Calculus 3, Chapter 12 Study Guide

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The following is a *brief* list of topics covered in Chapter 12 of *Thomas' Calculus*. Test questions will be chosen directly from the text. This list is not meant to be comprehensive, but only gives a list of several important topics. I reserve the right to ask you definitions and theorems on the tests. If I do so, then I will choose from the **bold-faced** items below.

12.1 Three-Dimensional Coordinate Systems. Right-hand coordinate system, coordinate planes, octants, distance between points.

12.2 Vectors. Vector between points (initial point, terminal point), vector notation (versus point notation), magnitude, vector addition, scalar multiplication, Parallelogram Law of Addition, algebraic properties of vector operations, standard unit vectors, linear combination, direction of a vector, midpoint of a line segment, physics problems (with forces).

12.3 The Dot Product. Angle between two vectors (in 2-D or 3-D), dot product, **definition of orthogonal vectors**, algebraic properties of dot products, **projection of one vector onto another**, work.

12.4 The Cross Product. **Definition of cross product** (in terms of magnitudes and $\sin\theta$), algebraic properties of cross product, symbolic determinant computation of a cross product, area of a parallelogram in terms of cross products, torque, **scalar triple product**, volume of a parallelepiped in terms of scalar triple product.

12.5 Lines and Planes in Space. Vector equation for a line, standard parametrization of a line, distance from a point to a line, equation for a plane in 3-D and normal vectors to a plane, distance from a point to a plane.

12.6 Cylinders and Quadric Surfaces. Cylinder and generating curve; quadric surface; examples of quadric surfaces: ellipsoid, elliptical paraboloid, elliptical cone, hyperboloid of one sheet, hyperboloid of two sheets, hyperbolic paraboloid; ability to recognize the graph of a quadric surface from the equation for the surface.