Homework Section 15.9

1. Find the Jacobian of the transformation: $x = u^3 - v^2, \ y = u^3 + v^2$.

2. Find the image of the set under the given transformation: $S$ is the triangular region with vertices $(0, 0), (1, 1), (0,1)$; $x = u, \ y = v^2$.

3. Use the given transformation to evaluate the integral:
   
   a) $\iint_R y^2 \, dA$, where $R$ is the region bounded by the ellipse $4x^2 + 9y^2 = 36$; $x = 3u$, $y = 2v$.
   
   b) $\iint_R xy \, dA$, where $R$ is the region in the first quadrant bounded by the lines $y = x$, $y = 2x$ and the hyperbolas $xy = 1$, $xy = 2$; $x = \frac{y}{u}$, $y = u$.
   
   c) $\iint_R (x^2 + xy + y^2) \, dA$, where $R$ is the region bounded by the ellipse $x^2 + xy + y^2 = 1$; $x = \frac{1}{\sqrt{3}}u + v$ and $y = \frac{1}{\sqrt{3}}u - v$.

4. Evaluate the integral by making an appropriate change of variables.
   
   a) $\iint_R \frac{2x - y}{x - 3y} \, dA$, where $R$ is the parallelogram enclosed by the lines $2x - y = 0$, $2x - y = 4$, $x - 3y = 1$, $x - 3y = 6$.
   
   b) $\iint_R e^{xy^2} \, dA$, where $R$ is the trapezoidal region with vertices $(1, 0), (3,0), (0, 3)$, and $(0, 1)$.