

## Math 241S Fall 2015- Review Sheet for 1<sup>st</sup> Exam

The first midterm is Thursday October 1 and will cover All of Chapter 12-13 plus 14.1-3. As a good first step make sure you understand all the quiz problems and homework problems and examples worked out in class.

### Definitions/Formulas to know:

- Distance formula, equation of a sphere
- Difference between vector quantities and scalar quantities.
- Vector addition and scalar multiplication and properties (p. 802)
- Dot product and cross product, including properties (p. 807, 819)
- Direction angles and direction cosines.
- Right hand rule.
- Work, torque
- Scalar and vector projection.
- Unit vector
- Vector, parametric and scalar equations of a line, parameter
- Vector and scalar equations of a plane
- Cylinder
- Space curve, component functions
- Derivative of space curve, tangent vector, tangent line, unit tangent vector
- Differentiation rules (p. 858)
- Arc length formula, arc length function.
- Parameterized by arc length.
- Curvature formula for  $r(t)$
- Unit normal vector, osculating plane to a space curve.
- Velocity vector, acceleration vector, speed
- Newton's second law of motion
- Limit of a multivariable function, continuity.
- Partial derivatives.
- Clairaut's theorem.

### Skills you should have:

- Neatly sketch surfaces in three dimensions, planes, hyperboloids, cylinders, etc.. Sketch level curves/level surfaces to assist in this.
- Match sketches of surfaces with equations.
- Describe regions of  $\mathbf{R}^3$  given by inequalities, sketch the regions.
- Find and sketch the domain of a multivariable function.
- Add vectors geometrically (with pictures) or algebraically. Find a unit vector in a given direction.
- Decide if 2 vectors are perpendicular or parallel, find the angle between two vectors, between two lines, between two planes.

- Find the scalar and vector projection of a vector onto another vector.
- Find area of parallelogram or the volume of parallelepiped.
- Find vector, parametric and scalar equation of lines given a point and a direction or two points.
- Find vector and scalar equation of a plane given three points, or two vectors in the plane, or a point and a normal vector.
- Sketch space curves, including labeling the direction of increasing  $t$ .
- Determine if two particles have intersecting paths, also do they collide.
- Find unit tangent vectors to a space curve at a given point, also the tangent line to a space curve.
- Calculate the arc length of a curve.
- Determine the curvature of a curve.
- Interpret derivatives of a parameterized curve as velocity and acceleration and use this to solve projectile problems.
- Calculate partial derivatives and understand how to interpret them.
- Estimate partial derivatives given a table of values.
- Estimate partial derivatives given the graph  $z=f(x,y)$ .