

Math 241, Exam 1 Information

Exam 1 will be based on:

- Sections 12.1 - 12.6, 13.1, 13.2.
- The corresponding assigned homework problems
(see <http://www.math.sc.edu/~boylan/SCCourses/241Sp09/241.html>)
At minimum, you need to understand how to do the homework problems.
- Lecture notes: 1/12 - 2/6.

Topic List (not necessarily comprehensive):

You will need to know how to define vocabulary words/phrases defined in class.

§12.1: **3-space.** Distance formula and equations for spheres.

§12.2: **Vectors.** Arithmetic (e.g., addition, subtraction, scalar multiplication); what is the geometric meaning of addition of two vectors? subtraction?; the **norm** of a vector; **unit vectors**; normalizing a vector to make it a unit vector; the vectors $\vec{i}, \vec{j}, \vec{k}$.

§12.3: **Dot product and projections.** Basic properties; cosine formula for the angle between two vectors; how can you test whether two vectors are orthogonal (perpendicular)?; orthogonal projections (our notation for the orthogonal projection of a vector \vec{v} on a vector \vec{b} is $\text{proj}_{\vec{b}}\vec{v}$); what is the formula for the orthogonal projection?

§12.4: **Cross product.** Computation of the cross product (using the determinant formula); basic algebraic properties (it is not commutative!); geometric properties (mainly, that $\vec{u} \times \vec{v}$ is orthogonal to both \vec{u} and \vec{v} ; sine formula for the norm of a cross product; the norm of a cross product as the area of a parallelogram.

§12.5: **Parametric equations of lines.** What two things are necessary for writing down parametric equations for a line? (a point on the line, and the direction of the line, given by a **direction vector**); how do you write parametric equations for a line in vector form? How can you tell whether:

- Two lines are parallel?
- Two lines are skew?
- Two lines intersect?
- Two lines are the same line?

§12.6: **Planes.** What two things are necessary for writing down the equation of a plane? (a point on the plane and the direction perpendicular to the plane, given by a **normal vector**); how can you tell whether:

- two planes are parallel?
- two planes are perpendicular?
- a line and a plane are parallel?
- a line and a plane are perpendicular?;

compute the distance between the following objects (assumed to be non -intersecting so the distance makes sense):

- a point and a plane;
- a point and a line;
- a line and a plane;
- two planes;

find the intersection (if any) of a line and a plane.

§13.1: **Vector-valued functions.** What is a vector-valued function?

§13.2: **Calculus of vector-valued functions.** Limits, derivatives, and integrals of vector-valued functions; tangent lines to graphs of vector-valued functions, geometric interpretation of derivative of a vector-valued function.