Homework Set 2

DUE: SEP 18-20, 2017 (AT THE BEGINNING OF RECITATION)

1. Find the arclength of the curve $y = \frac{2\sqrt{3}}{9}(3x^2+1)^{3/2}$ from $x = -1$ to $x = 2$.

2. Assume the position of a particle at each time t (measured in terms of its distance to the origin) is given by $s(t) = \frac{1}{12}e^t + 3e^{-t}$. How far has the particle traveled during the time interval $t = \ln 2$ to $t = \ln 4$?

3. Compute the area of the surface obtained by rotating the arc of the curve $y = \sqrt{x}$, $\frac{3}{4} \leq x \leq 2$ about the x-axis.

4. An artist is designing a wine glass in a flower shape, which can be generated by rotating the region bounded by $y = \sqrt{x}$ and $x = y$, between $x = 0$ and $x = 1$, about the x-axis. What is the surface area (which contains both the inside and the outside surfaces) of such a glass?

5. For logistic reasons, a company wants to build its distribution center at the precise location corresponding to the center of mass of the population density of customers in its geographical zone. Suppose the geographical zone where the company operates is modeled by the region bounded between the curves $y = 1 - x^2$ and $y = x^2 - 1$, and the population density of its customers is modeled by $\delta(x, y) = -x^2 + 2x + 3$. Based on this model, at what (x, y) coordinates should the company build its distribution center?

6. Find the centroid of the region bounded by the parabola $y = \frac{x^2}{4}$ and the line $y = 5$.