Math 53 – Worksheet 3

GSI: Oltman, (2/12/19)

13.1 - 13.3 (tangents, normals, binormals of vector valued functions)

Problem 1. *Do the particles with the following trajectories collide? Do their paths collide?*

$$\vec{r_1}(t) = \langle t^2, 7t - 12, t^2 \rangle$$
$$\vec{r_2}(t) = \langle 4t - 3, t^2, 5t - 6 \rangle$$

Problem 2. *For $r(t) = \langle t - 2, t^2 + 1 \rangle$ sketch the curve, find $r'(t)$, and sketch the position vector $r(t)$ and $r'(t)$ at $t = -1$.*

Problem 3. *Find the unit tangent vector at the point of the curve $r(t) = \langle \cos t, 3t, 2 \sin 2t \rangle$*

Problem 4. *Evaluate:*

$$\int \cos \pi t \boldsymbol{i} + \sin \pi t \boldsymbol{j} + t \boldsymbol{k} dt$$

Problem 5. *Prove that:*

$$\frac{d}{dt}(r(t) \times r'(t)) = r(t) \times r''(t)$$

Problem 6. *Compute the length of the curve $r(t) = \boldsymbol{i} + t^2 \boldsymbol{j} + t^3 \boldsymbol{k}$ for $0 \leq t \leq 1$.*

Problem 7. *Find the curvature for the curve $r(t) = \langle t, t, 1 + t^2 \rangle$*

Problem 8. *Find $\boldsymbol{T}, \boldsymbol{N}$, and $\boldsymbol{B}$ for $r(t) = \langle t^2, \frac{2}{3}t^3, t \rangle$ at the point $(1, 2/3, 1)$*

Problem 9. *At what point on the curve $x + t^3, y = 3t, z = t^4$ is the normal plane parallel to the plane $6x + 6y - 8z = 1$?*

Problem 10. *Prove that:*

$$\frac{dT}{ds} = \kappa N$$