

Exercises 1

First Semester 2018

Problem 1 (Unit Tangent Vector)

For the curve $\gamma(t) = (t^2 - 1, t^2 + 1, t^3 + t)$

- (i) compute the velocity,
- (ii) compute the speed,
- (iii) check that the curve is regular,
- (iv) compute the unit tangent vector of the curve.

Problem 2 (Arc length)

For the space curve $\gamma(t) = (6 \cos 2t, 6 \sin 2t, 5t)$, where $t \in [0, \pi]$, find the following:

- (i) check that the curve is unit speed curve,
- (ii) arc length of γ measured from $t = 0$ to $t = t_0$,
- (iii) the normal reparametrisation of γ .

Problem 3 (Closest Point to the Origin) (*-Question)

Let $\gamma(t)$ be a regular parametrised space curve which does not pass through the origin. Show that, if $\gamma(t_0)$ is the point on the curve closest to the origin, then $\gamma(t_0)$ is orthogonal to $\gamma'(t_0)$.

[Hint: Let $f(t) = \gamma(t) \bullet \gamma(t) = \text{dist}^2(0, \gamma(t))$. Deduce that $f'(t_0) = 0$.]

Hand in your solutions in the lecture by 2pm on Tuesday 25/08/2018.