Basic skills list for the 126 Midterm 2

The following is a collection of some of the things you are expected to be able to do on the second midterm. It is intended as a starting point, not as a comprehensive summary of the material. You are also expected to be able to combine these skills to solve more complex problems such as those that appeared in the assigned homework.

1. Unit tangents, unit normals, velocity and acceleration

   You should be able to:

   (a) Determine the unit tangent and principal unit normal for a space curve $\vec{r}(t)$

   (b) Find the velocity and acceleration vector functions for a particle whose motion is specified by $\vec{r}(t)$

   (c) Determine the positive vector function for a particle whose velocity or acceleration vector function is specified

   (d) Determine the tangential and normal components of acceleration of a particle whose motion is specified by $\vec{r}(t)$

2. Functions of Several Variables

   You should be able to:

   (a) Find, describe and sketch the domain of a given two variable function

   (b) Sketch and interpret level curves and contour maps of a given two variable function

   (c) Find the partial derivatives $f_x, f_y, f_{xx}, f_{xy}, f_{yx}$, and f_{yy} of a given two variable function $f(x, y)$, including by implicit differentiation

   (d) Find the equation of a tangent plane

   (e) Use linear approximation to approximate the value of a two-variable function

   (f) Compute and interpret a total differential

   (g) Find and classify all critical points of a function of two variables using the Second Derivative Test

   (h) Find global optima of a two-variable function on a closed region

   (i) Solve applied optimization problems involving functions of two variables

3. Multiple Integrals

   You should be able to:

   (a) Approximate double integrals using Riemann sums

   (b) Express the volume beneath a surface $z = f(x, y) > 0$ over a region R in the plane as a double integral

   (c) Evaluate double integrals over general regions

   (d) Reverse the order of integration to evaluate a double integral

   (e) Use polar coordinates to evaluate double integrals

   (f) Find the center of mass of a two-dimensional lamina with variable density.