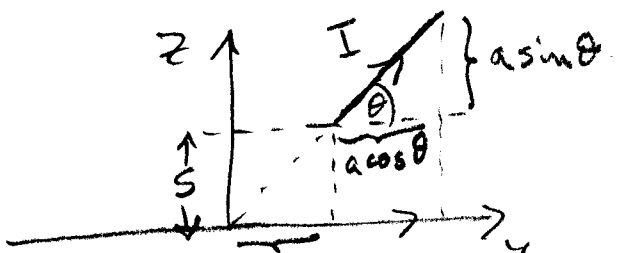
Name .....

Quiz 10
PH361

$\vec{p} = \int \vec{r'} \rho(r') d\tau'$
$\vec{F} = (\vec{p} \cdot \vec{\nabla}) \vec{E}$
$E = \frac{1}{4\pi\epsilon_0} \frac{1}{r^3} (3\vec{p} \cdot \hat{r}\, \hat{r} - \vec{p})$
$\vec{\nabla} t = \frac{\partial t}{\partial r} \hat{r} + \frac{1}{r} \frac{\partial t}{\partial \theta} \hat{\theta} + \frac{1}{r \sin\theta} \frac{\partial t}{\partial \phi} \hat{\phi}$
$\hat{r} = \sin\theta \cos\phi\ \hat{x} + \sin\theta \sin\phi\ \hat{y} + \cos\theta\ \hat{z}$
$\hat{\theta} = \cos\theta \cos\phi\ \hat{x} + \cos\theta \sin\phi\ \hat{y} - \sin\theta\ \hat{z}$
$\hat{\phi} = -\sin\phi\ \hat{x} + \cos\phi\ \hat{y}$
$\vec{D} = \epsilon_0 \vec{E} + \vec{P}$
$\vec{D} = \epsilon \vec{E}$
$\vec{F} = q\vec{v} \times \vec{B}$
$d\vec{F} = I d\vec{l} \times \vec{B} = \vec{K} \times \vec{B} da = \vec{J} \times \vec{B} d\tau$

1. Write an integral expression for the force on the diagonal segment of the triangular loop (equilateral triangle with each side a distance "a") which is a distance s away from an infinite straight wire. Both the wire and loop carry current I. Please do not evaluate the integral.



$s = \sqrt{3}\, y_i$

$z = \tan\theta\, y = \sqrt{3}\, y$

$d\vec{l} = dy\,\hat{y} + dz\,\hat{z} = dy\,\hat{y} + \sqrt{3}\,dy\,\hat{z}$

Ampere's Law $\Rightarrow \vec{B} = \frac{\mu_0 I}{2\pi z} \hat{x}$

$y_f = y_i + a/2$

$\vec{F} = \int d\vec{F} = \int_{y_i}^{y_f} I\, d\vec{l} \times \vec{B}$

$y_i = s/\sqrt{3}$

↖ variable of integration is y so z must be expressed explicitly in terms of y.