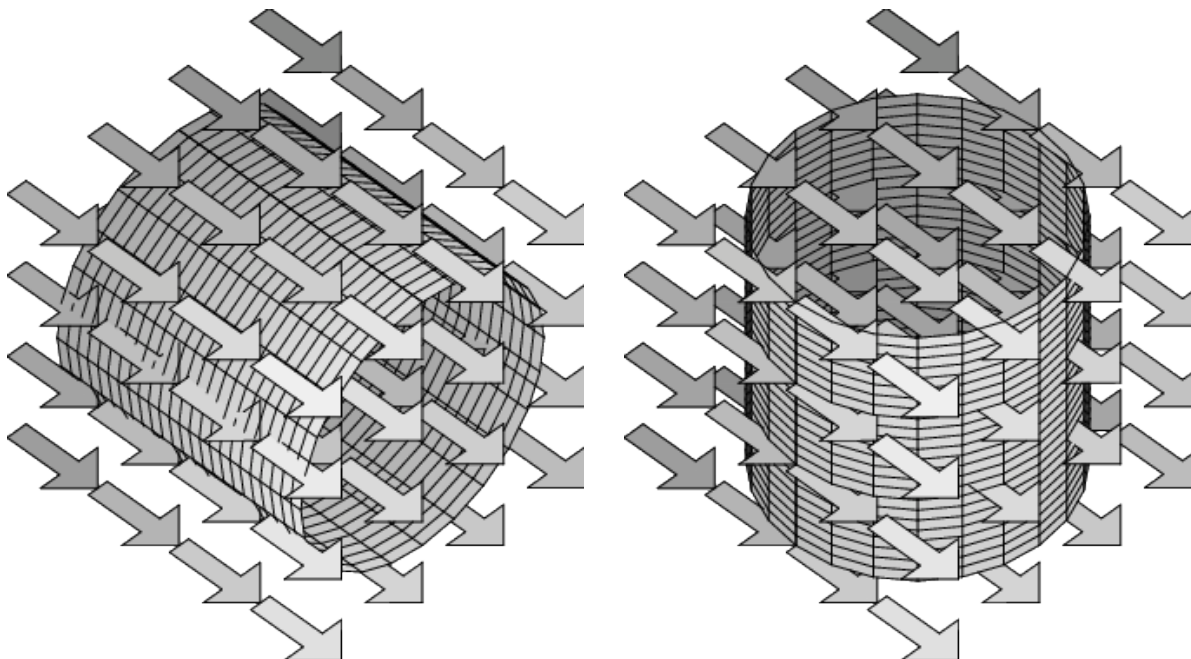




1 Flux through a Cylinder

- What do you think will be the flux through the cylindrical surface that is placed as shown in the constant vector field in the first figure?
- What if the cylinder is placed upright, as shown in the second figure? Explain.

2 Flux I

Find the flux of $\vec{F} = x\hat{x} + y\hat{y} + z\hat{z}$ out of a closed cylinder of radius 2 centered on the z -axis, with $-3 \leq z \leq 3$.

3 Flux II

Find the flux of $\vec{F} = z^2\hat{z}$ through the upper hemisphere of the sphere $x^2 + y^2 + z^2 = 25$, oriented away from the origin.

4 Flux III

Let $\vec{H} = (e^{xy} + 3z + 5)\hat{x} + (e^{xy} + 5z + 3)\hat{y} + (3z + e^{xy})\hat{z}$. Calculate the flux of $\vec{H}$ through the square of side 2 with one vertex at the origin, one edge along the positive y -axis, one edge in the xz -plane with $x > 0, z > 0$, and with normal $\hat{n} = \hat{x} - \hat{z}$.

5 Flux through a Plane

Find the upward pointing flux of the vector field $\vec{H} = 2z \hat{x} + \frac{1}{x^2+1} \hat{y} + (3+2z) \hat{z}$ through the rectangle R with one edge along the y axis and the other in the xz -plane along the line $z = x$, with $0 \leq y \leq 2$ and $0 \leq x \leq 3$.

6 Gauss's Law for a Rod inside a Cube

Consider a thin charged rod of length L standing along the z -axis with the bottom end on the x, y -plane. The charge density λ_0 is constant. Find the total flux of the electric field through a closed cubical surface with sides of length $3L$ centered at the origin.

7 Volume Charge Density

Consider the volume charge density:

$$\rho(x, y, z) = c \delta(x - 3)$$

- (a) Describe in words how this charge is distributed in space.
- (b) What are the dimensions of the constant c ?