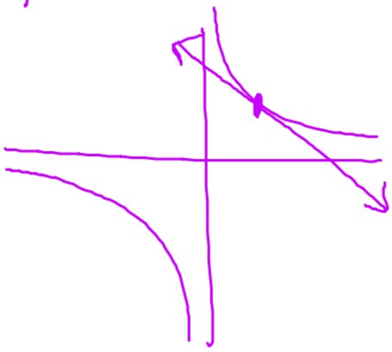
71.) $f(x) = \frac{k}{x}$ $\qquad y = -\frac{3}{4}x + 3$



$\frac{k}{x} = -\frac{3}{4}x + 3$ $\qquad +\frac{k}{x^2} = +\frac{3}{4}$

$4k = 3x^2$

$\frac{3x}{4} = -\frac{3}{4}x + 3$ $\qquad k = \frac{3x^2}{4}$

$\frac{6}{4}x = 3$

$x = 2$ $\qquad k = 3$

$x = 2$

27.) $y = \frac{6}{(5x)^3} = \frac{6}{125x^3}$

$y = \frac{6}{125} x^{-3}$

$y' = \frac{-18}{125} x^{-4}$

2.2 Basic Differentiation Rules Cont.

ex: Differentiate.

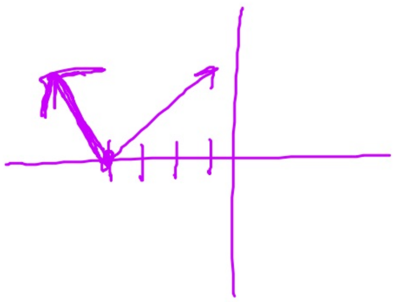
Check for continuity first!!!

a) $f(x)=\begin{cases} x^2+3, & x\le 0 \\ e^x-x, & x>0 \end{cases}$ 3 1

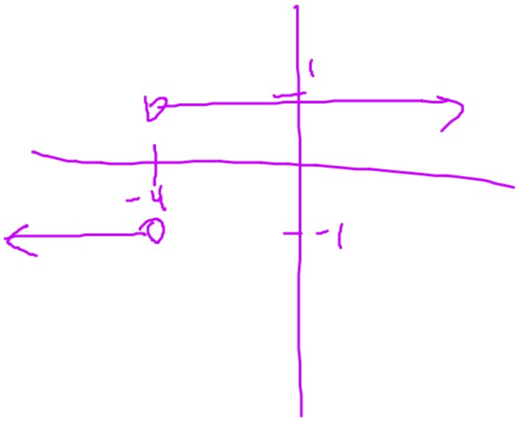
$f'(x)=\begin{cases} 2x & x<0 \\ e^x-1 & x>0 \end{cases}$

ex: Differentiate.

b) $f(x) = |x+4|$



$$f(x) = \begin{cases} -x-4, & x \leq -4 \\ x+4, & x > -4 \end{cases}$$



$$f'(x) = \begin{cases} -1, & x < -4 \\ 1, & x > -4 \end{cases}$$

ex: Differentiate.

c) $g(x) = \begin{cases} 2, & x < 7 \\ 3 - 5x, & x \geq 7 \end{cases}$ $\begin{matrix} 2 \\ -32 \end{matrix}$

$g'(x) = \begin{cases} 0 & , x < 7 \\ -5 & x > 7 \end{cases}$

ex: Find the slope at the indicated x-value or explain why it does not exist.

a) $f(x)=|x+4|, \quad x=0$

$f'(0)=1$

b) $f(x)=|x+4|, \quad x=-5$

$f'(-5)=-1$

c) $f(x)=|x+4|, \quad x=-4$

$f'(-4)$ dne

$\lim_{x\to -4^-} f'(x) \neq \lim_{x\to -4^+} f'(x)$

ex: Find a and b so that f(x) is differentiable. $\Rightarrow$ continuity

$$g(x)=\begin{cases}2x-x^2, & x\le 1\\ x^2+ax+b, & x>1\end{cases} \qquad g'(x)=\begin{cases}2-2x, & x\le 1\\ 2x+a, & x>1\end{cases}$$

Continuity	differentiability
$\lim_{x\to 1^-} g(x)=\lim_{x\to 1^+} g(x)=g(1)$	$\lim_{x\to 1^-} g'(x)=\lim_{x\to 1^+} g'(x)=g'(1)$
$1=1+a+b$	$0=2+a$
$0=a+b$	$-2=a$
	$2=b$

FR 1

Let $f(x) = 4x^3 - 3x - 1$.

(a) Find the x-intercepts of the graph of f.

(b) Write an equation for the tangent line to the graph of f at $x = 2$.

FR 4

Let f be the function defined as follows:

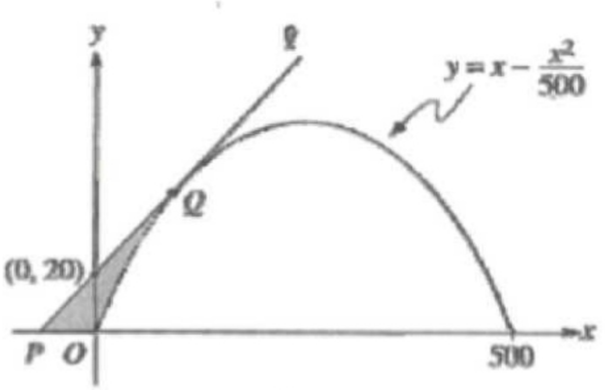
$$f(x) = \begin{cases} |x-1|+2, & \text{for } x<1 \\ ax^2+bx, & \text{for } x \geq 1, \text{ where } a \text{ and } b \text{ are constants.} \end{cases}$$

(a) If $a=2$ and $b=3$, is f continuous for all x? Justify your answer.

(b) Describe all values of a and b for which f is a continuous function.

(c) For what values of a and b is f both continuous and differentiable?

FR 16



Line ℓ is tangent to the graph of $y = x - \dfrac{x^2}{500}$ at the point Q, as shown in the figure above.

(a) Find the x-coordinate of point Q.

(b) Write an equation for line ℓ.

(c) Suppose the graph of $y = x - \dfrac{x^2}{500}$ shown in the figure, where x and y are measured in feet, represents a hill. There is a 50-foot tree growing vertically at the top of the hill. Does a spotlight at point P directed along line ℓ shine on any part of the tree? Show the work that leads to your conclusion.

ex:

At $x = 3$, the function given by $f(x) = \begin{cases} x^2 & , \quad x < 3 \\ 6x - 9, & x \geq 3 \end{cases}$ is $\begin{matrix} 9 \\ 9 \end{matrix}$

$f'(x) = \begin{cases} 2x & , x < 3 \\ 6 & , x \geq 3 \end{cases}$

(A) undefined.

(B) continuous but not differentiable.

(C) differentiable but not continuous.

(D) neither continuous nor differentiable.

(E) both continuous and differentiable.