MA 114 Worksheet #24: Review for Exam 03

1. Find the volume of the following solids.
   (a) The solid obtained by rotating the region bounded by $y = x^2$ and $x = y^2$ about the x-axis,
   (b) The solid obtained by rotating the region bounded by $x = y^2$ and $x = 1$ about the line $x = 1$,
   (c) The solid obtained by rotating the region bounded by $y = 4x - x^2$ and $y = 3$ about the line $x = 1$,
   (d) The solid with circular base of radius 1 and cross-sections perpendicular to the base that are equilateral triangles.

2. Find the area of the surface of revolution obtained by rotating the given curve about the given axis.
   (a) $y = \sqrt{x+1},\ 0 \le x \le 3$; about x-axis,
   (b) $x = 3t^2,\ y = 2t^3,\ 0 \le t \le 5$; about y-axis.

3. Compute the arc length of the following curves.
   (a) $x = a\cos^3\theta,\ y = a\sin^3\theta,\ 0 \le \theta \le 2\pi$,
   (b) $y = \sqrt{2 - x^2},\ 0 \le x \le 1$.

4. Find the centroid of the region bounded by $y = \sqrt{x}$ and $y = x$.

5. Find the average value of the function $y = 3\sin(x) + \cos(2x)$ on the interval $[0, \pi]$.

6. Compute the slope of the tangent line to the curve in Problem 3(a) above, with $a = 8$, at the point $(1, 3^{3/2})$. Use this to determine an equation for the tangent line.

7. Consider the curve given by the parametric equations $(x(t), y(t)) = (t^2, 2t + 1)$.
   (a) Find the tangent line to the curve at $(4, -3)$. Put your answer in the form $y = mx + b$.
   (b) Find second derivative $\dfrac{d^2y}{dx^2}$ at $(x, y) = (4, -3)$. Is the curve concave up or concave down near this point?