Using Maxwell's equations:

(1) $\vec{\nabla} \cdot \vec{\mathbf{E}} = \rho / \varepsilon_0$ (2) $\vec{\nabla} \cdot \vec{\mathbf{B}} = 0$

(3) $\vec{\nabla} \times \vec{\mathbf{E}} = -\partial \vec{\mathbf{B}} / \partial t$ (4) $\vec{\nabla} \times \vec{\mathbf{B}} = \mu_0 \vec{\mathbf{J}} + \mu_0 \varepsilon_0 \, \partial \vec{\mathbf{E}} / \partial t$

and the following vector identity:

$$\vec{\nabla} \times \left(\vec{\nabla} \times \vec{f} \right) = \vec{\nabla} \left(\vec{\nabla} \cdot \vec{f} \right) - \nabla^2 \vec{f}$$

show that in vacuum (where there are no charges or currents) each of the three spatial components of the *electric* field satisfy the three-dimensional wave equation.

$$\nabla^2 \vec{f}\left(\vec{r}, t\right) = \frac{1}{v^2} \frac{\partial^2}{\partial t^2} \vec{f}\left(\vec{r}, t\right)$$

What is the speed v of this wave?