1. [10 pts] Given vectors \( \vec{a} = \vec{j} - \vec{k} \) and \( \vec{b} = \vec{i} + 2\vec{j} - 3\vec{k} \), find the following:
   
   (a) the angle between \( \vec{a} \) and \( \vec{b} \)
   
   (b) the scalar projection of \( \vec{b} \) onto \( \vec{a} \).

2. [12 pts] Given the three points \( P(0, 1, 1) \), \( Q(1, 0, 1) \), and \( R(1, 1, 0) \), find the following:

   (a) An equation of the plane through the points \( P \), \( Q \), and \( R \).
   
   (b) The equation of the plane through the origin and parallel to the plane in part (a).
   
   (c) The area of the triangle \( \Delta PQR \).

3. [12 pts] Consider the parametric equations \( x = 2 \cos t \), \( y = 2 \sin t \), and \( z = t \).

   (a) Find the length of the curve from \( t = 0 \) to \( t = 2\pi \).
   
   (b) Find a parametric equation for the tangent line to the curve at \( t = \pi/2 \).

4. [8 pts] Find the position vector \( \vec{r}(t) \) of a particle with velocity \( \vec{v}(t) = \vec{i} + \vec{j} + (9 - 10t)\vec{k} \) and initial position \( \vec{r}(1) = 2\vec{i} + 3\vec{j} \).

5. [8 pts] Consider the function \( g(x, y) = \sqrt{4 - x^2 - y^2} \).

   (a) Find and sketch the domain of \( g \).
   
   (b) Sketch the level curves \( g(x, y) = 0 \) and \( g(x, y) = 1 \).