

$\frac{\partial(x, y)}{\partial(u, v)} = \begin{vmatrix} 2 & 0 \\ 0 & 3 \end{vmatrix} = 6$ ,  $4y^2 = 36v^2$  and the planar ellipse  $9x^2 + 4y^2 \leq 36$  is the image of the disk  $u^2 + v^2 \leq 1$ . Thus

$$\begin{aligned} \iint_R 4y^2 dA &= \iint_{u^2+v^2 \leq 1} (36v^2)(6) dv du \\ &= \int_0^{2\pi} \int_0^1 (216r^2 \sin^2(\theta)) r dr d\theta \\ &= 216 \int_0^{2\pi} \sin^2(\theta) d\theta \int_0^1 r^3 dr \\ &= 216 \left[ \frac{1}{2}\theta - \frac{1}{4}\sin(2\theta) \right]_0^{2\pi} \left[ \frac{1}{4}r^4 \right]_0^1 \\ &= 216(\pi) \left( \frac{1}{4} \right) = 54\pi \end{aligned}$$