

Differential Geometry

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1. Compute the curvature and torsion of the helix given by

$$\alpha(s) = (a \cos(s/c), a \sin(s/c), bs/c),$$

where $c = \sqrt{a^2 + b^2}$.

2. Suppose p is a point on a regular surface S at which the Gaussian curvature is negative. Show that there is an asymptotic direction at p .
3. Define a geodesic on a surface S to be a curve $\alpha(t)$ lying on S such that $\alpha''(t)$ is perpendicular to S . Show that a geodesic has constant speed. Is the converse true?