

Math 1232: Single-Variable Calculus 2
George Washington University fall 2024
Recitation 13

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Problem 1. Consider the curve $\vec{r}(t) = (\frac{t}{1+t}, \ln(1+t))$.

- (a) At what time does this curve pass through the origin?
- (b) Does this curve hit the point $(2, \ln(3))$?
- (c) Does it hit the point $(1/2, \ln(2))$?
- (d) Try to sketch a graph of this curve. What do you know about it?
- (e) Find a parametric equation for the tangent line to the curve at the time $t = 3$. Find an implicit equation for the same line.
- (f) Set up an integral to compute the length of the curve for $0 \leq t \leq 2$?

Problem 2. Let $\vec{r}(t) = (\cos^3(t), \sin^3(t))$.

- (a) Find the length of the curve for $0 \leq t \leq 2$.
- (b) Did you get zero? Does that make any sense?
- (c) Where did that go wrong? Can you fix it?

Problem 3. Consider the polar curve $r = e^\theta$.

- (a) Sketch a graph of this curve.
- (b) At what points (r, θ) does this intersect the x -axis?

- (c) What are the Cartesian coordinates of the point where $\theta = 4\pi/3$?
- (d) Can we write this curve as a parametric equation?
- (e) Find the points (r, θ) where the tangent line is horizontal.
- (f) Find the points (r, θ) where the tangent line is vertical.

Problem 4. (a) Find the area under the curve $\vec{r}(t) = (\cos(t), e^t)$ and above the line $y = 1$ for $x \geq 0$.

- (b) Find the area enclosed by one petal of $r = 3 \cos(2\theta)$.