AP Calculus
Unit 1 – Limits
Group Assignment 1.1

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Name: _____

1. The following table shows the distance $d(t)$, in meters, travelled by a particle at time, t, in seconds.

t	9.8	9.9	10	10.1	10.2
$d(t)$	256.52	257.32	258.11	258.9	259.69

   a. Determine the average velocity of the particle over the time interval, $[9.8, 10.2]$. [2]

   b. Determine the instantaneous velocity of the particle at $t = 9.9$. [3]

2. The height (in ft) of a projectile fired vertically in the air with an initial velocity of 64 ft/s is given by $h(t) = 64t - 16t^2$.

   a. Determine the <u>simplified</u> expression for the average <u>velocity</u> of the projectile over the interval, $[1, t]$. [2]

   b. Use the expression from part (a) to find the average velocity over several arbitrary intervals $[1, t]$, with *t* close to 1 (from the left and right). [2]

c. Use the results from part (b) to explain and estimate the instantaneous velocity at time, $t = 1$. [1]

d. Evaluate the limit: $\lim_{t \to 1} \left(Average\ Velocity \right)$. [2]

e. Comment on your answer to part (d). [2]

3. a. $f(x) = \begin{cases} \sin^2 x + k \ ; \ x < -\dfrac{\pi}{2} \\ |x| \qquad ; \ x \geq -\dfrac{\pi}{2} \end{cases}$ Determine the value of *k* that makes $f(x)$ continuous at $x = -\dfrac{\pi}{2}$. [3]

b. $f(x) = \begin{cases} ax + \cos x \ ; \ x \leq \dfrac{\pi}{4} \\ bx + 2 \qquad ; \ x > \dfrac{\pi}{4} \end{cases}$ Show that $f(x)$ has no discontinuities when $a - b = \dfrac{8 - 2\sqrt{2}}{\pi}$. [3]