Math 240 Review 1 Name:

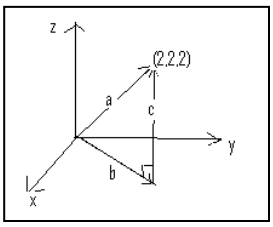
This is only the review and besides this, you should redo all Hw, Quiz problems with problems done in class. This exam is based upon sections 9.1 thru 9.7 and some theorems, facts, or formulas will be asked to prove, show or derive in the exam.

1. Describe and sketch the following in rectangular coordinates.

(a) The intersection of the surfaces given in cylindrical coordinates by $\theta = \frac{\pi}{4}$ and $\theta = \frac{2\pi}{3}$.

(b) The intersection of the surfaces given in spherical coordinates by $\rho = 1$ and $\theta = \frac{\pi}{2}$.

2. Find $b \times c$ from the graph shown to the right side.



3. Let $a = (x+y)i + 2j + yk$ and $b = 3i + (4x+y+1)j + 4k$.
(a) Find values of x and y such that $a \perp b$ (orthogonal).
(b) Find the values of x and y such that a is parallel to b.

4. Let a, b and c be three vectors in the plane 3x-5y+6z=7. Compute (-a+4b-7c) • (-3i+5j-6k).

5. Describe and sketch the following in space defined by the following equations.

(a) $y = -z + 1$ (b) $x^2 + 4y^2 + z^2 = 4$ (c) $y^2 - \frac{1}{9}z^2 = 1$ (d) $z = \sqrt{9 - x^2 - y^2}$

(e) $z = x^2 + y^2$ (f) $z = \sqrt{x^2 + y^2}$ (g) $0 \le y \le \sqrt{1 - x^2 - z^2}$

6. Calculate the given quantity if $a = i + j - 2k, b = 3i - 2j + k$ and $c = j - 5k$.
(a) $\text{comp}_a b$ (b) $\text{proj}_a b$ (c) The angle between a and b (d) $a \bullet (b \times c)$ (e) $\text{comp}_b a$ (f) $\text{proj}_b a$

7. Find the equation of the following.

(a) The line thru (4,-1,2) and parallel to the line $\frac{1}{3}(x-4) = \frac{1}{2}y = z + 2$.

(b) The plane thru (3,-1,1),(4,0,2) and (6,3,1)
(c) The line of intersection of the planes $x - z = 1$ and $y + 2z = 3$.

8. Suppose A, B, and C are mutually orthogonal vectors. Let D=5A-6B+3C.
If A,B, and C are unit vectors, find ||D||.

9. Fill in the blanks in the table to the right.

Rectangular	Cylindrical	Spherical
	$(1, \pi/2, 1)$	
		$(\sqrt{3}, 3\pi/2, \pi/3)$
$(1, \sqrt{3}, -1)$		

10. What points satisfy the equations $r = 2, \theta = \pi/4$?

11. The parallelogram ABCD has vertices at A(2,-1,4), B(1,0,-1), C(1,2,3) and D. Find
(a) the coordinates of D.
(b) the cosine of the interior angle at B.
(c) the vector projection of $\overrightarrow{BA}$ onto $\overrightarrow{BC}$.
(d) the area of the parallelogram ABCD.
(e) the equation of the plane of the parallelogram.

This is a brief outline of the main topics we had in class.

Chapter 9. Vectors and the geometry of spaces
9.1 Three-dimensional coordinates systems
Coordinates planes and their equations
Distance and midpoint between two points
The equation of the sphere at (a,b,c) and a radius r
Finding the center and radius of a sphere,
Finding the region given by an inequality

9.2 Vectors
Vector addition, subtraction, constant multiple of a vector
Vector representation $\overrightarrow{AB}$ from two points A and B and its length
Vector notation using i, j, and k, standard basis vectors and $\langle a,b,c\rangle$
Finding the unit vector in the direction of the given vector
Application: resulting force vector, example 7 in page 645

9.3 The dot product
Two methods to find the dot product of two vectors
Finding the amount of work done by the force vector
The angle between two vectors
Properties of dot product
Projections: scalar projection and vector projection and rewrite the given vector as a sum of vector projection and its orthogonal projection

9.4 The cross product
Two methods to find the cross product of two vectors
Properties of cross product
The area of parallelogram spanned by two vectors
The volume of parallelepiped spanned by three vectors
Triple scalar product, coplanar
Distance from a point to a line and distance from a point to a plane

9.5 Equations of lines and planes
Equation of a line thru two points: vector equation, parametric equation, symmetric equation
Two lines: parallel, intersecting, skew
Equation of a plane thru three points or having two vectors
The angle between two planes and intersecting line
Extra: distance between planes and between skew lines

9.6 Functions and surfaces
Domain and range of functions with two variables
Graphs of several functions of two variables: cylinders, planes, quadric surfaces
Traces and cross sections
Matching the functions with graphs

9.7 Cylindrical and spherical coordinates: Only Cylindrical coordinates
Change from rectangular to cylindrical or cylindrical to rectangular
Identify or describe the surface given by cylindrical coordinates