Fluid Mechanics

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All errors, typographical and substantive, and other offenses, are entirely my own.

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2 - Cartesian Tensors

Question: 2.1

For three spatial dimensions, rewrite the following expressions in index notation and evaluate or simplify them using the values or parameters given, and the definitions of δ_{ij} and ϵ_{ijk} wherever possible. In b) through e), $\boldsymbol{x}$ is the position vector, with components x_i.

    a. $\boldsymbol{b} \cdot \boldsymbol{c}$ where $\boldsymbol{b} = (1, 4, 17)$ and $\boldsymbol{c} = (-4, -3, 1)$.

    b. $(\boldsymbol{u} \cdot \nabla)\boldsymbol{x}$ where $\boldsymbol{u}$ a vector with components u_i.

    c. $\nabla\phi$, where $\phi = \boldsymbol{h} \cdot \boldsymbol{x}$ and $\boldsymbol{h}$ is a constant vector with components h_i.

    d. $\nabla \times \boldsymbol{u}$, where $\boldsymbol{u} = \Omega \times \boldsymbol{x}$ and Ω is a constant vector with components Ω_i.

    e. $C \cdot \boldsymbol{x}$, where

$$C = \begin{Bmatrix} 1 & 2 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 1 \end{Bmatrix}$$

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a. $\boldsymbol{b} \cdot \boldsymbol{c} = -4 - 12 + 17 = 1$

b.