MATH 563 First Mock Mid-Term Exam

1. Consider the curve
$$c(t) = (\cos t, \sin t, \sin t)$$
   in the Euclidean space $\mathbb{R}^3$.

   (a) Compute its Frenet frame.

   (b) Compute its curvature and torsion.

2. Consider the paraboloid $z = x^2 + y^2$.

   (a) Find a parametrization of the paraboloid.

   (b) Compute the first fundamental form as a matrix in the coordinate frame of your parametrization.

   (c) Compute the second fundamental form as a matrix in the coordinate frame of your parametrization.

   (d) Find the Gauss curvature at $(x, y, z) = (0, 0, 0)$.