IntroCosmo24

Homework problems #6

Due December 5, 2024

1. Find the principal vectors (tangent, normal, and binormal), and curvature, and torsion for the curve given in the parametric form by

$$x = 4\cos t;\;\; y = 4\sin t;\;\; z = 3t$$

2. A surface Σ is given in the parametric form by

$$x = a\cosh\theta\cos\varphi\,,$$

$$y = a\cosh\theta\sin\varphi\,,$$

$$z = a\sinh\theta\,.$$

Calculate its intrinsic line element and the normal vector at a generic point on Σ. a is a positive constant.

3. Calculate the critical density of our Universe, express it in g/cm^3 and number of protons per m^3. Assume that the Hubble constant is 70 km/sMpc. Comments are welcome.