Review for Exam 1

Chapter 12

$\vec{u} \cdot \vec{v}$, $\vec{u} \times \vec{v}$

$$\text{Proj}_{\vec{v}} \vec{u} = \left(\vec{u} \cdot \frac{|\vec{v}|}{|\vec{v}|} \right) \frac{\vec{v}}{|\vec{v}|}$$

Equations • line $(x, y, z) = (x_0, y_0, z_0) + t\vec{v}$

• plane $\vec{n} \cdot (x - x_0, y - y_0, z - z_0) = 0$

Distances • pt $S(x_1, y_1, z_1)$ to a line $(x, y, z) = (x_0, y_0, z_0) + t\vec{v}$ (P)

$$d = \frac{|\vec{PS} \times \vec{v}|}{|\vec{v}|}$$

• pt $S(x_1, y_1, z_1)$ to a plane $\vec{n} \cdot (x - x_0, y - y_0, z - z_0) = 0$, $P(x_0, y_0, z_0)$

$$d = \text{abs}\left(\frac{\vec{PS} \cdot \vec{n}}{|\vec{n}|} \right)$$

quadratic surfaces

Chapter 13

$\vec{r}(t) = (x(t), y(t), z(t)), \quad t \in [a,b]$

$\vec{v} = \vec{r}'(t)$

$\vec{a} = \vec{v}'(t) = \vec{r}''(t)$

$\lim_{t \to t_0} \vec{r}(t), \quad \vec{r}'(t), \quad \int \vec{r}(t)\,dt$

arc length $L = \int_a^b |\vec{v}|\,d\tau$.

arc length parameter $s(t) = \int_{t_0}^{t} |\vec{v}(\tau)|\,d\tau$

$\vec{T} = \frac{\vec{v}}{|\vec{v}|} = \frac{d\vec{r}}{ds}$

curvature $\kappa = \left|\frac{d\vec{T}}{ds}\right| = \frac{\left|\frac{d\vec{T}}{dt}\right|}{|\vec{v}|}$

$\vec{N} = \frac{d\vec{T}}{dt} \Big/ \left|\frac{d\vec{T}}{dt}\right| = \frac{1}{\kappa}\frac{d\vec{T}}{ds}$

$\vec{B} = \vec{T} \times \vec{N}$

torsion $\tau = -\frac{d\vec{B}}{ds} \cdot \vec{N} = \begin{vmatrix} \frac{d}{dt}\vec{r} \\ \frac{d^2}{dt^2}\vec{r} \\ \frac{d^3}{dt^3}\vec{r} \end{vmatrix}$

$\vec{a} = a_T \vec{T} + a_N \vec{N}, \quad a_T = \frac{d}{dt}|\vec{v}|, \quad a_N = \sqrt{|\vec{a}|^2 - a_T^2}$

Chapter 14

f, domain, range, open set, close set, bounded

limit, continuity