

COMPUTER PROJECT 3

Space Curves, Arc Length, Curvature, and Torsion

DUE: 11/09/2020

Instructions: Use *Mathematica* to solve the following problems. Email a copy of your finalized notebook to byoung@wyoamingseminary.org with the subject "Computer Project 3."

For this project, you will be given a periodic space curve (with period 2π), $\vec{r}(t)$. The curve is different for each student and can be found on the next page.

- 1.) Use the `ParametricPlot3D` command to generate a plot of the space curve for $0 \leq t \leq 2\pi$.
- 2.) Use the `ArcLength` command to numerically compute the arc length of the curve over the interval $0 \leq t \leq 2\pi$. Make sure your answer is accurate to at least 3 decimal places. You will need to pass the option `WorkingPrecision` \rightarrow 10 to the `ArcLength` command.
- 3.) Use *Mathematica* to give a plot of the curvature of your space curve as a function of t over $0 \leq t \leq 2\pi$. You can use the command `ArcCurvature` to compute the function.
- 4.) Use the command `FindMaximum` to identify the point of maximum curvature. Give a second plot of the space curve where you explicitly mark this point.

Student Data

| Student | Space Curve |
|--------------|---|
| Yiqing Cao | $\langle 4 \sin^2(2t) + 2 \cos(3t), 2 \sin(2t) + 6 \cos^2(3t), \sin^2(t) + 6 \sin(2t) \cos(3t) \rangle$ |
| Hyewon Jo | $\langle 6 \sin^2(4t) + 5 \cos(3t), 5 \sin(4t) + 5 \cos^2(3t), \sin^3(t) + 6 \sin(4t) \cos(3t) \rangle$ |
| Yifei Liu | $\langle 6 \sin^2(4t) + 5 \cos(5t), 5 \sin(4t) + 6 \cos^2(5t), \sin^3(t) + 4 \sin(4t) \cos(5t) \rangle$ |
| Kaiqi Shen | $\langle 6 \sin^2(4t) + 4 \cos(3t), 4 \sin(4t) + 3 \cos^2(3t), \sin^3(t) + 6 \sin(4t) \cos(3t) \rangle$ |
| Xiyue Tan | $\langle 3 \sin^2(2t) + 6 \cos(5t), 6 \sin(2t) + 3 \cos^2(5t), \sin^3(t) + 4 \sin(2t) \cos(5t) \rangle$ |
| Roy Wang | $\langle 4 \sin^2(2t) + 4 \cos(3t), 4 \sin(2t) + 5 \cos^2(3t), \sin^3(t) + 3 \sin(2t) \cos(3t) \rangle$ |
| Yiheng Yan | $\langle 4 \sin^2(4t) + 5 \cos(5t), 5 \sin(4t) + 3 \cos^2(5t), \sin^3(t) + 5 \sin(4t) \cos(5t) \rangle$ |
| Tiange Yang | $\langle 6 \sin^2(2t) + 5 \cos(5t), 5 \sin(2t) + 5 \cos^2(5t), \sin^2(t) + 6 \sin(2t) \cos(5t) \rangle$ |
| Zherui Zhang | $\langle 4 \sin^2(2t) + 6 \cos(3t), 6 \sin(2t) + 2 \cos^2(3t), \sin^3(t) + 5 \sin(2t) \cos(3t) \rangle$ |