

⑦ Calculate the area of the surface

$$x = yz, \quad y^2 + z^2 \leq 1$$

$$A = \iint_D f \, ds$$

$$= \iint_D \sqrt{1 + \left(\frac{\partial x}{\partial y}\right)^2 + \left(\frac{\partial x}{\partial z}\right)^2} \, dA$$

$$= \iint_D \sqrt{1 + y^2 + z^2} \, dA \leftarrow$$

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

$$= \int_0^{2\pi} \frac{1}{3} (1+r^2)^{3/2} \Big|_0^1 \, d\theta$$

$$= \int_0^{2\pi} \frac{1}{3} (2^{3/2} - 1) \, d\theta$$

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

parametrisation

$$x = yz$$

$$y = y$$

$$z = z$$

$$\vec{r}(y, z) = \langle yz, y, z \rangle$$

$$\vec{r}_y = \langle z, 1, 0 \rangle$$

$$\vec{r}_z = \langle y, 0, 1 \rangle$$

$$\boxed{|\vec{r}_u \times \vec{r}_v| = \sqrt{1 + y^2 + z^2}}$$