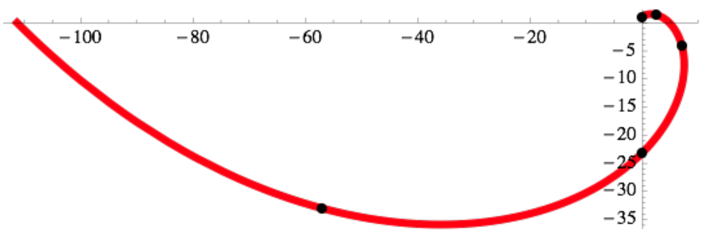
Assignment 1

A curve is described by $\vec{r}(t) = \langle e^t \sin t, e^t \cos t, 0\rangle$. Its graph over the interval $0 \leq t \leq \frac{3\pi}{2}$ is shown below along with points spiraling out from $(0, 1)$ plotted for t values of $0, \pi/3, 2\pi/3, \pi$ and $4\pi/3$.



1. Find the arclength function $s(t)$ where we measure the curve starting from $(0, 1)$ at $t = 0$. Use the arclength function to find the length of the curve graphed above ($0 \leq t \leq 3\pi/2$).

2. Solve the arclength function for t in terms of s and use this formula to parameterize $\vec{r}$ in terms of the arclength s; i.e. find $\vec{r}(s)$.

3. Using the result from the previous problem, find the coordinates of the point, accurate to nearest 0.1, at a distance of 120 along the curve from $(0, 1)$.

4. Find the curvature $\kappa(t)$.

5. Use the relation between t and s from part (2) to parameterize κ in terms of s; i.e. find $\kappa(s)$. From this result find the values of $\kappa(0)$ and $\kappa(5)$, the curvature at $(0, 1)$ and at the point five units along the curve from $(0, 1)$, respectively.

Note: Be sure to simplify your expressions as much as possible and to write you answers in a pleasing form. If you use Mathematica, Wolfram Alpha or similar tools, to do some of the calculations, you must print or take screen shots of the computations and hand them in with the rest of your work. All the answers, when appropriately simplified, should be fairly simple expressions. You can check your answers (approximately) by comparing them to the graph of the curve.