$$\therefore I = \iint_R 2xy\,dA = \iint_{\substack{\text{unit}\\ \text{circle, } S}} 2(3u)(2v)\cdot 6\,dA_{u,v}$$

use polar coordinates in uv-plane. $u = r\cos\theta$, $v = r\sin\theta$.

$\Rightarrow S = \{(u,v) : u^2+v^2 \le 1\}$, since $R = \{(x,y) : 4x^2 + 9y^2 \le 36\}$

(2) $\rightarrow$ $$I = \int_0^{\pi/2}\int_0^1 \underbrace{72}_{(1)} \underbrace{(r\cos\theta)}_{(1)}\underbrace{(r\sin\theta)}_{(1)}\, r\,dr\,d\theta$$

$$= 72\int_0^{\pi/2} \sin\theta\cos\theta\,d\theta \cdot \int_0^1 r^3\,dr$$

$$= 72\cdot \frac{\sin^2\theta}{2}\Big|_0^{\pi/2}\cdot\frac{1}{4} = \frac{72}{8} = \underbrace{9}_{(1)}$$