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 $xy = 1$, $xy = 2$; $x = \frac{v}{u}$, $y = u$.

   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) $\iint_R e^{\frac{y-x}{y+x}} dA$, where *R* is the trapezoidal region with vertices (1, 0), (3,0), (0, 3), and (0, 1).