**Math 53, Discussions 116 and 118** **2022-8-31**

# More calculus with parametric curves

## Questions

**Question 1.** Recall the formulas for area and arclength for parametric curves. Make sure you understand how to use them—for example, are there any assumptions you should make regarding how the curve is traced out?

**Question 2.** Sketch the graph $y = \ln x$ between the points $(1, 0)$ and $(e, 1)$. Rewrite this as a parametric curve (remember that every graph has a "canonical" parametric representation).

(a) Write down an integral which computes the area underneath this curve and above the $x$-axis.

(b) Write down an integral which computes the area to the left of this curve and to the right of the $y$-axis.

(c) Observe that the two areas together form a rectangle. Use this to relate the two integrals from the preceding parts, and then compute the value of the integral from part (a) via your equation. **What is the name of this integration technique?**

**Question 3** (Stewart §10.2 #51)**.** Find the distance traveled by a particle with position $(x, y)$ as $t$ varies in the given time interval. Compare with the length of the curve.

$$x = \sin^2 t \qquad y = \cos^2 t \qquad 0 \le t \le 3\pi$$

(The purpose of this question is to remind you that these two quantities can be different. You can actually do this particular problem without any calculus.)