## Planning your midterm review

1. Vectors (12.2-12.4)
(a) Computing sum, scalar product, dot product and cross product of vectors.
(b) The geometry of sum, scalar product, dot product and cross product of vectors.
(c) Applications: Determining when vectors are paralell or perpendicular. Computing angle between them. Areas of parallelograms and triangles. Projections.
2. Equations of lines and planes (12.5)
(a) You need a point and a direction vector for the vector equation of a line. After finding that, you can convert it to parametric equations or symmetric equations. Two points in space or two intersecting planes determine lines.
(b) You need a point and a normal vector for a plane equation. Three (non linear) points, a line and a point not on the line, two parallel lines and two intersecting lines determine planes.
(c) Can you compute distances between points, lines and planes using vectors?
3. Surfaces in space given by single equations with $x, y$ and $z$ (possibly not all three) (12.6)
(a) Planes
(b) Generalized cylinders where one of the variables is missing
(c) Quadratic surfaces $A x^{2}+B y^{2}+C z^{2}+D x+E y+F z+G=0$. You may have to complete the square and rearrange the equation so that you can reference it from the table in Section 12.6 of the textbook.
4. Curves and Vector Functions Geometry (13.1)
(a) Sketching basic curves and matching pictures for messier ones (by determining which surfaces they sit on)
(b) Intersection of curves (use different parameters, for example $s$ and $t$ ) versus colliding (when $s=t$ )
(c) Intersection of a curve with a surface
(d) Intersections of two surfaces gives a curve. We can write parametric equations for that curve. (The parametrization is not unique)
5. Curves and Vector Functions Calculus (13.2 and 13.3)
(a) Computing $\mathbf{r}^{\prime}(t)$ and its geometrical interpretation. We always sketch $\mathbf{r}(t)$ starting at the origin and $\mathbf{r}^{\prime}(t)$ starting at the point of tangency. The first shows the position, the second where it is headed.
(b) Finding equations of tangent lines and angles of intersection. See 4(b).
(c) Computing arclength and reparametrizing with respect to arclength. Here you will need some integration skills from Math 125. Arclength integrals involve square roots by definition of the length of a vector. Use 4(d) if necessary.
(d) Computing the curvature $\kappa$.
(e) Finding the unit tangent $\mathbf{T}$ and the unit normal $\mathbf{N}$ and showing them on the curve. Both are sketched starting at the point of tangency like $\mathbf{r}^{\prime}(t)$.

Also, look at Chapter 12 Concept Check and True-False questions, Chapter 13 Concept Check (1-6) and True-False (except 8 and 18) questions.

Look at old midterm questions for practice. Some midterms may contain questions from 13.4 about acceleration. Ignore those.

