LESSON 8

MA 26100-FALL 2023

DR. HOOD

LESSON 8 - WARM UP

(Recall from Calc 2)

Find the arc length of $y = 2x + 3$ from $x = 0$ to $x = 1$

$$L = \int_a^b \sqrt{1 + (y')^2}\, dx$$

$$= \int_0^1 \sqrt{1 + (2)^2}\, dx$$

$$= \sqrt{5}\,(1 - 0) = \sqrt{5}$$

a) $\sqrt{3}$

b) 2

c) $\sqrt{5}$

OFFICE HOURS

- **Dr. Hood's Office Hours:**
  - Mon, Wed, Fri at 2:00-3:00pm in MATH 844

- **TA's have office hours in the Math Resource Room (MRR)**
  - Room WTHR 182
  - Mon – Thurs 9:30am – 5:20pm and Friday 9:30am – 1:20pm
  - Schedule is posted online:
    - https://www.math.purdue.edu/academic/courses/helproom

POLL 1

(Fall 16 Exam 1 #3) Find the length of the curve given by:

$$\vec{r}(t) = \langle 2t, 4\sqrt{t}, \ln(t) \rangle$$

For $1 \leq t \leq e$

a) $e - 1$

b) $2e + 1$

c) $e + 1$

d) $2e - 1$

$$L = \int_1^e |\vec{r}\,'(t)|\,dt$$

$$= \int_1^e \sqrt{4 + \frac{4}{t} + \frac{1}{t^2}}\,dt$$

$$= \int_1^e \sqrt{\frac{4t^2+4t+1}{t^2}}\,dt$$

$$= \int_1^e \sqrt{\frac{(2t+1)^2}{t^2}}\,dt = \int_1^e \frac{2t+1}{t}\,dt$$

$$= \int_1^e 2 + \frac{1}{t}\,dt = \left[2t + \ln t\right]_1^e$$

$$= 2e + \ln(e) - 2 - \ln(1)$$

$$= 2e - 1$$

POLL 2

$|\vec{r}'(t)| = |\langle 1, 2, 2\rangle|$

$= \sqrt{1^2 + 2^2 + 2^2} = 3 \neq 1$

NOT

Consider the vector-valued function:

$$\vec{\boldsymbol{r}}(t) = \langle t + 3, 2t - 4, 2t \rangle \quad \text{for } t \geq 0$$

Is $\vec{\boldsymbol{r}}(t)$ parameterized by arclength?

Reparameterize

$$s = \int_0^t |r'(u)|\,du = \int_0^t 3\,du = 3t$$

$$t = \frac{s}{3}$$

a) Yes

b) No

$$\tilde{\vec{r}}(s) = \left\langle \frac{s}{3} + 3, \frac{2s}{3} - 4, \frac{2s}{3} \right\rangle$$

Yes

MUDDIEST POINT

What was the muddiest point from today's lecture?

a) Arclength
b) Parameterized by Arclength
c) Curvature
d) None – understood everything today