Name:

1. Find the Jacobian of the transformations:

   (a) $x = \frac{1}{4}(u + v)$, $y = \frac{1}{4}(v - 3u)$.

   (b) $x = \sqrt{2}u - \sqrt{2/3}v$, $y = \sqrt{2}u + \sqrt{2/3}v$.

2. Find the image of the following sets under the given transformations, draw them out.

   (a) R = the parallelogram with vertices $(-1, 3)$, $(1, -3)$, $(3, -1)$, and $(1, 5)$ under the change of variables $x = \frac{1}{4}(u + v)$, $y = \frac{1}{4}(v - 3u)$.

   (b) S = is the region bounded by the ellipse $x^2 - xy + y^2 = 2$ under the change of variables $x = \sqrt{2}u - \sqrt{2/3}v$, $y = \sqrt{2}u + \sqrt{2/3}v$. (Warning: don't muck it up, the answer is nice).

3. Calculate the following integrals using the transformations given:

   (a) $\iint_R (4x + 8y)dA$ where R is the region from 2.a, using the transformations from 1.a.

   (b) $\iint_S (x^2 - xy + y^2)dA$ where S is the region from 2.b, using the transformations from 1.b. (Hint: You can be clever here and use a second change of coordinates to make this easier).