Calculus III – Technology Exercises

Create the following documents and email them to the instructor at james@richland.edu before the exam over that material. There are example solutions on the website.

Really important note! When creating Maxima files, do not use the numbered equations in any of your calculations. If you need to use a line later on, then assign it a label and use the label.

Chapter 11 – Vectors

There will be two files for this project. One will be a Word with graphs from DPGraph. The other will be an annotated Maxima file.

1. Use Word to make a document describing the six basic quadric surfaces. For each one, give the general equation of the quadric and then use DPGraph to sketch an example. If the quadric has a nice form in cylindrical or spherical coordinates, then include those forms as well.
2. Use Maxima to create new functions **norm(u)** and **proj(u,v)** that find the norm of a vector **u** and the projection of **u** onto **v**, respectively. Then use the functions (and others) to solve problems 100, 102, 106, and 110 from section 11.5.

Chapter 12 – Vector-Valued Functions

There will be two files for this project. The first is an annotated Maxima file with the calculations. The second will be a Winplot 3D graph for question 1.

1. Use Maxima to answer problem 12.4.78. Use Winplot to make a graph showing the vector on the TNB frame (similar to figure 12.73 and 12.74 but without the shading).
2. Use Maxima to rewrite problem 12.5.14 in terms of the arclength parameter *s*. Then use that to find the length of the curve.
3. Use Maxima to find the curvature for problem 12.5.44.

Chapter 13 – Multivariate Functions

There are two files for this project. One is a Maxima file. You will need to load("vect") in your Maxima program so you will have access to the *grad* function. Remember that you will need to *ev(express(grad(F)),diff)* to actually get Maxima to find the gradient of F. The other file is a Word document into which you've copied the Winplot graphs.

1. Use Winplot to sketch the level curves for problem 13.1.54. *Hint: Graph two functions, one equal to k and one equal to 1/k.*

2. Use Winplot to generate a contour plot for problem 13.8.18. Identify the interesting points on the graph. Then use Maxima find the relative extrema and saddle points.
3. Use Maxima to find the following. Consider the surface and point given in problem 13.7.12. Find a unit normal vector to the surface at the given point. Find the equation of the tangent plane at the point. Find symmetric equations of the normal line to the surface at the given point.
4. Use Maxima to work problem 13.10.18.

Chapter 14 – Multiple Integration

There will be two files for this project. One will be a Word document containing the graphs from DPGraph and Winplot. The other will be an annotated Maxima file.

1. Use DPGraph to sketch the solid described in problem 14.2.48 and then use Maxima to find the volume.
2. Use Maxima to answer problem 14.4.38.
3. Use Maxima to answer problem 14.5.16.
4. Use Maxima to answer problem 14.8.24. Graph the original region R and the transformed region S using Winplot.

Chapter 15 – Vector Analysis

There will be two files for this part. One will be a Word document containing the Winplot and DPGraph graphs. The other will be an annotated Maxima file.

1. Use Maxima to answer problem 15.1.58.
2. Use Maxima to answer problem 15.4.18. Use Winplot to graph the region.
3. Setup an iterated integral equal to $\iint_{\sigma} xyz\,dS$ by projecting σ onto a) the *xy*-plane, b) the *yz*-plane, and c) the *xz*-plane. Then use Maxima to evalute each integral and show they are equivalent. σ is the portion of the plane $2x+3y+4z=12$ in the first octant. Use DPGraph to sketch the surface σ.
4. Use Maxima to answer problem 15.7.14. Use DPGraph to sketch the solid.