PROBLEM SET 8. DUE THURSDAY, 14 SEPTEMBER

Reading. *Quick Calculus*, pp. 185–198.
Supplementary reading. Simmons, sections 5.4, 7.3, 7.4, 10.4, and 10.6.

1. (4pts) Graph the following regions. Rotate them around the x-axis and compute their volumes.
   (a) The region below $f(x) = \sqrt{x}$, above $y = 0$ and to the left of $x = 4$.
   (b) The region below $f(x) = 4x - x^2$ above $y = 0$.
   (c) The region below $f(x) = 4x - x^2$ and above $g(x) = 3(x-2)^2$. (Hint: $f(x) = g(x)$ when $x = 1, 3$.)
2. (4pts) Graph the following regions. Rotate them around the y-axis and compute their volumes.
   (a) The region below $f(x) = \sqrt{x}$, above $y = 0$ and to the left of $x = 4$.
   (b) The region above $f(x) = x^3$, below $y = 8$ and to the right of $x = 0$.
   (c) The region below $f(x) = \sin(x)$, above $y = 0$ from $x = 0$ to $x = \pi$.
3. (10pts) Compute the following integrals. For some, you may need to apply more than one technique to compute the final integral.
   (a) $\int \frac{x^2}{\sqrt{1-x^2}}\ dx$
   (b) $\int \frac{x}{\sqrt{1-x^2}}\ dx$
   (c) $\int \frac{25}{(x-4)(2x+1)}\ dx$
   (d) $\int \frac{6x^2-4}{x^2(x-2)}\ dx$
   (e) $\int \frac{4e^x}{e^{2x}-4}\ dx$
4. (2pts) Let's compute the integral $\int \sec(\theta)\ d\theta$. We can transform this

$$\int \sec(\theta)\ d\theta = \int \frac{d\theta}{\cos(\theta)} = \int \frac{\cos(\theta)\ d\theta}{\cos^2(\theta)} = \int \frac{\cos(\theta)}{1 - sin^2(\theta)}\ d\theta.$$

   Now make a substitution, and then use partial fractions to complete the integral.