Curvature

Dr. Sarah's Differential Geometry

Welcoming Environment: Actively listen to others and encourage everyone to participate! Keep an open mind as you engage in our class activities, explore consensus and employ collective thinking across barriers. Maintain a professional tone, show respect and courtesy, and make your contributions matter.

Try to help each other! Discuss and keep track of any questions your group has. Feel free to ask me questions during group work time as well as when I bring us back together. I'll also try and monitor the open ended response at
`https://pollev.com/drsarah314`
and you can type questions or comments there if you prefer to contact me that way during class.

1. Sit in a group of 4 (if possible) and introduce yourselves to those sitting near you. What are their preferred first names?

2. If you have technology with you, like a phone, tablet, or computer, then answer the poll question on the front slide via responding at
   `https://pollev.com/drsarah314`
   If not, then answer in your notes.

3. Various curvatures will be important all semester long.

   (a) In Calculus with Analytic Geometry III, you may have seen the curvature of a plane curve $y = f(x)$ at the point x_0 as the scalar $\kappa = \dfrac{f''(x_0)}{(1 + f'(x_0)^2)^{\frac{3}{2}}}$. Compute this by-hand for $y = x^2$ and compare with your group.

   (b) Evaluate κ at $x_0 = 0$.

   (c) The tangent to a curve is the best fitting line. The radius of the best fitting circle, called the osculating circle, is $\dfrac{1}{\kappa}$, so what is the radius of the best fitting circle at $x_0 = 0$?

   (d) Sketch the curve $y = x^2$ by-hand.

   (e) Roughly add to your curve sketch what seems to you to be the best fitting circle at $x_0 = 0$ and compare with your group.

   (f) Does the best fitting circle have the same radius at other points? Discuss with your group and then write in your notes why or why not.

   (g) What happens to the curvature when $y = mx + b$?

4. Discuss with each other as you review content from the lines and Maple interactive video including, one at a time:

   1) $\alpha(t)$ is a curve that is a constant speed straight line iff the acceleration is $\vec{0}$.

   2) Why a line $l(t) = \vec{p} + t(\vec{q} - \vec{p})$ is shorter than any other curve $\alpha(t)$ between $\vec{p}$ and $\vec{q}$ in Euclidean geometry.

   3) Maple intro related to the cardioid and lines.

   What are significant takeaways of each? Also reflect on personal connections and/or any remaining questions you have. Each group member takes a turn for each. Try to help each other solidify and review!