Studyguide for Math 2110Q

Section 3, Fall 09, Arend Bayer

The final will cover the material of the entire semester. About a third of the final will be based on chapter 16. All final problems on material from 16.4 on (i.e., anything not covered by the midterms) will be fairly similar to one of the odd-numbered problems in the lists below.

Of course, you should also go through the midterms and quizzes. Don't hesitate to stop by my office or e-mail me if you have questions on one of the midterm or quiz problems.

Sect	**What you should be able to do**
12.1.	draw points in 3-space (2-6); find the distance between two points (7-8); the equation of a sphere (12-18)
12.2.	add/subtract vectors – in coordinates or by drawing (4-6, 13-20); compute the displacement vector between two points (7-12); multiply a vector by a scalar; find the length of a vector (21-23, 24);, go back and forth between the representation of a vector in terms of standard basis vectors, or in terms of coordinates
12.3.	compute the dot product of two vectors (3-10); basic properties of the dot product (Box 2 in the book); the geometric interpretation of the dot product (11-12, 15-22; check whether two vectors are orthogonal (13, 23-27); compute the direction angles of a vector (29-33); compute the vector projection and scalar projection of one vector onto another vector (35-40).
12.4.	compute the cross product of two vectors (1-12); the geometric interpretation of the cross product (14-18); basic properties of the cross product (Thm 8); find vector orthogonal to two given vectors (19,20. 29-32); compute the area of a parallelogram determined by two vectors (27-32); compute the volume of a parallelpiped determined by three vectors (33-36)
12.5.	various forms of equations for lines: vector, parametric, symmetric; go back and forth between these (2-12); find these equations for the line through two points (6-9); determine whether lines are parallel or skew or perpendicular or intersecting (13-14, 19-22); find equations of parallel or perpendicular lines (15-16); vector equation of a line segment (17,18); various forms of equations for a plane: vector, scalar, linear and go back and forth between these (23-28); find these equations for a plane passing through 3 points; intersection of a line with a plane (43-47); find line that is intersection of two planes (55-58); determine whether planes are parallel or perpendicular or neither (49-54); distance from a point to a plane (69-70); distance between parallel planes (71-72); distance between skew lines (75-76).
12.6.	go back and forth between basic shapes of quadric surfaces and the equations defining them (match quadric surfaces and their equations) (21-28).
13.1.	find vector and parametric equations for line segments (15-18); match curves defined by vector equations with their graphs (19-24).
13.2	find derivative of a vector function (3-16); find (unit) tangent vector at a point on a curve described by a vector function (17-22); find tangent line to a curve described by a vector function at a given point (23-29); differentiation rules; definite and indefinite integrals of vector functions (33-38).
13.3	find the arc length of a curve (1-9,11-12); find the curvature of a curve at a given point (it is useful to know the different formulas for doing this) (17-29); find normal and binormal vectors as well as normal and osculating planes for a point on a curve (17-20, 43-46).
14.1	evaluate functions in several variables (5-10); find domain and range of functions in several variables (11-20); find level sets of functions in two variables (39-46); match functions with their graphs (30, 55-60); match functions with their level sets (55-60); sketch a function from a level set (35-38).

Sect	What you should be able to do
14.2	show in examples that limit does not exist and find limits (using continuous functions) (5-12, 14,15,18-22); determine where a function is continuous (29-38).
14.3.	compute partial derivative (15-42, 61-68); estimate partial derivatives from tables (1-4); estimate partial derivatives from graph or level set of function (5-8, 10); use implicit differentiation to find partial derivatives (45-50).
14.4.	find the equation of a tangent plane of a surface at a point (1-6); find linearization at a point and use it (11-19, 21).
14.5.	use the chain rule to compute (partial) derivatives of compositions of functions (1-15); application to real world examples (35-43); use chain rule to find implicit dervatives (Equation 6; problems 27-30).
14.6.	find gradient vector and directional derivative in direction of a vector (7-19); find maximal value of directional derivative at a point (21-26); real world applications (30-35); estimate directional derivative at a point from level set (36, 38)
14.7.	find local maxima and minima of functions (1-18); find absolute minima and maxima of functions on a set (29-36); set up functions from word problems and find maxima/minima of such functions (31-51);
15.1.	estimate double integrals (in particular volumes) using Riemann sums (3a,4a)
15.2	compute double integral over rectangle using Fubini's theorem (1-22); compute volumes of solids (23-31); compute average value (35-36)
15.3	compute double intgrals over general regions (1-18); find volumes of solids (19-28); simplify integrals by changing order of integration (39-50); find average value (55-56)
15.4	evaluate double integral using polar coordinates (7-14, 29-32); determine areas of regions and volumes of solids by integration using polar coordinates,(15-27, 33-34); decide whether to use polar coordinates or usual coordinates (1-4)
15.6	evaluate triple integrals (3-18); find volume of solid (19-22).
15.7	convert cylindrical coordinates to rectangular coordinates and vice versa (1-4); describe regions in cylindrical coordinates (1-13); use cylindrical coordinates to compute volumes (15-16); use cylindrical coordinates to compute triple integrals (17-23a, 27-28)
15.8	convert spherical coordinates to rectangular coordinates and vice versa (1-4); describe surfaces and solids using spherical coordinates (5-16); compute triple integrals using spherical coordinates (17-30, 35, 36, 39,40)
15.9	compute the Jacobian of a transformation (1–6); express images of regions of transformations (7–10); use the change of variables formula to evaluate an integral (11-16).
16.1	match vector fields with their plots (11-18), find gradient vector fields (21-26).
16.2	evaluate line intgrals over curves (1-16); evaluate line integrals of vector fields (19-22); compute work done by force fields (39-44,47). **Remember the difference between line integral of a function (equation 3) and line integral of a vector field (defition 13).**
16.3.	conservative vector fields (3-10); apply Fundamental theorem of line integrals (12-18, 21-22).
16.4.	apply Green's theorem (5-14, 17-19).
16.5.	compute curl and divergence of vector field (1-8); determine whether a vector field is conservative, and find a function f with $\nabla f = F$ (13-18); decide whether a vector field is the curl of another vector field (19-20).
16.6.	identify surfaces given parametrically (3-6); parametrize surfaces (19-26).
16.7	compute the surface integral of a vector field (19-30)
16.8	Use Stokes' Theorem to compute flux (2-6) and line integrals (7-10); verify Stokes' Theorem (13-15).
16.9	**Snow!**