AP Calculus AB
Wednesday, August 28, 2013

1. Check Piecewise functions HW with each other. Write any questions on the board.

2. Complete the problems below. (This is from MMM02 at the top of page 16.

Example 1) For the function $f(x) = x^2 + 1$, find the following. Confirm c) on your calculator.

a) the slope of the secant line between $x = 1$ and $x = 3$

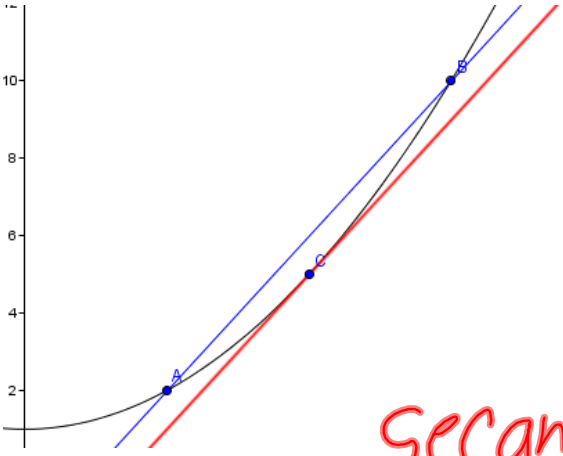
b) the slope of the tangent line at $x = 2$.

c) the equation of the tangent line at $x = 2$.

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

$y = 4x - 2$

$m = \dfrac{[f(x) - 5]}{[x - 2]}$



Average Velocity

At 1pm, I am on I-75 at mile marker 2. At 3pm, I am on I-75 at mile marker 10. What was my average velocity?

Secant line

$$\frac{10\text{ mi} - 2\text{mi}}{3 - 1} = \frac{8\text{ mi}}{2\text{ hrs}}$$

4 mph

How fast was I traveling @ 2pm? → tangent line
instantaneous velocity

Piecewise Functions WS.pdf - Adobe Reader

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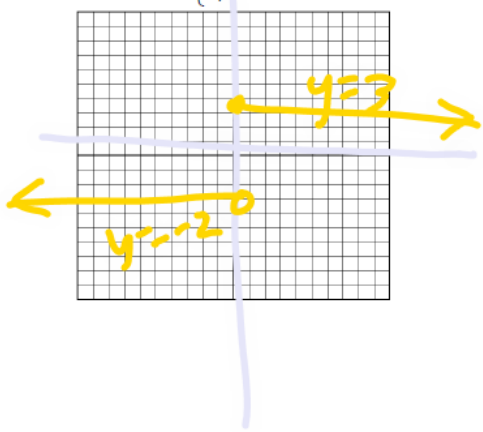
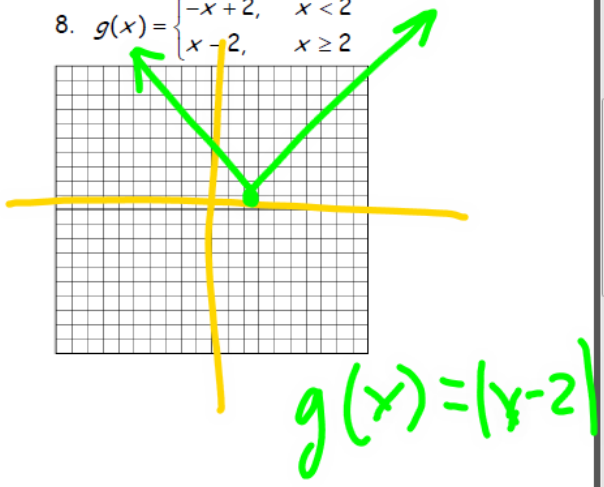
Graph the following piecewise functions.

7. $f(x) = \begin{cases} -2, & x < 0 \\ 3, & x \geq 0 \end{cases}$



8. $g(x) = \begin{cases} -x+2, & x < 2 \\ x-2, & x \geq 2 \end{cases}$



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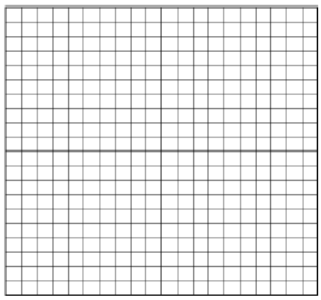
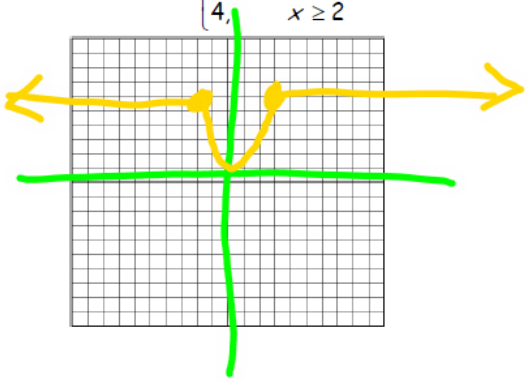
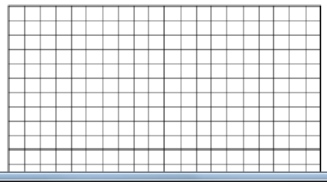
9. $h(x)=\begin{cases}-3x+2, & x\le 2\\ \frac{1}{2}x-4, & x>2\end{cases}$



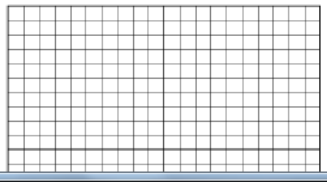
10. $f(x)=\begin{cases}4, & x\le -2\\ x^2, & -2<x<2\\ 4, & x\ge 2\end{cases}$



11. $g(x)=\begin{cases}3x+12, & x\le -3\\ |x|, & -3<x<3\\ -3x+12, & x\ge 3\end{cases}$



12. $h(x)=\begin{cases}x^2-4, & x<3\\ \frac{2}{3}x-5, & x\ge 3\end{cases}$



Let us suppose that an object is traveling along a straight line according to the formula $s(t) = 2t + 3$ where t is measured in seconds and $s(t)$ is measured in feet. Complete the chart.

t sec	0	1	2	3	4	5
$s(t) = 2t + 3$ ft	3	5	7	9	11	13

If we want to calculate the average velocity between $t = 0$ and $t = 4$, we know average velocity $= \dfrac{\text{total distance}}{\text{total time}}$

So, average velocity equals $\dfrac{11 - 3}{4 - 0} = 2$ measured in ft/sec.

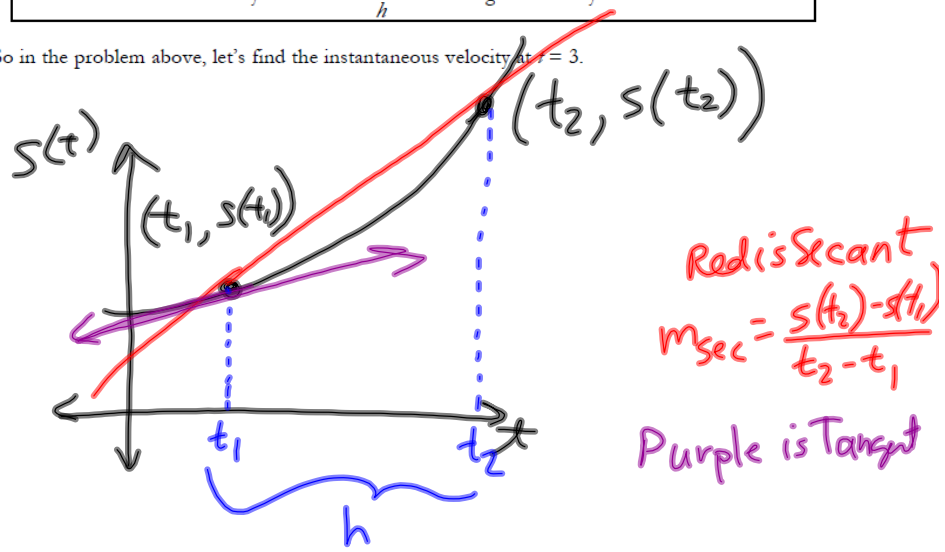
But, if we wish to calculate the instantaneous velocity at $t = 3$ seconds, we are interested in exactly how fast we are traveling at $t = 3$. This is not as easy to do.

Using the analogy above, we can now state 2 formulas which allow us to find both average and instantaneous velocity. slope of tangent line @ $t=3$ → 2 ft/sec

Two formulas you will need to know are: Given $s(t)$ as the distance traveled in time t

- Average velocity = $\dfrac{s(t_2) - s(t_1)}{t_2 - t_1}$
- Instantaneous velocity: $\dfrac{s(t_1 + h) - s(t_1)}{h}$ as h gets infinitely close to zero.

So in the problem above, let's find the instantaneous velocity at $t = 3$.



Red is Secant

$m_{sec} = \dfrac{s(t_2) - s(t_1)}{t_2 - t_1}$

Purple is Tangent

$t_2 = t_1 + h$

Use $(t_1, s(t_1))$ & $(t_1 + h, s(t_1 + h))$ to calculate slope.

$$m_{tan} = \frac{s(t_1 + h) - s(t_1)}{t_1 + h - t_1}$$

$$m_{tan} = \frac{s(t_1 + h) - s(t_1)}{h}$$

$h \to 0$

Classwork/Homework

6. For the function $f(x)=\frac{5}{x-3}$, find the following. Confirm c) on your calculator.

a) the slope of the secant line between $x = 4$ and $x = 6$

b) the slope of the tangent line at $x = 1$.

c) the equation of the tangent line at $x = 1$.

10. If $s(t)=t^2-3t+2$ is a measure of miles t[illegible], find

a) the average velocity between $t = 0$ and $t = 4$

b) the instantaneous velocity at $t = 1$ hour.

$m_{sec}=\frac{s(4)-s(0)}{4-0}=\frac{6-2}{4}=1$ mph

Watch & take notes on the six limit videos.

http://www.calculus-help.com/tutorials/

10b inst. vel at $t=1$

$s(t)=t^2-3t+2$

$m_{tan}=\frac{s(t_1+h)-s(t_1)}{h}$ $\rightarrow t_1=1$

$=\frac{s(1+h)-s(1)}{h}$

$=\frac{(1+h)^2-3(1+h)+2-(1^2-3\cdot 1+2)}{h}$

$=\frac{1+2h+h^2-3-3h+2-1+3-2}{h}$

$=\frac{h^2-h}{h}$

$=\frac{h(h-1)}{h}$

$=h-1$

$h\rightarrow 0$

$m_{tan}=-1$