

Basic skills list for the 126 Midterm 1

The following is a collection of some of the things you are expected to be able to do on the first midterm. It is intended as a starting point, not as a comprehensive summary of the course: review all lectures, reading materials, and homework problems to get the complete picture.

1. Vectors

You should be able to determine or find:

- (a) The magnitude of a vector
- (b) The **dot product** of two vectors
- (c) The **cross product** of two vectors
- (d) The angle between two vectors
- (e) Whether or not two vectors are parallel
- (f) Whether or not two vectors are perpendicular

2. Lines, planes, and points in 3D

You should be able to determine or find:

- (a) The center and radius of a sphere given by its equation
- (b) The point of intersection of two lines
- (c) The line of intersection of two planes
- (d) The equation of a line passing through two given points
- (e) The equation of a plane passing through three given points
- (f) The equation of a plane passing through a point, parallel to a given plane
- (g) The equation of a plane containing a line and a given point
- (h) The angle between two intersecting planes
- (i) The angle between two intersecting lines
- (j) Whether or not a point is part of a given line, or a given plane
- (k) Whether or not a line is part of a given plane
- (l) Whether or not two planes intersect or are parallel
- (m) Whether or not two lines intersect or are parallel
- (n) Whether or not two sets of equations define the same, or different, lines or planes

3. Cylinders and Quadric Surfaces

You should be able to:

- (a) identify a quadric surface from its equation
- (b) identify a cylinder given its equation (i.e., be able to tell that it is a cylinder)
- (c) identify a quadric surface from a sketch of one
- (d) describe the traces of a surface given its equation

4. Parametric and polar stuff

You should be able to determine or find:

- (a) $\frac{dy}{dx}$ given $x = f(t)$ and $y = g(t)$
- (b) the tangent line to a curve defined parametrically
- (c) the arc length of (a piece of) a curve specified by $x = f(t)$, $y = g(t)$
- (d) the Cartesian equation of a curve defined using polar equations, and vice versa
- (e) the tangent line to a curve defined with a polar equation

You should be able to sketch the graph of a curve defined by a simple polar equation.

5. Vector functions, space curves, and motion You should be able to:

- (a) Find the derivative $\vec{r}'(t)$ or integral of a given vector function $\vec{r}(t)$
- (b) Find the arc length of a piece of a space curve defined by $\vec{r}(t)$
- (c) Understand what it means to reparametrize a curve with respect to arc length
- (d) Find the curvature κ at a point on a space curve $\vec{r}(t)$, on a planar curve (e.g. a curve given by $y = f(x)$ or parametrically).
- (e) Find the point of maximum curvature on a planar or space curve.