

$\mathbf{F}(x, y, z) = x\mathbf{i} + y\mathbf{j} + z^4\mathbf{k}$ ,  $z = g(x, y) = \sqrt{x^2 + y^2}$ , and  $D$  is the disk  $\{(x, y) \mid x^2 + y^2 \leq 1\}$ . Since  $S$  has downward orientation, we have

$$\begin{aligned}\iint_S \mathbf{F} \cdot d\mathbf{S} &= - \iint_D \left[ -x \left( \frac{x}{\sqrt{x^2 + y^2}} \right) - y \left( \frac{y}{\sqrt{x^2 + y^2}} \right) + z^4 \right] dA \\ &= - \iint_D \left[ \frac{-x^2 - y^2}{\sqrt{x^2 + y^2}} + \left( \sqrt{x^2 + y^2} \right)^4 \right] dA \\ &= - \int_0^{2\pi} \int_0^1 \left( \frac{-r^2}{r} + r^4 \right) r \, dr \, d\theta = - \int_0^{2\pi} d\theta \int_0^1 (r^5 - r^2) \, dr \\ &= -2\pi \left( \frac{1}{6} - \frac{1}{3} \right) = \frac{1}{3}\pi\end{aligned}$$