$$F = \frac{mv^2}{r} = q(\vec{v} \times \vec{B})$$

$$= qvB$$

$$\frac{mv}{r} = qB$$

$$r = \frac{mv}{qB}$$

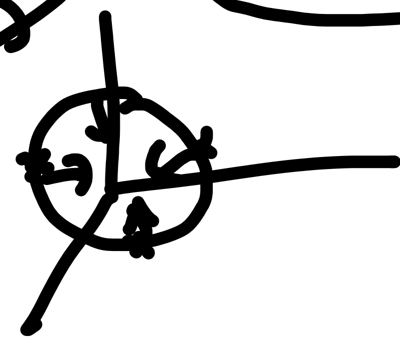
$$v = \frac{qBr}{m}.$$

$$T = \frac{2\pi r}{v} = 2\pi \frac{mv}{qB \times v}$$

$$\nu = \frac{1}{2\pi} \frac{qB}{m}$$

$$\omega = \frac{qB}{m}$$

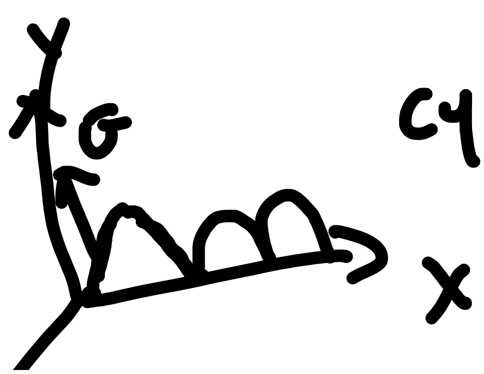
$$\nu = \frac{1}{2\pi}\frac{qB}{m}$$



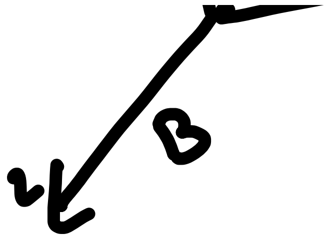
$$T = \frac{2\pi m}{qB}$$

$$\text{pitch} = T \times v\cos\theta$$

$$= \frac{2\pi m v\cos\theta}{qB}$$



cycloid.



$$(v_x, v_y, v_z)$$

$$F = m\left(\frac{dv_x}{dt}\hat{i} + \frac{dv_y}{dt}\hat{j} + \frac{dv_z}{dt}\hat{k}\right]$$

$$= q\left[E\hat{j} + (v \times B)_z\right]$$

$$v_x = E/B - \frac{m}{qB}\frac{dv_y}{dt}$$

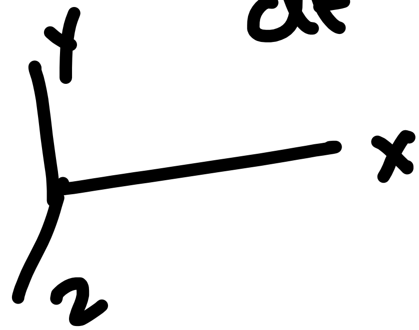
$t = 0$, $v_x = 0$

$$v_y = A\sin(\omega t + \phi)$$

$$v_x = E/B\,(1 - \cos\omega t)$$

$$\underline{\underline{v_z = 0}}$$

1. $F = F$ $\quad V_y = \frac{dy}{dt}$ $\quad V_x = \frac{dx}{dt}$
2. V_x, V_y, V_z
3. x, y, z

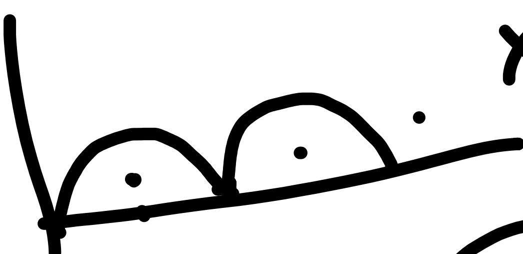


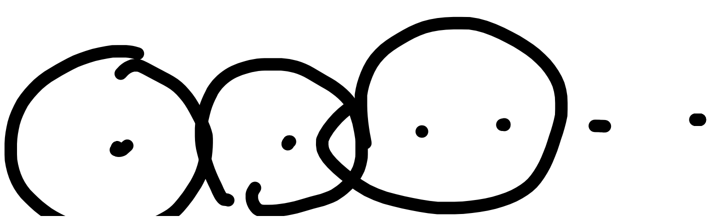
$$x = R(\omega t - \sin\omega t)$$

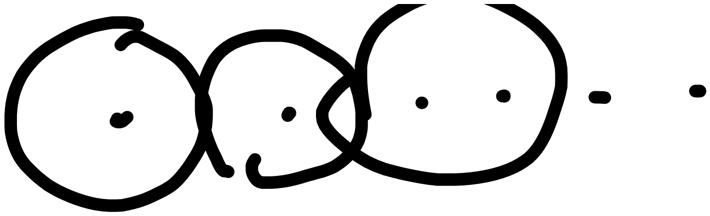
$$y = R(1 - \cos\omega t)$$

$$(x - R\omega t)^2 + (y - R)^2 = R^2$$

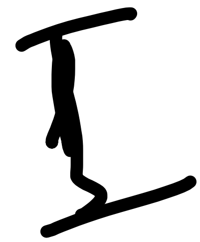
$$x^2 + y^2 = R^2$$



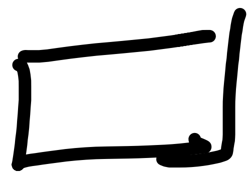




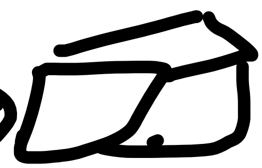
$I = \lambda v$ $\qquad F = \int (I \times B)\, dl$



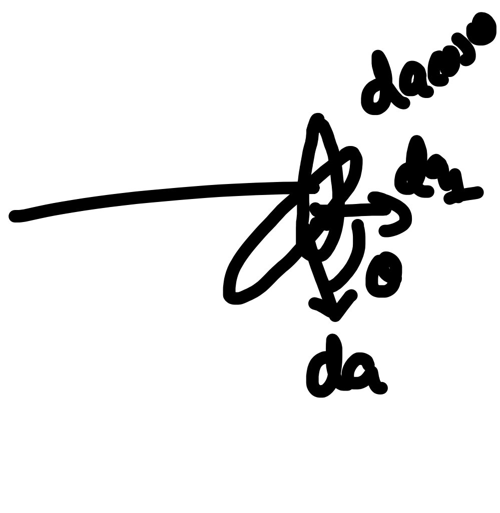
$K = \sigma v$ $\qquad F = \int (K \times B)\, da \rightarrow$



$J = \rho v$ $\qquad F = \int (J \times B)\, d\tau \rightarrow$



$$J = \frac{dI}{da_\perp}$$



$J\, da_\perp = dI$

$dI = J\, da \cos\theta = J \cdot da$

$$I = \int J \cdot da .$$

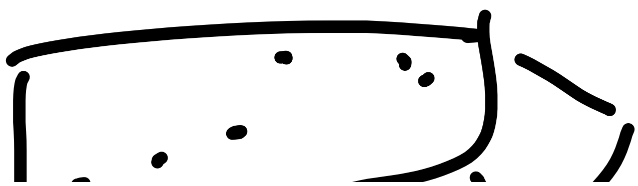
$$\int J \cdot da = \int \cancel{(\nabla \cdot A)}$$
$$= \int (\nabla \cdot J)\, d\overline{C}$$

$$\oint \vec{A} \cdot da = \int (\nabla \cdot \vec{A})\, dv$$

$$\oint \vec{A} \cdot dl = \int (\nabla \times A)\, da .$$

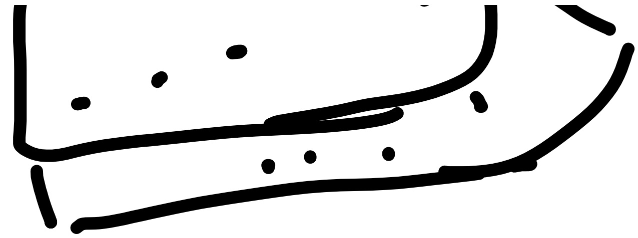
$$I = \int J \cdot da = \int (\nabla \cdot J)\, d\bar{V}$$

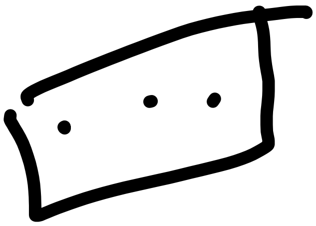
$$I = \frac{d \int \rho\, dv}{dt}$$



$\overline{dt}$

=





$$dq = \rho\, dv$$

$$-\frac{\partial}{\partial t}\int \rho\, dv = \int (\nabla\cdot \vec{J})\, dv$$

$$\int\left(-\frac{\partial\rho}{\partial t}\right) dv = \int (\nabla\cdot \vec{J})\, dv$$

$$\nabla\cdot\vec{J} = -\frac{\partial\rho}{\partial t}$$

$$\nabla\cdot\vec{J} + \frac{\partial\rho}{\partial t} = 0$$