

MAT235 Tutorial 16

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Tutorial this week will focus on some vector calculus problems. There will be a quiz (12) during the last 15 minutes.

1. Let $\mathbf{F}(x, y, z) = \langle 10x + \sin(y^2), 14y + 9z, 18z + e^{x^2} \rangle$ be a vector field and consider the following surfaces:
 - i. S_1 , a sphere of radius 2;
 - ii. S_2 , a cube with side length 2;
 - iii. S_3 , a sphere of radius 1.

Let Q_i be the flux of $\mathbf{F}$ through the surface S_i ($i = 1, 2, 3$). Arrange the Q_i in ascending order.

2. Let $f(x, y, z) = \sin(xyz)$.
 - (a) Find $\text{curl}(\text{grad } f)$ and $\text{div}(\text{grad } f)$.
 - (b) Prove that there does not exist a vector field $\mathbf{F}$ such that $\text{curl } \mathbf{F} = \text{grad } f$.