x^2)$

$\frac{\cancel{2}+\cancel{10x}+10h-\cancel{x^2}-2xh-h^2-\cancel{2}-\cancel{10x}+\cancel{x^2}}{h}$

$\lim_{h\to 0} 10-2x-h$ $f'(x) = 10-2x$

3.) $f(x) = \sqrt{-3x-5}$

$\lim_{h\to 0} \frac{\sqrt{(-3(x+h)-5)} - \sqrt{-3x-5}}{h} \cdot \frac{(\sqrt{-3(x+h)-5} + \sqrt{-3x-5})}{\sqrt{-3(x+h)-5} + \sqrt{-3x-5}}$

$\lim_{h\to 0} \frac{\overset{-3h}{\cancel{-3(x+h)-5-(-3x-5)}}}{h(5+\dots)} = -3$

$\cancel{f'(x) = \frac{-3}{2\sqrt{-3x-5}}}$

4.) $y = \frac{1}{3x-2}$

$\lim_{h\to 0} \frac{\frac{1}{3(x+h)-2} - \frac{1}{3x-2}}{h}$

$\lim_{h\to 0} \frac{\overset{-3h}{\cancel{3x-2}-(\cancel{3}(x+h)\cancel{-2})}}{(3(x+h)-2)(3x-2)} \cdot \frac{1}{h}$

$\frac{dy}{dx} = \frac{-3}{(3x-2)^2}$

Create an equation of the tangent line of f at the given point. The answer can be in point-slope or slope intercept form.

5.) $f(7) = 5$ and $f'(7) = -2$

$(7,5)$ $m=-2$

$y-5 = -2(x-7)$

$y = -2x+19$

6.) $f(-2) = 3$ and $f'(-2) = 4$

$(-2,3)$ $m=4$

$y-3 = 4(x+2)$

$y = 4x+11$

7.) $f(x) = 3x^2 + 2x$; $f'(x) = 6x + 2$; $x = -2$

$(-2, 8)$ $m = -10$

$y-8 = -10(x+2)$

$y = -10x-12$

8.) $f(x) = 10\sqrt{6x+1}$; $f'(x) = \frac{30}{\sqrt{6x+1}}$; $x = 4$

$(4, 50)$

$m = 6$

$y-50 = 6(x-4)$

$y = 6x+26$

9.) $f(x) = \cos 2x$; $f'(x) = -2\sin 2x$; $x = \frac{\pi}{4}$

$(\pi/4, 0)$ $m = -2$

$y = -2(x-\pi/4)$

$y = -2x + \pi/2$

10.) $f(x) = \tan x$; $f'(x) = \sec^2 x$; $x = \frac{\pi}{3}$

$(\pi/3, \sqrt{3})$ $m=4$

$y-\sqrt{3} = 4(x-\pi/3)$

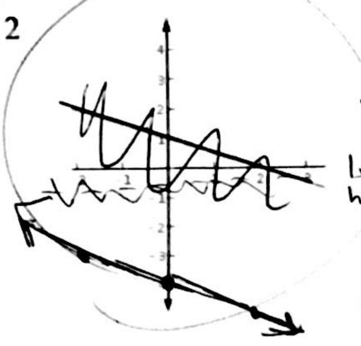
doesn't match

Find (a) the slope of the graph at the given point, (b) the equation of the tangent line to the graph at the point, (c) graph tangent line with the graph of the function.

11.) $f(x) = -\frac{1}{2}x - 4; x = 2$

$$\frac{-\frac{1}{2}(x+h) \cancel{-4} - (-\frac{1}{2}x \cancel{-4})}{h}$$

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



12.) $f(x) = 2x^2 - 5x + 1; x = 2$

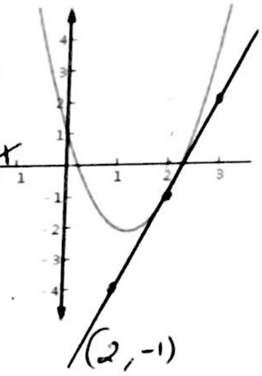
$$\lim_{h\to 0} \frac{2(x+h)^2 - 5(x+h) + 1 - (2x^2 - 5x + 1)}{h}$$

$$\lim_{h\to 0} \frac{\cancel{2x^2} + 4xh + 2h^2 \cancel{-5x} - 5h \cancel{+1} \cancel{-2x^2} \cancel{+5x} \cancel{-1}}{h}$$

$$\lim_{h\to 0} 4x + 2h - 5$$

$f'(x) = 4x - 5$

$f'(2) = 8 - 5 = 3$



$(2, -1)$

$y + 1 = 3(x - 2)$

$y + 1 = 3x - 6$

$y = 3x - 7$

13.) $f(x) = x^3 - 2x; x = 1$

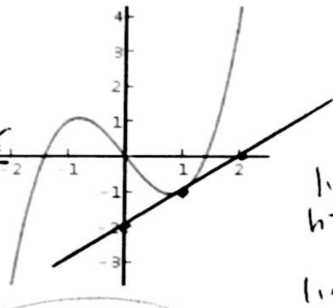
$$\lim_{h\to 0} \frac{(x+h)^3 - 2(x+h) - x^3 + 2x}{h}$$

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

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

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

$f'(1) = 1$



$y = x - 2$

14.) $f(x) = \sqrt{x-2}; x = 3$

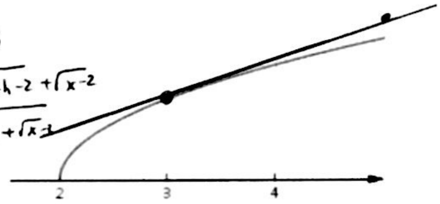
$$\lim_{h\to 0} \frac{\sqrt{x+h-2} - \sqrt{x-2}}{h} \cdot \frac{\sqrt{x+h-2} + \sqrt{x-2}}{\sqrt{x+h-2} + \sqrt{x-2}}$$

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

$$\lim_{h\to 0} \frac{1}{\sqrt{x+h-2} + \sqrt{x-2}}$$

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

$f'(3) = \frac{1}{2}$



$(3, 1)$ $m = 1/2$

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

Use the function and its derivative to determine algebraically which points on the graph of *f* have a tangent line that is horizontal. Verify with graphing calculator and graph the tangent line on the graph below.

15.) $f(x) = x^4 - 2x^2$, $f'(x) = 4x^3 - 4x$

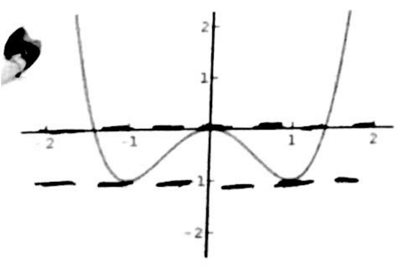
$4x(x+1)(x-1) = 0$

$x = 0, \pm 1$

$f'(0) = 0$

$f'(1) = 0$

$f'(-1) = 0$



16.) $f(x) = 2\cos x + x$, $f'(x) = -2\sin x + 1$, $(0, 2\pi)$

$-2\sin x + 1 = 0$

$\sin x = 1/2$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

$.5236 \quad 2.618$