

**MAT 275**  
September 14, 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) Find the unit tangent  $\mathbf{T}(t)$  and unit normal  $\mathbf{N}(t)$  vectors. On a graph with the car's position, sketch the velocity, acceleration, unit tangent, and unit normal vectors at  $t = 0, \pi/4, \pi/2, \pi$ .

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

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