

# Homework 2 GoA 3

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## Flux

In order to compute the flux of the vectorfield  $\mathbf{F}(x, y, z) = (x^4z, x^3y^2, 2x^3yz)$  over the box defined by  $0 \leq x \leq 1, 0 \leq y \leq 2, 0 \leq z \leq 1$  we use the divergens theorem since we have a vectorfield we can easily calculate the divergens of and a surface that encloses a simple volume the resulting tripple integral will be simple.

We begin by calculating the divergens of the field F

$$\frac{\partial F_x}{\partial x} = 4x^3z \quad (1)$$

$$\frac{\partial F_y}{\partial y} = 2yx^3 \quad (2)$$

$$\frac{\partial F_z}{\partial z} = 2x^3y \quad (3)$$

$$\nabla \cdot \mathbf{F} = 4x^3(y + z) \quad (4)$$

$$\iiint_D 4x^3(y + z) dx dy dz \quad (5)$$

Where D is the box mentioned above. Using Fubinis therorem we can rewrite it as a iterated integral

$$\int_0^1 dz \int_0^2 dy \int_0^1 4x^3(y+z)dx \quad (6)$$

$$\int_0^1 dz \int_0^2 [x^4(y+z)]_0^1 dy = \int_0^1 dz \int_0^2 y+z dy \quad (7)$$

$$\int_0^1 \left[ \frac{y^2}{2} + yz \right]_0^2 dz = \int_0^1 2 + 2z dz \quad (8)$$

$$[2z + z^2]_0^1 = 3 \quad (9)$$

Since the divergence theorem gives the wrong orientation we flip the sign and get that the flux over the box is -3

## Series