15 cont'd

$$= 3\int_0^1\int_0^{1-u} -u-5v\,dv\,du$$

$$= 3\int_0^1 \left[-u(1-u) - \frac{5}{2}(1-u)^2\right] du$$

$$= 3\int_0^1 -u+u^2-2.5-2.5u^2+5u\,du$$

$$= 3\int_0^1 -2.5-1.5u^2+4u\,du = 3\left[-2.5u-0.5u^3+2u^2\right]_0^1$$

$$= 3(-2.5-0.5+2) = 3(-1) = \boxed{-3}$$

(17) $\iint_R x^2\,dA$ $\quad 9x^2+4y^2=36 \quad x=2u \quad y=3v$

$9(4u^2)+4(9v^2)=36 \quad u^2+v^2=1 \quad \frac{\partial x}{\partial u}=2 \quad \frac{\partial y}{\partial v}=3$

$u=\pm\sqrt{1-v^2}$

$v=\pm 1$ $\quad \begin{vmatrix} 2 & 0 \\ 0 & 3 \end{vmatrix} = 6 =$ Jacobian

$x^2=4u^2$

$$\int_{-1}^1\int_{-\sqrt{1-v^2}}^{\sqrt{1-v^2}} 24u^2\,du\,dv \qquad u=r\cos\theta \quad v=r\sin\theta$$

$$= \int_0^{2\pi}\int_0^1 24(r\cos\theta)^2\,r\,dr\,d\theta = \int_0^{2\pi}\int_0^1 24r^3\cos^2\theta\,dr\,d\theta$$

$$= 24\int_0^{2\pi}\cos^2\theta\,d\theta\int_0^1 r^3\,dr = 6\int_0^{2\pi}\cos^2\theta\,d\theta = 3\left[\theta+\frac{\sin 2\theta}{2}\right]_0^{2\pi}$$

$$= 3(2\pi) = \boxed{6\pi}$$