**Mathematica Lab I**

*Visualizing 3-dimensional surfaces: Contour diagrams*



*(Lab report due:)*

Before beginning this lab, study the examples given in [graphing](http://www.math.luc.edu/~ajs/courses/263spring2017/Mathematica/examples/graphExamples.nb). Submit a *printed version* of your Mathematica notebook. *Copy the statement of each problem into your notebook.* You may work with other students and compare results, but ultimately you must submit *your own* lab results --- not a shared copy.

**I**  For each of the following surfaces, use Plot3D to plot the surface and ContourPlot to plot a contour diagram in the xy-plane. (Notice that by moving the mouse pointer over a level curve, you can see the value of the function on that particular level curve. Alternatively, you may use the ContourLabels command.)

1. z = sin(4x2 + y2)
2. z = x2 – y2
3. z = (x2 + 3y2) exp(1 – x2 – y2)
4. z = exp(– x2 – y2) sin(x2) cos(y2)
5. z = exp(– x2 – y2)

**II**  For each of the following implicitly-defined functions f(x, y, z) = 0, use ContourPlot3D to plot a particular level set that corresponds to the given surface. Of course, you will need to select an xyz-region wisely.

1. (x – 1)2 + y2 + (z – 3)2 = 4.
2. 9 ln(x2 + y2 + z2) = 1
3. x2 + z2 = 1
4. x + y2 – 4z2 = 1
5. sin x – (cos y)(x2 + z2)1/2 = 3

**III** For each of the following functions w = f(x, y, z),use ContourPlot3D to plot a contour diagram (that consists of several level sets). You may need to adjust **Opacity** to make the surfaces visible.

1. w = x2 + y2 + z2
2. w = x2 + y2
3. w = xyz
4. w = z2 – x2 – y2

**IV** Using **ParametricPlot3D** or **ParametricPlot**, graph each of the following parameterized curves:

1. (t) = (cos t) **i** + (sin t) **j** + t **k**
2. (t) = (cos t) **i** + (sin t) **j** + (1 – cos t) **k**
3. (t) = (cos t + t sin t) **i** + (sin t – t cos t) **j**
4. (t) = (t – sin t) **i** + (1 – cos t) **j**
5. (t) = (2+cos (24t)) cos (t) **i** + (2+cos (24t)) sin(t) **j** + sin(24t) **k**

**V** Using **PolarPlot**, graph each of the following curves:



Let ** vary from –/2 to 2. What shape do you see?

Now use: PlotSyle → {Red, Thickness[0.005]}

2. r = 1 + cos(100 **). Let ** vary from 0 to 2. Use PlotSyle → {Green}

*"It's very good jam," said the Queen.*

*"Well, I don't want any today, at any rate."*

*"You couldn't have it if you did want it," the Queen said. "The rule is jam tomorrow and jam yesterday but never jam today."*

*"It must come sometimes to ‘jam to-day,’” Alice objected.*

*"No it can't," said the Queen. "It's jam every other day; today isn't*

*any other day, you know."*

*"I don't understand you," said Alice. "It's dreadfully confusing."*

- Lewis Carroll, **Through the Looking Glass**



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