

# Numericals on curl and divergence

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1. Compute  $\operatorname{div}\vec{F}$  and  $\operatorname{curl}\vec{F}$  for  $\vec{F} = x^2y\vec{i} - (z^3 - 3x)\vec{j} + 4y^2\vec{k}$ .

$$\operatorname{div}\vec{F} = \nabla \cdot \vec{F} = \frac{\partial}{\partial x}(x^2y) + \frac{\partial}{\partial y}(3x - z^3) + \frac{\partial}{\partial z}(4y^2) = \boxed{2xy}$$

$$\begin{aligned}\operatorname{curl}\vec{F} &= \nabla \times \vec{F} = \begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ \frac{\partial}{\partial x} & \frac{\partial}{\partial y} & \frac{\partial}{\partial z} \\ x^2y & 3x - z^3 & 4y^2 \end{vmatrix} \\ &= \frac{\partial}{\partial y}(4y^2)\vec{i} + \frac{\partial}{\partial z}(x^2y)\vec{j} + \frac{\partial}{\partial x}(3x - z^3)\vec{k} - \frac{\partial}{\partial y}(x^2y)\vec{k} - \frac{\partial}{\partial x}(4y^2)\vec{j} - \frac{\partial}{\partial z}(3x - z^3)\vec{i} \\ &= 8y\vec{i} + 3\vec{k} - x^2\vec{k} + 3z^2\vec{i} \\ &= \boxed{(8y + 3z^2)\vec{i} + (3 - x^2)\vec{k}}\end{aligned}$$

# Vector Calculus

**C Cleary**



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