Nov 02
EM

<u>worksheet</u> for $\overset{EM}{Ex\ 5.2}$ <u>Cycloid motion</u>. You will find
$\overline{206}$ the general solution (5.6) to use in problem 5.2.

$$\vec{F} = m\vec{a} = m\ddot{x} + m\ddot{y} + m\ddot{z}$$

$F_y = m\ddot{y} =$ $\qquad\qquad$ $F_z = m\ddot{z}$

$\ddot{z} =$ $\qquad\qquad$ $\dddot{y} =$

Let $\dot{y} = u$, $\ddot{y} = \dot{u}$, $\rightarrow \dddot{y} = \ddot{u} =$

Let $(E - Bu) = p \rightarrow \ddot{p} =$

Guess $p = Ae^{i\omega t}$

$\omega =$

$p = Ae^{i\omega t} = (E - Bu) = (E - B\dot{y}) \rightarrow \dot{y} =$

$y = \int \dot{y}\, dt = \int (\qquad\qquad) dt$

$y =$

$\ddot{z} = \frac{m\dddot{y}}{qB} = \frac{1}{\omega}\dddot{y} \rightarrow \dot{z} = \frac{1}{\omega}\ddot{y}$

$z = \int \dot{z}\,dt = \frac{1}{\omega}\int \ddot{y}\,dt = \frac{1}{\omega}\dot{y} =$

Now use the initial conditions to determine the unknown constants:

AT REST   AT THE ORIGIN, initially:

$\dot{y}(0) = 0 \quad \dot{z}(0) = 0 \quad y(0) = 0 \quad z(0) = 0$

$y(t) =$ $z(t) =$

Let $R \equiv \frac{E}{\omega B}$. Then

$y^2 =$ $z^2 =$

Show that $(y - R\omega t)^2 + (z - R)^2 = R^2$: circle of radius R with center at $y = R\omega t$, $z = R$, $x = 0$ traveling with $\frac{d}{dt}(y - R\omega t) = 0 \longrightarrow v_y =$ ______