

## Math 213, Spring 2014

### Homework 1

Please show all work, and clearly explain your solution.

1. Consider vectors  $\mathbf{v} = 3\mathbf{i} - \mathbf{j}$  and  $\mathbf{u} = \mathbf{i} + 2\mathbf{j} - 3\mathbf{k}$ . Express vector  $\mathbf{u}$  as a sum of a vector parallel to  $\mathbf{v}$  (i.e., the projection of  $\mathbf{u}$  onto  $\mathbf{v}$ ) and a vector orthogonal to  $\mathbf{v}$ .
2. Find a vector of magnitude 2 parallel to the line of intersection of the planes  $x + 2y + z = 1$  and  $x - y + 2z = -3$ .
3. Find the equation of the plane that is perpendicular to, and cuts in half, the line connecting the points  $P(3, 2, -4)$  and  $Q(0, 4, -1)$ .
4. Find the distance between the point  $(6, 0, 1)$  and the following two objects:
  - (a) The plane  $x - 2y + z = 0$ .
  - (b) The line  $x = t, y = 1 - t, z = 3$ .
5. Consider the surface  $x^2 + z^2 - 2x - y^2 = 0$ .
  - (a) Describe  $x$ -  $y$ - and  $z$ -sections of this surface.
  - (b) Categorize this surface (i.e. is it an ellipsoid, a cylinder, ...).
  - (c) Make a rough sketch of this surface