1. Use polar coordinates, find the area of the region common to the curves, \( r = 1 + \sin \theta \) and \( r = 1 \).

2. Let \( \mathbf{u} = \langle 1, 2, 3 \rangle \), \( \mathbf{v} = \langle 1, 0, 1 \rangle \), \( \mathbf{w} = \langle -1, 1, -1 \rangle \).
   (a) Find the angle between \( \mathbf{u} \) and \( \mathbf{v} \).
   (b) Are \( \mathbf{u}, \mathbf{v}, \mathbf{w} \) co-planar?
   (c) Find the scalar projection of \( \mathbf{w} \) onto \( \mathbf{u} \), \( \text{Comp}_\mathbf{u} \mathbf{w} \).
   (d) Find \( \text{Proj}_\mathbf{u} \mathbf{v} \).
   (e) Find the unit vector which orthogonal to both \( \mathbf{v} \) and \( \mathbf{w} \)? What are the direction angles?

3. Find the work done by a force \( \mathbf{F} = 4 \mathbf{i} - 3 \mathbf{j} + 8 \mathbf{k} \) N that moves an object from point \((0, 5, 4)\) to \((4, 14, 10)\) along a straight line (meters).

4. Let \( \mathbf{x} \) be a vector with length 5 that starts at the origin and rotates the \( x-z \)-plane. Find the maximum and minimum values of the length of \( \mathbf{x} \times \mathbf{y} \). In what direction does \( \mathbf{x} \times \mathbf{y} \) point?