

Basic skills list for Midterm One, Math 126

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.

- **Vectors**

You should be able to determine or find:

- The magnitude of a vector
- The **dot product** of two vectors
- The **cross product** of two vectors
- The angle between two vectors
- Whether or not two vectors are parallel
- Whether or not two vectors are perpendicular

- **Lines, planes, and points in 3D**

You should be able to determine or find:

- The center and radius of a sphere given by its equation
- The point of intersection of two lines
- The line of intersection of two planes
- The equation of a line passing through two given points
- The equation of a plane passing through three given points
- The equation of a plane passing through a point, parallel to a given plane
- The equation of a plane containing a line and a given point
- The angle between two intersecting planes
- The angle between two intersecting lines
- The area of a triangle specified by three points in 3D
- Whether or not a point is part of a given line, or a given plane
- Whether or not a line is part of a given plane
- Whether or not two planes intersect or are parallel
- Whether or not two lines intersect or are parallel
- Whether or not two sets of equations define the same, or different, lines or planes

- **Cylinders and Quadric Surfaces**

You should be able to:

- identify a quadric surface from its equation
- identify a cylinder given its equation (i.e., be able to tell that is is a cylinder)
- identify a quadric surface from a sketch of one

- describe the traces of a surface given its equation

- **Parametric and polar stuff**

You should be able to determine or find:

- the arc length of (a piece of) a curve specified by $x = f(t), y = g(t)$
- the Cartesian equation of a curve defined using polar equations, and vice versa

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

- **Vector functions, space curves, and motion**

You should be able to:

- Find the derivative $\vec{r}'(t)$ or integral of a given vector function $\vec{r}(t)$
- Determine a specified tangent line to a curve specified by $\vec{r}(t)$
- Find the arc length of a piece of a space curve defined by $\vec{r}(t)$
- Understand what it means to reparametrize a curve with respect to arc length, and be able to do so with simple curves
- Find the curvature κ at a point on a space curve $\vec{r}(t)$ or on a planar curve (e.g. a curve given by $y = f(x)$ or parametrically).
- Find the point of maximum curvature on a planar or space curve.

- **Unit tangents, unit normals, velocity and acceleration**

You should be able to:

- Determine the unit tangent and unit normal for a space curve $\vec{r}(t)$
- Find the velocity and acceleration vector functions for a particle whose motion is specified by $\vec{r}(t)$
- Determine the position vector function for a particle whose velocity or acceleration vector function is specified
- Determine the tangential and normal components of acceleration of a particle whose motion is specified by $\vec{r}(t)$