## Math 1232: Single-Variable Calculus 2 George Washington University Spring 2025 Recitation 14

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

- (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  $0 \le 2 \le 2$ ?

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

- (a) Find the length of the curve for  $0 \le t \le 2$ .
- (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  $(r, \theta)$  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  $(r, \theta)$  where the tangent line is horizontal.
- (f) Find the points  $(r, \theta)$  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  $x \ge 0$ .
  - (b) Find the area enclosed by one petal of  $r = 3\cos(2\theta)$ .