Engineering Assignment:

Flux

Student learning outcomes:

2.7.4	Convert from rectangular to spherical coordinates
2.3.1	Calculate the dot product of two given vectors
2.4.1	Calculate the cross product of two given vectors
2.4.2	Use determinants to calculate a cross product
6.2.4	Describe the flux and circulation of a vector field
6.4.3	Calculate circulation and flux on more general regions
6.7.3	Use Stokes' theorem to calculate a surface integral

Assignment Overview

Recall Flux= $\int \int \vec{F} \cdot \vec{n} \, dS$ gives the flux of a vector field F with unit normal vector n

through a surface S.

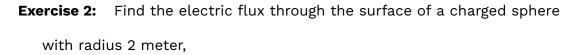
Exercise 1: Find the flux where vector field $\vec{F} = \langle x^2, y^2, z \rangle$ and S is the surface given by the paraboloid $z = 1 - x^2 - y^2$ and $z \ge 0$.

Gauss's Law for electric field states that the flux through a closed surface is

$$\Phi_E = \oint \vec{E} \cdot \vec{n} dA = \frac{Q}{\epsilon_0},$$

for any closed surface S containing charge Q, where E is the electric field, and ϵ_0 is a constant representing the permittivity of free space in C/Vm.

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when the charge Q is 2 \times 10 $^{-10}$ C/ m^2 . Use 2 methods with each part of Gauss's Law.