Outcomes List for Math 200-200935
Multivariable Calculus (8th edition of text)
Spring 2009-2010

The purpose of the Outcomes List is to give you a concrete summary of the material you should know, and the skills you should acquire, by the end of this course. As an overall summary, you should be able to, after completing this course:

- Do basic calculations with vectors and related geometric shapes (lines and planes), using dot products, cross products, and vector calculations
- Do calculus with space curves, including finding velocity and equations of tangent lines
- Work with plots of multivariable functions, including the computation of level curves and level surfaces
- Use partial derivatives, including chain rule formulas
- Compute tangent planes to surfaces, find critical points, and check for max/min
- Work with cylindrical and spherical coordinates
- Work with parametric surfaces
- Do basic multivariable integrals
- Do change of variables in multivariable integrals

This outcomes list will be updated with specific review problems and topics for each exam of the quarter.

The following information is for reviewing for the material of Exam 3:

Exam 3 will cover sections 14.4, 14.5, 14.6, 14.7, and 14.8

14.4 Compute the local linear approximation to a function of two or more variables. Use total differentials to estimate maximum possible (and percentage) errors.

In addition to reviewing assigned problems from 14.4, look at (all references to section 14.4):

Examples 3, 4; Quick Check problem 4; Regular problems 38, 50

14.5 Compute partial derivatives with the various versions of the multi-dimensional chain rule. Compare your answer with the direct method of computing the partial derivatives.
In addition to reviewing assigned problems from 14.5, look at (all references to section 14.5):

Quick Check problems 1, 4; Regular problem 58

14.6 Compute the gradient, and use it to compute a directional derivative of any given function in any given direction. Use the fact that the gradient of a function \( f(x,y) \) is perpendicular (normal) to the level curves \( f(x,y) = c \).

In addition to reviewing assigned problems from 14.6, look at (all references to section 14.6):

Example 5; Quick Check problems 3, 4; Regular problems 57, 68

14.7 Use the local linear approximation to \( f(x,y) \) to compute the equation of a tangent plane. Given an implicitly defined level surface \( F(x,y,z) = c \), be able to compute the equation of the tangent plane at a point on the surface. Compute the parametric equations for the normal line. Use gradients to find tangent lines to the intersection curve of two surfaces. Find (acute) angles between tangent planes and other planes.

In addition to reviewing assigned problems from 14.7, look at (all references to section 14.7):

Example 3; Quick Check problems 1, 2; Regular problems 16, 22

14.8 Use the partial derivatives to find critical points (possible locations of maxima or minima). Use the Second Partials Test for functions of two variables to determine whether a critical point is a relative maximum, relative minimum, or a saddle point. Solve word problems involving maxima and minima. Compute absolute maxima and minima on closed regions.

In addition to reviewing assigned problems from 14.8, look at (all references to section 14.8):

Example 5; Quick Check problem 2; Regular problems 12, 39

The preceding information is for reviewing for the material of Exam 3
The following information is for reviewing for the material of Exam 2:

Exam 2 will cover sections 12.1, 12.2, 13.1, 11.7, and 13.3

12.1 Work with and recognize simple parameterized curves (i.e. graphs of vector-valued functions), including lines and helices. Find the domain of vector-valued functions.

In addition to reviewing assigned problems from 12.1, look at (all references to section 12.1):

Example 6; Quick Check problems 1, 3: Regular problem 42

12.2 Differentiate vector-valued functions for curves in the plane and in space. Compute the equation for a tangent line to a curve; describe the tangent line as a vector equation and as a set of parametric equations. Determine (acute) angles between tangent lines. Use differentiation formulas involving cross-products and dot products. Evaluate indefinite and definite integrals of vector-valued functions. Solve vector initial-value problems.

In addition to reviewing assigned problems from 12.2, look at (all references to section 12.2):

Examples 3, 4, 9; Quick Check problem 4; Regular problems 24, 50

13.1 Describe and sketch the domain of a function of two or more variables. Evaluate functions of two or more variables. For functions of two variables, compute level curves.

In addition to reviewing assigned problems from 13.1, look at (all references to section 13.1):

Quick Check problem 3; Regular problems 22, 39, 41, 46

11.7 Compute traces of quadric surfaces, and recognize the resulting conic sections in the given plane. Given an equation for a quadric in standard form, be able to recognize the type of the quadric (and in particular, its graph).

In addition to reviewing assigned problems from 11.7, look at (all references to section 11.7):

Tables 11.7.1, 11.7.2; Quick Check problems 1, 4; Regular problems 27, 29, 34, 36
13.3 Compute first-order and second-order partial derivatives. Do implicit partial differentiation. Do various word problems involving rates of change, which use partial derivatives.

In addition to reviewing assigned problems from 13.3, look at (all references to section 13.3):

Quick Check problems 2, 3; Regular problems 53, 62

The preceding information is for reviewing for the material of Exam 2
The following information is for reviewing for the material of Exam 1:

Exam 1 will cover sections 11.1, 11.2, 11.3, 11.4, 11.5, and 11.6

11.1 Work with rectangular coordinates and work with equations of spheres, and "cylindrical surfaces", which are generalizations of regular cylinders.

In addition to reviewing assigned problems from 11.1, look at (all references to section 11.1):
Quick Check problem 4; Regular problems 18, 33, 55

11.2 Add vectors and do scalar multiplications. Compute lengths of vectors. Use vectors for basic geometry and force problems.

In addition to reviewing assigned problems from 11.2, look at (all references to section 11.2):
Example 8; Quick Check problem 4; Regular problems 27, 40

11.3 Compute a dot product, and use it to find the length of a vector. Use dot products to compute the angle between two vectors; in particular, how to check if two vectors are orthogonal. Compute the direction cosines of a vector. Decompose vectors into orthogonal components. Compute the orthogonal projection of one vector onto another.

In addition to reviewing assigned problems from 11.3, look at (all references to section 11.3):
Example 7; Quick Check problems 2, 4; Regular problems 4, 22

11.4 Compute a cross product, particularly using the determinant formula. Use a cross product to find a vector perpendicular to two given vectors. Use a cross product to find areas of parallelograms, and use a cross product together with a dot product to compute volumes of parallelepipeds.

In addition to reviewing assigned problems from 11.4, look at (all references to section 11.4):
Regular problems 12, 30, 34

11.5 Find the parametric equations of a line that satisfies certain conditions by finding a point on the line and a vector parallel to the line. Check if two lines in space are parallel, skew, or intersect. Determine where a line intersects a surface.
In addition to reviewing assigned problems from 11.5, look at (all references to section 11.5):

Example 3; Quick Check problems 2, 4; Regular problems 17, 27, 47, 55

11.6 Find the equation of a plane that satisfies certain conditions by finding a point on the plane and a vector normal to the plane. Find the parametric equations of the line of intersection of two (non-parallel) planes. Find the (acute) angle of intersection between two planes.

In addition to reviewing assigned problems from 11.6, look at (all references to section 11.6):

Examples 6, 7; Regular problems 26, 29

The preceding information is for reviewing for the material of Exam 1.