

### Quiz for Week1-3

1. (10points) Give the length of the vector  $\mathbf{v} = (1, 1, \dots, 1)$  in 9 dimensions. Find a unit vector  $\mathbf{u}$  in the same direction as  $\mathbf{v}$  and a unit vector  $\mathbf{w}$  that is perpendicular to  $\mathbf{v}$ .
2. (10points) Please give the normal vector of the plane  $2x - 3y + z = 1$ . Explain why this normal vector is perpendicular to the plane.
3. (5points) The dot product of two unit vectors  $\mathbf{v}$  and  $\mathbf{u}$  is  $-\frac{1}{2}$ . Please give the angle  $\theta$  between these two vectors.
4. (5points) If the dot product of  $\mathbf{v} = (2, 1)$  and  $\mathbf{u} = (x, y)$  is always 5. Describe geometrically all  $\mathbf{u}$ s and give the shortest  $\mathbf{u}$ .
5. (10points) Find the matrix  $\mathbf{M}$  that multiplies  $(x, y, z)$  to give  $(x, y - x, x + 2y - z)$ . Find the matrix  $\mathbf{A}$  that multiplies  $(x, y - x, x + 2y - z)$  to give  $(x, y, z)$