1. (1 pts) Let \( x = 2u + 3 \) and \( y = 5uv \). In changing variables for the integral \( \iint_D f(x, y) \, dx \, dy \) to \( u \) and \( v \), the stretching factor
   
   a) is constant  
   b) depends only on \( u \)  
   c) depends on both \( u \) and \( v \)  
   d) none of these.

   \[ J = 2 \cdot 5u - 0 \cdot 5v = 10u \]

   The stretching factor is \( J = 2 \cdot 5u - 0 \cdot 5v = 10u \) which depends only on \( u \).

2. (1 pts) Suppose \( \int_0^1 \left[ \int_y^1 x^2 y \, dx \right] dy = \int_0^1 \left[ \int_A^B x^2 y \, dy \right] dx \).
   
   a) \( A = x \) and \( B = 1 \)  
   b) \( A = 1 \) and \( B = x \)  
   c) \( A = 0 \) and \( B = x \)  
   d) \( A = y \) and \( B = 1 \)

   The region is bounded between \( x = y \) and \( x = 1 \), and comprises the triangle with corners \((0, 0)\), \((1, 0)\), and \((1, 1)\). So integrating in the other order \( A : y = 0 \) and \( B : y = x \).

3. (1 pts) Transforming to polar coordinates:
   
   \[ \int_0^{3\sqrt{2}/2} \int_x^{\sqrt{9-x^2}} x^2 y^2 \, dy \, dx = \int_A^B \int_C^D E \, dr \, d\theta. \]
   
   a) \( E = r^4 \).  
   b) \( E = r^5 \cos^2(\theta) \sin^2(\theta) \).  
   c) \( E = r^3 \theta^2 \).  
   d) none of these.

   The integrand is \( x^2y^2 = r^2 \cos(\theta)r^2\sin(\theta) \) multiplied by the stretching factor \( r \).

4. (1 pts) Transforming to polar coordinates:
   
   \[ \int_0^{3\sqrt{2}/2} \int_x^{\sqrt{9-x^2}} x^2 y^2 \, dy \, dx = \int_A^B \int_C^D E \, dr \, d\theta. \]
   
   a) \( C = \cos(\theta), D = 3 \).  
   b) \( C = 0, \) and \( D = 9 \).  
   c) \( C = 1/\cos(\theta), D = 9 \).  
   d) none of these

   The region is the sector with boundary curves \( x^2 + y^2 = 3^2 \), a circle of radius 3, and the lines \( y = x \) and \( x = 0 \), which is a circular sector with \( 0 \leq r \leq 3 \) and \( \pi/4 \leq \theta \leq \pi/2 \).
5. (6 pts) Let $\delta = 10 + x + y$ be a density function, and let $\mathcal{R}$ be the finite region bounded by $x^2 + y = 9$ and $2x + y = 6$.

Write down, but do not evaluate, $\int \int_{\mathcal{R}} \delta \, dA$ as in iterated integral in two ways, once with $x$ integration first, and once with $y$ integration first.

The finite region has boundaries $x^2 + y = 9$ and $2x + y = 6$ which come together when $0 = x^2 - 2x - 3 = (x - 3)(x + 1)$, so the $x$ interval is $[-1, 3]$ in which region the parabola is on top, so the integral is $\int_{x=-1}^{x=3} \int_{y=9-x^2}^{y=6-2x} (10 + x + y) \, dy \, dx$

Reversing the order, the $y$ on the parabola reaches its maximum in the interval at $x = 0$, when it is $9$. So the integral is split at $y = 8$, above which both $x$ limits lie on the parabola.

$\int_{y=0}^{y=8} \int_{x=(6-y)/2}^{x=\sqrt{9-y}} (10 + x + y) \, dx \, dy + \int_{y=8}^{y=9} \int_{x=-\sqrt{9-y}}^{x=\sqrt{9-y}} (10 + x + y) \, dx \, dy$