Physics 333 **Electromagnetic Theory I** **Fall 2022**

Homework Assignment #6

(due Sept. 7, 2022, at beginning of class)

1. Griffiths 1.45
2. Griffiths 1.48
3. In homework #2.3 and #2.4 you determined the divergence and the curl for
   - $\mathbf{v}_a = y^2\,\hat{\mathbf{x}} + (2xy + z^2)\,\hat{\mathbf{y}} + 2yz\,\hat{\mathbf{z}}$
   - $\mathbf{v}_b = -xy\,\hat{\mathbf{x}} + 2yz\,\hat{\mathbf{y}} + 7xz\,\hat{\mathbf{z}}$
   - $\mathbf{v}_c = x^2\,\hat{\mathbf{x}} + 3xz^2\,\hat{\mathbf{y}} - 2xz\,\hat{\mathbf{z}}$

   (i) Which of these vectors can be expressed as $\mathbf{v} = \nabla T$? For the corresponding $\mathbf{v}$ find T.

   (ii) Which of these vectors can be expressed as $\nabla \times \mathbf{A}$? For the corresponding $\mathbf{v}$ find $\mathbf{A}$. Hint: Choose one of the $\mathbf{A}$-components to be zero, for example $A_y = 0$. To not give away, which of the vectors above you will use, let me explain the next step with some other vector $\mathbf{v}_d = 3xy^2\,\hat{\mathbf{x}} + (y^2 - y^3)\,\hat{\mathbf{y}} + 2yz\,\hat{\mathbf{z}}$. In this case choosing $A_y = 0$ means $v_{d,x} = (\nabla \times \mathbf{A})_x = \left(\frac{\partial}{\partial y}A_z - \frac{\partial}{\partial z}A_y\right) = \frac{\partial}{\partial y}A_z = 3xy^2$ and therefore $A_z = xy^3 + f(x,z)$, where $f(x,z)$ indicates a function which may depend on x and/or z, but not on y. Similarly you use $v_{d,y}$ and $v_{d,z}$.