Math 8
Winter 2020

Written Homework
Assigned Friday, February 14

Note: Standard (not preliminary) written homework is graded on your work and your explanations, not just on your answer.

Explanations are important for many reasons. Being able to communicate what you know shows a depth of understanding beyond that of being able to get the right answer to a problem. Doing the mental work of putting explanations into words helps create that depth of understanding. On exams, we will grade your work and not just your answers, so this is good practice for taking exams.

For all these reasons, be sure to: show all your work; explain your reasoning; use clear English; write neatly so all this effort does not go to waste.

Written homework is always due at 10:00 AM on the following Monday.

Assignment: An object moves in the plane with position function $\vec{r}(t) = \langle t, \cos(t) \rangle$.

1. Find the object's velocity, speed, and acceleration at any time t.

2. Find the tangential and normal components of the object's acceleration at the time $t = \pi$.

   (Recall that acceleration can be written as the sum of its tangential and normal components,

   $$\vec{a} = \vec{a}_{\mathbf{T}} + \vec{a}_{\mathbf{N}},$$

   where $\vec{a}_{\mathbf{T}}$ is parallel to the direction of motion and $\vec{a}_{\mathbf{T}}$ is normal (perpendicular) to the direction of motion.)

   Hint: This will be easier if you don't try to compute $\vec{a}_{\mathbf{T}}(t)$ and $\vec{a}_{\mathbf{N}}(t)$ for every t, just for $t = \pi$.

3. Using the fact that the magnitude of the normal component of acceleration is

   $$|\vec{a}_{\mathbf{N}}| = \left(\frac{ds}{dt}\right)^2 \kappa,$$

   where $\dfrac{ds}{dt}$ denotes speed and κ denotes curvature, find the circle in the xy-plane that best matches the object's path at time $t = \pi$.