# MATH 311 – TOPICS for EXAM 1

**Vector algebra** (Chapter 1)

- Geometry.
  - *add, subtract, multiply vectors geometrically*
  - *proof relations in triangles, parallelograms, etc*
- Dot Product. Cross Product.
  - *evaluate them.*
  - *magnitude. direction of cross product.*
  - *find projections and orthogonal projections. apply.*
- Equations of lines and planes
  - *find equations of lines/planes*
  - *find intersections of lines/lines, lines/planes, planes/planes*
  - *find angles between lines/lines, lines/planes, planes/planes*

**Space curves** (Chapter 2)

- Derivatives, Differentiation rules.
- Arclength.
- Tangent, Normal, Binormal vectors.
- Velocity, speed, acceleration, curvature, torsion.
  - *Find all of the above for a given curve* $\mathbf{r}(t)$
  - *Note: the only equation you will be given if needed is* $d\mathbf{B}/ds = -\tau\mathbf{N}$, *where* $\tau$ *is the torsion.*
- Velocity and acceleration for planar motion in polar coordinates.
  - *Be able to derive and use the formulas*

**Scalar and Vector Fields** (Chapter 3)

- Gradient.
  - *know meaning of magnitude and direction*
  - *find directional derivatives*
  - *find normals to surfaces*
- Vector fields
  - *plot vector fields and integral curves (particle trajectories)*
- Divergence and curl
  - *compute and interpret*
- Laplacian
- Vector identities