Midterm (MATH 138A, Winter 2019, 2/11/19)

Answer all three questions, show your work.

(1) Determine the curvature and torsion of the helix

$$\alpha(s) = \left(3\cos\frac{s}{5}, 3\sin\frac{s}{5}, \frac{4}{5}s\right), \quad s \in \mathbb{R}$$

(2) Let $\alpha(s)$ be a unit speed curve lying on the plane with curvature $k(s) = c$, where c is a positive constant. Prove that $\alpha(s)$ is part of a circle of radius $\frac{1}{c}$.

(3) Determine the unit normal and the equation of the tangent plane of the surface $2x^2 + y^2 + z = 1$ at the point $P = (1, 1, -2)$.