MA205 - Integral Calculus
Lesson 24: Rectangular Regions II

Plan for today:

- Practice the mechanics of how to compute an iterated integral.
- Practice how to plot 3-D regions in Mathematica and how to check your double integral calculations in Mathematica.
- Practice word problems that require double integration.

1. **Mechanics and Mathematica:**
   For each of the integrals below, use Mathematica to plot the volume you're calculating. Then calculate the volume by hand and check your answer in Mathematica. (Note: Some of these require u-substitution!)

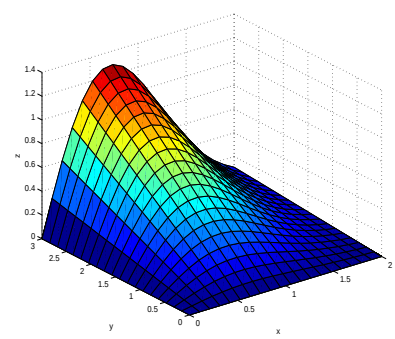
   (a) $\displaystyle\int_1^3 \int_0^1 1 + 4xy \, dy \, dx$

   (b) $\displaystyle\int_1^4 \int_1^2 \frac{x}{y} + \frac{y}{x} \, dx \, dy$

   (c) $\displaystyle\int_0^1 \int_{-3}^3 \frac{xy^2}{x^2+1} \, dx \, dy$

(d) $\displaystyle\int_0^{\pi/6}\int_0^{\pi/6} x\sin(xy)\,dy\,dx$

(e) $\displaystyle\int_0^{1}\int_0^{1} 2 - x^2 - y^2\,dy\,dx$

2. **Word Problems using double integrals:**
   PSP 5 in Lesson 23 (page 124 of your student guide) and all problems in Lesson 24 (page 126-27 of your student guide).

3. Find the volume of the solid bounded by the surface $f(x,y) = xye^{-x^2}$ over the region $R = \{(x,y)\,|\,0 \le x \le 2\,,\ 0 \le y \le 3\}$.