MATH 249

Today

1. Questions from last time

2. 13.3 Arc length and curvature (Understand the formulas and intuition behind the arc length and curvature formulas and be able to apply them)

3. WeBWorK

13.3 Arc Length, Curvature, and the TNB Frame

Let $\vec{r}(t) = <f(t), g(t), h(t)>$, and let C be the space curve determined by $\vec{r}$ on $[a, b]$.

1. $L = \int_a^b |\vec{r}\,'(t)|dt = \int_a^b \sqrt{(f'(t))^2 + (g'(t))^2 + (h'(t))^2}dt$

2. $s(t) = \int_a^t |\vec{r}\,'(u)|du = \int_a^t \sqrt{(f'(u))^2 + (g'(u))^2 + (h'(u))^2}du$ for $t \in [a, b]$.

3. Speed is $v = |\vec{r}\,'(t)| = |\vec{v}|$

4. Recall: C is **smooth** if $\vec{r}\,'$ is continuous and nonzero.

5. **Curvature** is given by

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

$$= \frac{|\vec{T}'(t)|}{|\vec{r}\,'(t)|}$$

$$= \frac{|\vec{r}\,'(t) \times \vec{r}\,''(t)|}{|\vec{r}\,'(t)|^3}$$

6. $\vec{T} = \dfrac{\vec{r}\,'}{|\vec{r}\,'|}, \vec{N} = \dfrac{\vec{T}'}{|\vec{T}'|}, \vec{B} = \vec{T} \times \vec{N}$. [Tangent, Normal, and Binormal]

7. Examples: p. 836: 4, 20, 43, 32, (45).

8. WeBWorK: 13.3, #2, 5, 7 (abs)

Next Time

1. Watch 13.4 [~ 32]

2. Review for exam.