Study Guide for Test #1 for MA242

1. Chapter 1: You should know:
   (a) How to add and subtract vectors and multiply a vector by a scalar.
   (b) How to compute the magnitude of a vector.
   (c) How to make a vector into a unit vector.
   (d) How to use the dot product to find angles between vectors and to determine orthogonality of vectors.
   (e) How to decompose one vector **orthogonally** with respect to another vector.
   (f) How to use the cross product to produce a vector orthogonal to two given non-parallel vectors.
   (g) How to use the cross product to determine if two non-zero vectors are parallel.
   (h) How to use the cross product to find the area of a parallelogram spanned by two vectors.
   (i) How to find equations of lines and planes. (See the exercises with solutions in section 1.5)

2. Chapter 2: You should know:
   (a) The calculus of vector-valued functions (VVFs) (Section 2.1): How to compute limits of VVFs; derivatives and integrals of VVFs.
   (b) How to describe a curve C as a parameterized curve in space: i.e. by giving $\vec{r}(t) =< x(t), y(t), z(t) >$ for $a \leq t \leq b$.
   (c) The basic quantities defined by a curve, namely:
      i. Tangent vector $\frac{d\vec{r}}{dt}$.
      ii. Magnitude of tangent vector $||\frac{d\vec{r}}{dt}||$.
      iii. The unit tangent vector $\hat{T}$
      iv. The definition of arc length of a curve and the arc length function $s(t)$.
      v. The Curvature of a curve κ
      vi. The unit normal vector $\hat{N}$
      vii. The unit binormal vector $\hat{B}$
      viii. The orthogonal decomposition of the acceleration $\vec{r}''$ into its **tangential** and **normal** components a_T and a_N, respectively.
      ix. How to compute a_T and a_N and κ in the simple way described in section 2.4
      x. How to compute the osculating plane and the osculating circle.
      xi. The details of projectile motion under the action of gravity.