

MAT 275
September 12, 2007

Names _____

Please hand in one worksheet per group.

1. Suppose that the position of a car on a track with respect to time t is $x = 80 \cos(t)$, $y = 80 \sin(t)$.

(a) Sketch a graph of the car's position for $0 \leq t \leq 2\pi$.

(b) Calculate the velocity $\mathbf{v}(t)$ and acceleration $\mathbf{a}(t)$ of the car. On the graph of the car's position, sketch and label the velocity and acceleration vectors at $t = 0, \pi/4, \pi/2, \pi$.

(c) Show that the car has constant speed.

- (d) Find the unit tangent $\mathbf{T}(t)$ and unit normal $\mathbf{N}(t)$ vectors. On the the graph with the car's position, sketch the velocity, acceleration, unit tangent, and unit normal vectors at $t = 0, \pi/4, \pi/2, \pi$.

- (e) Find the tangential component of acceleration, a_T , and the normal component of acceleration, a_N . Interpret your results physically.

- (f) Show that $\mathbf{a}(t) = a_T\mathbf{T}(t) + a_N\mathbf{N}(t)$