| NAME: | Quiz #3b: Phys270 |
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1. [10 pts] Laboratory scientists have created the electric and magnetic fields shown below. These fields are also seen by scientists that zoom past in a rocket traveling in the +x-direction at a speed of $1.0 \times 10^6$ m/s.

Note that $c=3.0 \times 10^8$ m/s, and $\cos 45° = \sin 45° = \frac{\sqrt{2}}{2}$

a. [5 pts] According to the rocket scientists, what is the magnetic field expressed as a vector in x, y, and z components?

$v < 10^7$ m/s. Hence it's safe to apply Galilean transformation of fields according to which $\vec{B}' = \vec{B} - \frac{\vec{v} \times \vec{E}}{c^2} = -1.0\,T\,\hat{k} - \frac{1.0\times10^6 \frac{m}{s}\,\hat{i} \times 1.0\times10^6 \frac{V}{m}\left(-\frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}\right)}{(3\times10^8 \frac{m}{s})^2}$

or, $\vec{B}' = -1.0\,T\,\hat{k} - \frac{1}{\sqrt{2}\cdot 9}\times10^{-4}\,T\,\hat{k}$

b. [5 pts] According to the rocket scientists, what is the electric field expressed as a vector in x, y, and z components?

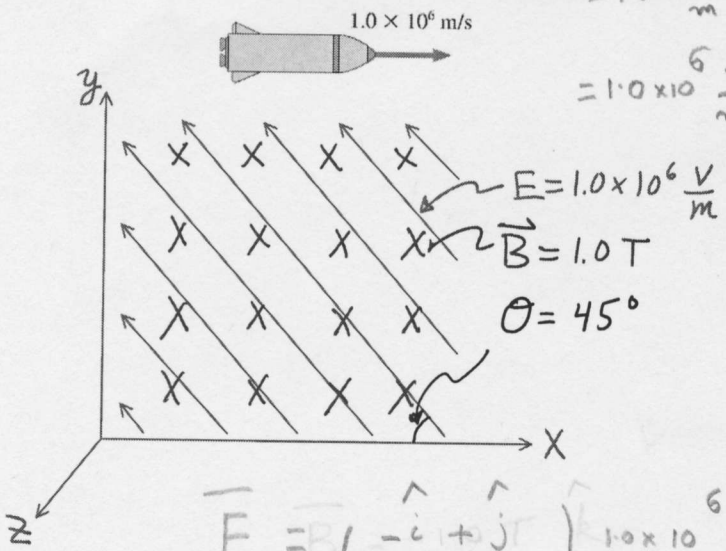
Using Galilean transformation for Electric field we have

$$\vec{E}' = \vec{E} + \vec{v} \times \vec{B}$$

$$= 1.0\times10^6 \frac{V}{m}\left(-\frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}\right) + 1.0\times10^6 \frac{m}{s}\,\hat{i} \times (-1.0\,T\,\hat{k})$$

$$= 1.0\times10^6 \frac{V}{m}\left(-\frac{\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}\right) + 1.0\times10^6 \frac{V}{m}\,\hat{j}$$

$$= 1.0\times10^6 \frac{V}{m}\left(-\frac{\hat{i}}{\sqrt{2}} + \left(1+\frac{1}{\sqrt{2}}\right)\hat{j}\right)$$




$$\vec{E} = \left(\frac{-\hat{i}}{\sqrt{2}} + \frac{\hat{j}}{\sqrt{2}}\right) 1.0\times10^6 \frac{V}{m}, \quad \vec{B} = -\hat{k}\ 1.0\,T$$

$$\vec{v} = 1.0\times10^6 \text{ m/s}\ \hat{i}$$