Exercises 2

First Semester 2018

Problem 1 (Serret-Frenet Frame)

Show that the curve

$$\gamma(t) = (\frac{(1+t)^{\frac{3}{2}}}{3}, \frac{(1-t)^{\frac{3}{2}}}{3}, \frac{t}{\sqrt{2}})$$

is a regular curve, then find the Serret-Frenet frame of γ if exist.

Problem 2 (Helix)

Find the curvature and the torsion of the helix

$$\gamma(t) = (a\cos t, a\sin t, ct),$$

where a and c are real constants and a is positive.

Problem 3 (Curvature and Torsion Zero Points)

Consider the space curve

$$\gamma(t) = (t, t^3, t^4 + ut^2),$$

where u is a real constant.

(i) Show that for $u \neq 0$ the curve γ has no points where $\kappa(t) = 0$.

(ii) Show that for $u > 0$ there are exactly two points where the torsion is zero and for $u < 0$ there are no torsion zero points.

(iii) **(*-Question)** Show that for $u > 0$ binormal vectors at the torsion zero points are positive multiples of

$$(-2u^{3/2}, -12u^{1/2}, \pm 3\sqrt{6}).$$

Hand in your solutions in the lecture by 2pm on Tuesday 10/10/2018.