Topics for Exam 1
Math 32, Fall 2015

General information. Exam 1 will be a timed test of 75 minutes, covering 12.1–12.6 of the text, along with the material reviewed on HW01. Most of the exam will be based on the homework assigned for those sections. If you can do all of that homework, and you know and understand all of the ideas behind it, you should be in good shape.

You are allowed to use a calculator and notes on **ONE** 3×5 note card (both sides).

As mentioned above, your first priority should be to understand the homework and quizzes and the ideas behind them. Besides the list of things you should know, below, you should also be familiar with everything specially emphasized in the text. If time permits, try to do some of the problems that have answers in the back of the book.

Section 12.1. Standard (right-hand rule) picture of xyz-axes. Definitions: coordinate planes, octants. Plotting 3-D points. Distance formula in 3-D, equation of a sphere.

Section 12.2. Idea of vectors: Definition, vector addition, scalar multiplication, through pictures. Computing with vectors: components, vector addition, scalar multiplication, magnitude/length. Properties of vectors. Special vectors: **i**, **j**, **k**, unit vectors. Applications (statics).

Section 12.3. Definition of dot product; basic algebraic properties. Geometric interpretations: angle ($\cos\theta$ formula), orthogonality. Projections.

Section 12.4. Definition of cross product (3×3 determinant trick). Geometric properties: $\mathbf{a} \times \mathbf{b}$ is orthogonal to both **a** and **b**, magnitude $|\mathbf{a}|\,|\mathbf{b}|\sin\theta$; right-hand rule; $\mathbf{a} \times \mathbf{b} = \mathbf{0}$ if and only if parallel. Algebraic properties 1–4. Applications: volume of parallelopiped, torque.

Section 12.5. Equation of a line: vector equation, parametric equations. When lines are parallel, perpendicular, skew; angle between two lines. Equation of a plane: point-normal form, $ax + by + cz = d$ form. When planes are parallel, perpendicular; angle between two planes. Tricks involving the cross-product.

Section 12.6. Cylinders in 3-D (2-variable equations graphed in 3-D). Quadric surfaces: ellipsoids, paraboloids, saddles (hyperbolic paraboloids), cones, hyperboloids.

Review topics. Computing derviatives and integrals (see gateway exams). In 4.3: Increasing/decreasing test, concavity test (THE BOX); critical points, first derivative test, second derivative test. In 5.2: Definition of definite integral in terms of Riemann sums; interpretation of definite integral in terms of areas. In 5.3: Fundamental Theorem of Calculus (p. 401) and its use in curve-sketching (pp. 394–395).

Not on exam. (12.3) Direction cosines. (12.4) Algebraic properties 5–6 (p. 818). (12.5) Symmetric equation of a line; equation of a line segment; distance from a point to a plane.