HW 8
Math 261, S19

Please see the course syllabus for details on how to turn in your homework assignments. This one is due at the beginning of your class on **<u>Friday, April 12</u>**.

1. (5 pts.) TRUE OR FALSE:
   (a) Let R denote a plane region, and $(u, v) = (u(x, y), v(x, y))$ be a different set of coordinates for the Cartesian plane. Then for any function $F(u, v)$
   $$\int_R F(u,v)dudv = \int_R F(u(x,y), v(x,y))dxdy.$$
   (b) Let R denote a plane region, and $(u, v) = (u(x, y), v(x, y))$ be a different set of coordinates for the Cartesian plane. Then
   $$\int_R dudv = \int_R |u_x v_y - u_y v_x| dxdy.$$
   (c) Let R denote a square of sidelength 2 defined by the inequalities $|x| \leq 1, |y| \leq 1$, and $(u, v) = (3y, 2x)$. Then the area of R is computed as
   $$\int_{-2}^{2}\int_{-3}^{3} dudv.$$
   (d) Let R denote a square of sidelength 2 defined by the inequalities $|x| \leq 1, |y| \leq 1$, and $(u, v) = (3y, 2x)$. Then the area of R is computed as
   $$\int_{-2}^{2}\int_{-3}^{3} (1/6)dudv.$$
   (e) Let R denote a square of sidelength 2 defined by the inequalities $|x| \leq 1, |y| \leq 1$, and $(u, v) = (3y, 2x)$. Then the area of R is computed as
   $$\int_{-1}^{1}\int_{-1}^{1} (1/6)dudv.$$
2. (3 pts.) Using *cylindrical* coordinates, set up the integral to find the volume of the region enclosed by the vertical cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $y + z = 4$. Do **NOT** evaluate the integral; just set it up.
3. (3 pts.) Using *spherical* coordinates, set up the integral to find the volume of the region enclosed by the vertical cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $z = 2$. Do **NOT** evaluate the integral; just set it up.
4. (3 pts.) Use *cylindrical* coordinates and set up the integral to find the volume of the region enclosed by a circular cone of base radius 1 and height 2. Do **NOT** evaluate the integral; just set it up. Your set-up should include a description of how the cone is positioned in $\mathbb{R}^3$.

5. (3 pts.) Consider using the substitution $\begin{cases} x = u - v, \\ y = 2u + v \end{cases}$ for the integral of $x + y^2 - 2$. What is the *integrand* in terms of u and v? (Don't bother with the integral signs, the bounds, or the $du\ dv$.)

6. (3 pts.) Using the same substitution as in the previous problem, suppose the (x, y) region over which we wish to integrate includes the boundary line $2x - y = 3$. Convert this line into a (u, v) boundary line.