Worksheet
11/9/2017

1. (a) Compute the Jacobian determinant $\dfrac{\partial(x,y)}{\partial(u,v)}$ of the transformation $x = u+v$, $y = -u+2v$.

   (b) Compute the Jacobian determinant $\dfrac{\partial(x,y)}{\partial(u,v)}$ of the transformation $u = xy$, $v = y/x$.
   (*Note: you need to solve for x and y in terms of u, v.*)

   (c) Compute the Jacobian determinant $\dfrac{\partial(x,y,z)}{\partial(u,v,w)}$ of the transformation $x = uv + w$, $y = w$, $z = v$.

2. Use the polar coordinates to compute

$$\iint_R \cos(x^2 + y^2) dA$$

where R is the annulus $1 \leq x^2 + y^2 \leq 4$.

3. Determine the new region that we get by applying the given transformation to the region R.

   (a) R is the region bounded by $y = x$, $y = 3x$, $x + y = 4$, and the tranformation is $x = u - v$, $y = u + v$.

   (b) R is the region bounded by $x = 0$, $x = 1$, $y = 0$, $y = \sqrt{x}$, and the tranformation is $x = u^2$, $y = v$.

4. Use the cylindrical coordinates to compute

$$\iiint_E (8 + x + y)dV$$

where E is the solid bounded by $z = 16 - x^2 - y^2$ and $z = 0$.

5. Use the spherical coordinates to compute

$$\iiint_U \sqrt{x^2 + y^2 + z^2}dV$$

where U is the unit ball $x^2 + y^2 + z^2 = 1$.

6. Use a suitable change of variables to compute the area of the ellipse

$$\frac{x^2}{9} + \frac{y^2}{4} = 1$$

7. Compute

$$\iint_R \sqrt{xy}\, dA$$

where R is the region bounded by $xy = 1$, $xy = 9$, $y = x$, $y = 2x$, using the change of variables $u = xy$, $y = vx$.