$\boxed{18}$

$z = 0 \rightarrow \quad 7 = x^2 + y^2$

$z = 2 \rightarrow \quad 2^2 = x^2 + y^2 - 7 \rightarrow (4 + 7) = x^2 + y^2$

$$f = \begin{bmatrix} x_1 - x_3 \\ x_1 + x_2 \\ x_3 + 1 \end{bmatrix} \begin{array}{l} \rightarrow f_1 \\ \rightarrow f_2 \\ \rightarrow f_3 \end{array}$$

3 flater: rød (krum), toppsirkel, bunnsirkel
((krum), topp, bunn)

$$\underbrace{\iint_{\text{krum}} f \cdot \hat{n}\, dS}_{\text{slem}} = \underset{\uparrow \text{ Divergensteorem}}{\oiint_{\partial T} f \cdot \hat{n}\, dS} - \underbrace{\iint_{\text{bunn}} f \cdot \hat{n}\, dS - \iint_{\text{topp}} f \cdot \hat{n}\, dS}_{\text{snille}}$$

$$= \underset{①}{\iiint_T \nabla \cdot f\, dV} - \underset{②}{\iint_{\text{bunn}} f \cdot \hat{n}\, dS} - \underset{③}{\iint_{\text{topp}} f \cdot \hat{n}\, dS}$$

① $\nabla \cdot f = 1 + 1 + 1 = 3$

$$3 \cdot \iiint_T dV \qquad T = \left\{ (s, \theta, z) : \begin{array}{l} 0 \le s \le \sqrt{z^2 + 7} \\ 0 \le \theta \le 2\pi \\ 0 \le z \le 2 \end{array} \right.$$

Sylinderkoordinater.

$$\begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} s\cos\theta \\ s\sin\theta \\ z \end{bmatrix} \leftrightarrow \begin{bmatrix} s \\ \theta \\ z \end{bmatrix} = \begin{bmatrix} \sqrt{x_1^2 + x_2^2} \\ \tan^{-1}\left(\frac{x_2}{x_1}\right) \\ x_3 \end{bmatrix} \leftrightarrow s^2 = x_1^2 + x_2^2$$

$$z = \sqrt{s^2 - 7}$$

$$z^2 = s^2 - 7$$

$$s^2 = z^2 + 7$$

$$s = \sqrt{z^2 + 7}$$

NB!

$$|J| = s$$

$$3 \cdot \int_0^2 \int_0^{2\pi} \int_0^{\sqrt{z^2+7}} s \, ds \, d\theta \, dz = 3 \cdot \int_0^2 \int_0^{2\pi} \left[\frac{1}{2} s^2\right]_0^{\sqrt{z^2+7}} d\theta \, dz$$

$$= 3 \cdot \frac{50\pi}{3}$$

$$= \underline{\underline{50\pi}}$$

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(2) $$\iint_{bunn} f \cdot \hat{n} \, ds = \iint_{bunn} -f_3 \big|_{x_3=0} \, ds = \iint_{bunn} \underbrace{f(x_1, x_2, 0)}_{[x_1 \cancel{x_2}, x_1 + x_2, 1]} \cdot (0, 0, -1) \, ds$$

$$bunn = \left\{ (r, \theta) : \begin{array}{l} 0 \leq r \leq \sqrt{7} \\ 0 \leq \theta \leq 2\pi \end{array} \right\}$$

$$= -1 \cdot \underbrace{\iint_{bunn} ds}_{\text{Areal av bunnflaten}}$$

$$\rightarrow -1 \cdot \int_0^{2\pi} \int_0^{\sqrt{7}} r \, dr \, d\theta$$

$\rightarrow$ Areal av sirkel

$$-1 \cdot \pi r^2 = -1 \cdot 7\pi$$

$$= \underline{\underline{-7\pi}}$$

(3) $$\iint_{topp} \underset{f(x_1, x_2, 2)}{f} \cdot \hat{n}\, ds = \iint [x_1 - 2,\ x_1 + x_2,\ 3] \cdot [0, 0, 1]\, ds$$

$$= 3 \iint_{topp} ds = 3 \cdot \pi r^2$$

$$= 3 \cdot \pi \cdot 11$$

$$= 33\pi$$

Endelig svar

$$\iint_{Krum} f \cdot \hat{n}\, ds = (1) - (2) - (3)$$

$$= 50\pi - (-7\pi) - 33\pi$$

$$= \underline{\underline{24\pi}}$$