

Homework 2

Math 352, Fall 2014

Due Date: Friday, September 12

1. Evaluate $\int_{\mathcal{C}} xy \, ds$, where \mathcal{C} is the portion of the ellipse $4x^2 + 9y^2 = 36$ lying in the first quadrant.

2. (a) Let \mathcal{C} be any polar curve of the form $r = f(\theta)$ for $a \leq \theta \leq b$, where f is a differentiable function. Show that the arc length of \mathcal{C} is given by the integral

$$\int_a^b \sqrt{f(\theta)^2 + f'(\theta)^2} \, d\theta.$$

- (b) Use the formula in part (a) to find the length of the curve $r = e^{2\theta}$ between the points $(1, 0)$ and $(0, e^\pi)$.
3. The **tractrix** is the curve parametrized by $\vec{x}(t) = (t - \tanh t, \operatorname{sech} t)$.
 - (a) Find the arc length function $s(t)$ for the above parametrization.
 - (b) Find a unit speed parametrization of the tractrix. (*Note:* The y -component of your answer should not involve any hyperbolic trig functions.)
4. [RollingAlongCatenary.gif](#) shows a unit circle rolling along the bottom of the catenary $y = \cosh$. Find parametric equations for the indicated curve.