1. Consider the coordinate transformation defined by

$$u(x,y) = 2x + 3y \qquad v(x,y) = 2x + y.$$

Let Σ be the image of the rectangle in the xy-plane with vertices $\{(0,0),(1,0),(1,2),(0,2)\}$.

(a) Find the area of Σ.

(b) Compute the integral $\iint_\Sigma f(u,v)\, d\sigma$, where $f(u,v) = 2v$.

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2. Consider the coordinate transformation defined by

$$u(x,y) = x^2 - y^2 \qquad v(x,y) = 2xy.$$

Let Σ be the image of the rectangle in the xy-plane with vertices $\{(0,0),(1,0),(1,2),(0,2)\}$.

(a) Find the area of Σ.

(b) Compute the integral $\iint_\Sigma f(u,v)\, d\sigma$, where $f(u,v) = 2v$.

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3. Compute the surface area of the section of the cone $z = \sqrt{x^2+y^2}$, $0 \le z \le 1$.

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4. Compute the surface area of the portion of the plane $y+2z = 2$ inside the cylinder $x^2+y^2 = 1$.