AP Calculus AB
Friday, November 1, 2013

Bellwork:

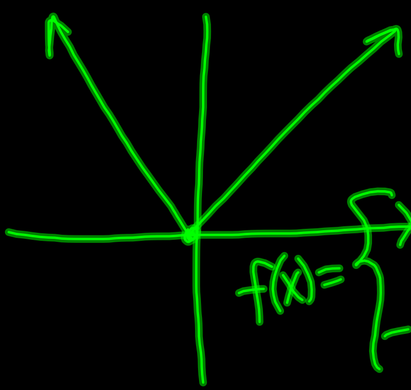
Find the slope of the tangent line to f(x) = |x| at the following points:

1. x = -2
2. x = -1

$\Big\} \rightarrow m_{tan} = -1$

3. x = 0 $\rightarrow$ undefined
4. x = 1
5. x = 2

$\Big\} \; m_{tan} = 1$



$$f(x) = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$$

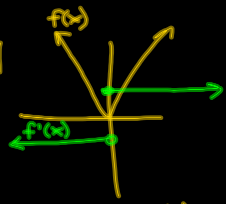
Historical Curves Assignment

1.
2.
3.
4.
5.

1. Find equation of tangent line at specific point.
2. Check your work with GGB.
3. Print out a graph with the original curve & the tangent line.
4. Paste onto colored paper (I have some).
5. Tape/paste your work onto the back of the paper.
6. I will be displaying these!

You have to do all five problems.
You will be assigned ONLY ONE to print & post.

$f(x) = |x|$



$\lim_{x \to 0^-} f'(x) = -1$

$\lim_{x \to 0^+} f'(x) = 1$

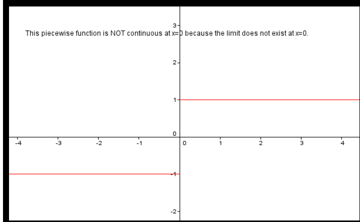
$\lim_{x \to 0^-} f'(x) \neq \lim_{x \to 0^+} f'(x) \quad \therefore f'(0)$ dne

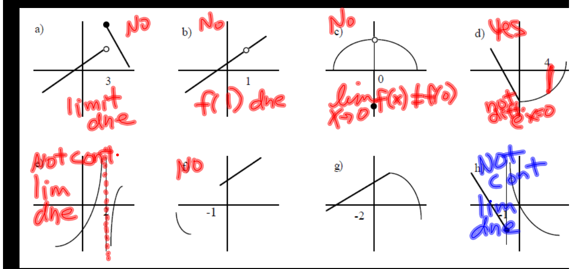
What can we conclude about the absolute value function?

Continuity → continuous $(-\infty, \infty)$

Differentiability
↳ Can we take deriv everywhere?

No. $|x|$ is not differentiable @ $x=0$.





Know your ABCD's.

In order for a function to be differentiable at a point, it must also be continuous at that point.

differentiability → "smooth" curve

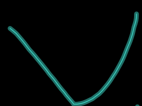
How can we determine differentiability by looking at the equation (not the graph)?

Consider

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

domain: $(-\infty, 0) \cup (0, \infty)$

look @ domain → deriv's domain

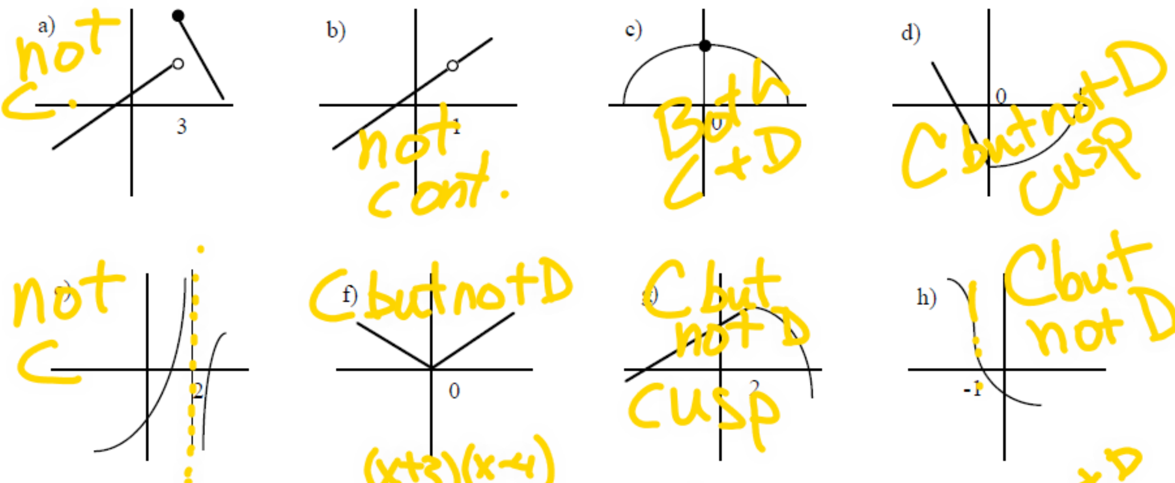


$$f(x) = \begin{cases} 1 - x, & x < 1 \\ x^2 + 2, & x \geq 1 \end{cases}$$

Look carefully @ piecewise functions

And, if a function is not continuous, then it can't be differentiable at $x = c$. $\boxed{\text{not } C \Rightarrow \text{ not } D}$

Example: determine whether the following functions are continuous, differentiable, neither, or both at the point.



i) $f(x) = x^2 - 6x + 1$

C & D

j) $f(x) = \dfrac{x^2 - x - 12}{x + 3}$

(x+3)(x-4)

not C @ x=-3

k) $f(x) = \sin x$

C & D

l) $f(x) = \dfrac{\sin x}{x}$

$f = \frac{0}{0}$ not C ∴ not D

a) $f(x)=\begin{cases} x^2-6x+10, x\geq 2 \\ 4-x, x<2 \end{cases}$

$f(2)=2^2-6\cdot 2+10$

$f(2)=2$

$$\left.\begin{aligned} \lim_{x\to 2^-}(4-x)&=2 \\ \lim_{x\to 2^+}(x^2-6x+10)&=2 \end{aligned}\right\} \lim_{x\to 2} f(x) \text{ exists and} =2.$$

$$f(2)=\lim_{x\to 2} f(x)$$

$f(x)$ is continuous @ $x=2$.

$$f'(x)=\begin{cases} 2x-6, & x\geq 2 \\ -1, & x<2 \end{cases}$$

$$\left.\begin{aligned} \lim_{x\to 2^-} f'(x)&=-1 \\ \lim_{x\to 2^+} f'(x)&=-2 \end{aligned}\right\}$$

The deriv is not continuous @ $x=2$.

$\therefore$ $f(x)$ is <u>not</u> differentiable @ $x=2$.

Is this function continuous at x= -1?