

APPM 2450 Calculus 3 Computer Lab  
Lab Exercise 8

Create a Mathematica notebook that does all of the following. Feel free to ask your neighbor or your lab instructor for help if you get stuck. Items with a  $\blacktriangleright$  are required, items with a  $\star$  are optional.

---

Review of all kinds of plots

- $\blacktriangleright$  Check out the help, and examples for `ContourPlot`, `PolarPlot`, `RevolutionPlot3D`, and `SphericalPlot3D` if you don't know how to use them.
- $\blacktriangleright$  Consider the equation  $x^2 + (y - 1)^2 = 1$ . Plot this equation using `ContourPlot`. (why might you want to use `ContourPlot` instead of `Plot`?) Then, convert this equation into Polar coordinates (by hand). Plot it using `PolarPlot`.
- $\blacktriangleright$  Doing plots in cylindrical coordinates is easy, as long as you have your equation written as  $z = f(r, \theta)$ . Try making plots of  $z = r^n$  for  $n = 1, 2, \frac{1}{2}$ . You will have to pick an appropriate domain for  $r$  and  $\theta$ .
- $\blacktriangleright$  Now try plotting  $z = \theta$ , and  $z = \sin(\theta) + r^2$ .
- $\blacktriangleright$  Plotting in Spherical is easy too! You just need  $\rho$  in terms of  $\theta$  and  $\phi$ ,  $\rho = f(\theta, \phi)$ . Try plotting  $\rho = 1$  for  $0 \leq \theta \leq 2\pi$ ,  $0 \leq \phi \leq \pi$ .
- $\blacktriangleright$  What does the equation  $\rho = 2 \cos(\theta)$  represent? Try it and see. Take a close look at your axes. Where is the center of this object? Be sure to plot this for  $0 \leq \theta \leq \pi$ ,  $0 \leq \phi \leq \pi$ .
- $\blacktriangleright$  Plot  $\rho = \sin(\theta + \phi)^2$  for  $0 \leq \theta \leq 2\pi$ ,  $0 \leq \phi \leq \pi$ . Play around with the options `PlotPoints` and `ViewPoint` until you know what this thing looks like.
- $\blacktriangleright$  Lets plot  $\rho^2 = 2\rho(\cos(\theta) \sin(\phi) - \cos(\phi)) + 2$ . Since we need  $\rho$  in terms of  $\phi$  and  $\theta$ , you'll have to use `Solve` to solve the above equation for  $\rho$  before you can plot it. Again, use  $0 \leq \theta \leq 2\pi$ ,  $0 \leq \phi \leq \pi$ .
- $\blacktriangleright$  Go to 'Cell', then 'Delete All Output'. Save your notebook as *YourLastName\_YourFirstName\_worksheet8.nb* and email as an attachment to your instructor.