Name Answer Key
Date 2012/2013 Period _____

Secant line/Tangent line Activity.

A **secant line** of a graph is a linear line that passes through two and only two points of the graph. How many secant lines are there for any nonlinear graph? infinite

1. Define slope: rise over run, steepness of a graph, rate of change, $\frac{y_2 - y_1}{x_2 - x}$

   Now is the time to make sure you are using the correct formula for slope.

2. Given the points $(x_1, f(x_1))$ and $(x_2, f(x_2))$, what is the formula to find the slope of that line? $m = \frac{f(x_2) - f(x_1)}{x_2 - x_1}$

3. The point $P(3, 1)$ lies on the curve $y = \sqrt{x-2}$.
   If Q is the point $(x, \sqrt{x-2})$, use your calculator to find the slope of the secant line PQ (correct to six decimal places) for the following values of x:

Value of x	Point Q	Slope of PQ
2.5	(2.5, 0.707107)	$\frac{0.707107 - 1}{2.5 - 3} = .585786$
2.9	(2.9, 0.94868)	.5132
2.99	(2.99, 0.99498)	.502
2.999	(2.999, 0.9995)	.5
3.001	(3.001, 1.0005)	.5
3.01	(3.01, 1.00499)	.499
3.1	(3.1, 1.04881)	.4881
3.5	(3.5, 1.22474)	.44948

4. What happens to the slope of the secant line as x approaches 3?

   The slope appears to be around 1/2.

This is one way to estimate the slope of a tangent line to a curve at a particular point. We could say that the slope of the tangent line to the curve at point P is 1/2.

5. **Velocity** is the change in position versus time. What happens if we just want to know the velocity at one particular point in time? (This is called **instantaneous velocity.**)

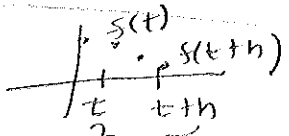
   We think of average velocity as the slope of the secant line obtained when looking at speed over a time interval.

6. If a ball is thrown into the air with a velocity of 40 ft/s, its height in feet t seconds later is given by $y = 40t - 16t^2$. Find the average velocity for the time period beginning when $t = 2$ and lasting the number of seconds indicated on the chart. (Hint: Look back to number two and the equation for the slope of a line.) $t=2$ $y=16$ $(2, 16_2)$ 16

Time lasting $(x_2 - x_1)$	Change in height $(y_2 - y_1)$	Slope of secant line (average velocity)
0.5 second $X=2.5$	$(Q - 16) = -16$	$\frac{-16}{.5} = -32$ ft/s
0.1 second $X=2.1$	$(13.44 - 16) = -2.56$	$\frac{-2.56}{2.1} = -25.6$ ft/s
0.05 second $x=2.05$	$(14.76 - 16) = -1.24$	-24.8 ft/s
0.01 second $X=2.01$	$(15.7584 - 16) = -.2416$	-24.16 ft/s

7. The instantaneous velocity for $t = 2$ seconds is given by the slope of the tangent line at $t = 2$. Based on your chart in number 6, estimate the instantaneous velocity when $t = 2$. [-24 ft/s]

$t=2 \qquad s(2) = 16$



$$\frac{s(t+h) - s(t)}{t+h - t} = \frac{s(t+h) - s(t)}{h} = \frac{s(2+h) - s(2)}{h}$$

$$= \frac{40(2+h) - 16(2+h)^2 - 16}{h} = \frac{80 + 40h - 16(4 + 4h + h^2) - 16}{h}$$

$$= \frac{-24h - 16h^2}{h} = -24 - 16h$$

$h = 0 \Rightarrow -24$