(3) $x^2+y^2=4 \quad 4x^2+4y^2+z^2=64$

$r^2=4$ $\quad z^2=64-4x^2-4y^2=64-4r^2$

$r=2$ $\quad Z=\pm\sqrt{64-4r^2}=\pm 2\sqrt{16-r^2}$

$r\in[0,2]$ $\quad f(r,\theta)=4\sqrt{16-r^2}$

$\theta\in[0,2\pi]$

$D=\{(r,\theta)\mid \theta\in[0,2\pi]\wedge r\in[0,2]\}$

$$\int_0^{2\pi}\int_0^2 4r\sqrt{16-r^2}\,dr\,d\theta=-2\int_0^{2\pi}d\theta\int_{16}^{12}\sqrt{u}\,du=-4\pi\left[\frac{2}{3}u^{3/2}\right]_{16}^{12}$$

$u=16-r^2$

$du=-2r\,dr$

$-\frac{1}{2}du=r\,dr$

$$=4\pi\left[\frac{2}{3}(16)^{3/2}-\frac{2}{3}(12)^{3/2}\right]$$

$$=\frac{8\pi}{3}(64-\sqrt{1728})=\frac{8\pi}{3}(64-24\sqrt{3})=\boxed{\frac{64\pi}{3}(8-3\sqrt{3})}$$

(4) $z=xy \quad x^2+y^2=1$

$r^2=1$

$r\in[0,1] \quad \theta\in[0,2\pi]$

$\frac{\partial z}{\partial x}=y \quad \frac{\partial z}{\partial y}=x \quad A(S)=\sqrt{1+y^2+x^2}$

$A(S)=\sqrt{1+r^2}$

$$\int_0^{2\pi}\int_0^1 r\sqrt{1+r^2}\,dr\,d\theta=\int_0^{2\pi}d\theta\int_0^1 r\sqrt{1+r^2}\,dr=2\pi\int_0^1 r\sqrt{1+r^2}\,dr$$

$u=1+r^2$

$du=2r\,dr$

$\frac{1}{2}du=r\,dr$

$$=\pi\int_1^2\sqrt{u}\,du=\pi\left[\frac{2}{3}(2)^{3/2}-\frac{2}{3}\right]$$

$$=\boxed{\frac{2\pi}{3}(2\sqrt{2}-1)}$$