

Chapter 13 Review

1. Vector Functions and Spacecurves $\mathbf{r}(t) = \langle f(t), g(t), h(t) \rangle$
 - a. Component Functions
 - b. Limits and continuity
 - c. Parametric Equations
 - d. Circle, ellipse, helix, etc $\mathbf{r}(t) = \langle a \cos t, b \sin t \rangle$, $\mathbf{r}(t) = \langle a \cos t, b \sin t, ct \rangle$
2. Derivative and Integrals of Vector Functions
 - a. First and second derivatives
 - b. Differentiation rules
 - c. $|\mathbf{A}(t)| = \text{const} \Rightarrow \mathbf{A}(t) \perp \mathbf{A}'(t)$
 - d. Definite Integrals
3. Arclength and Curvature
 - a. Length of curve $L = \int_a^b |\mathbf{r}'(t)| dt$
 - b. Arclength function $s = \int_a^t |\mathbf{r}'(\tau)| d\tau$, $\frac{ds}{dt} = |\mathbf{r}'(t)|$
 - c. Curvature $\kappa = \frac{|\mathbf{T}'(t)|}{|\mathbf{r}'(t)|} = \frac{|\mathbf{r}'(t) \times \mathbf{r}''(t)|}{|\mathbf{r}'(t)|^3}$ and radius of curvature
 - d. Tangent, Normal and Binormal Vectors
$$\mathbf{T} = \frac{\mathbf{r}'(t)}{|\mathbf{r}'(t)|}, \mathbf{N} = \frac{\mathbf{T}'(t)}{|\mathbf{T}'(t)|}, \mathbf{B} = \mathbf{T} \times \mathbf{N}$$
4. Velocity and Acceleration
 - a. Velocity and Acceleration vectors $\mathbf{v} = \mathbf{r}'$, $\mathbf{a} = \mathbf{v}' = \mathbf{r}''$
 - b. Forces $\mathbf{F} = m\mathbf{a}$ - Given \mathbf{a} , find \mathbf{v} and \mathbf{r} .
 - c. Projectile Motion $\mathbf{F} = -mg\mathbf{j}$
 - d. Tangential and Normal components of acceleration $\mathbf{a} = v'\mathbf{T} + \kappa v^2\mathbf{N}$