Level 2 EM question 9 2002/3

At large r the vector potential associated with a Hertzian dipole is given by

$$\underline{A}(\underline{r},t) = \frac{\mu_o I_o}{4\pi r} e^{j\omega(t-r/c)} d\underline{l}$$

which is equivalent to

$$\underline{A}(\underline{r},t) = \frac{\mu_o I_o}{4\pi r} e^{j\omega(t-r/c)} \left[\cos\theta\,\hat{\underline{r}} - \sin\theta\,\hat{\underline{\theta}}\right] dl$$

Demonstrate that this leads to the results given in lectures for $\underline{B} = \nabla \times \underline{A}$ by using the spherical coordinate form of the expression for $\nabla \times \underline{A}$ i.e.

$$\underline{B} = \nabla \times \underline{A} = \frac{1}{r^2 \sin\theta} \begin{vmatrix} \hat{\underline{r}} & r\,\hat{\underline{\theta}} & r\sin\theta\,\hat{\underline{\phi}} \\ \dfrac{\partial}{\partial r} & \dfrac{\partial}{\partial \theta} & \dfrac{\partial}{\partial \phi} \\ A_r & rA_\theta & r\sin\theta\,A_\phi \end{vmatrix}$$