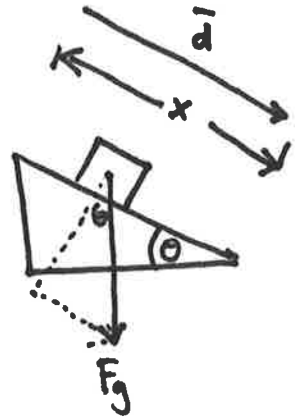
ASG v.3 Ex A.3 (vector multiplication, part 1)



$W = \bar{F} \cdot \bar{d}$

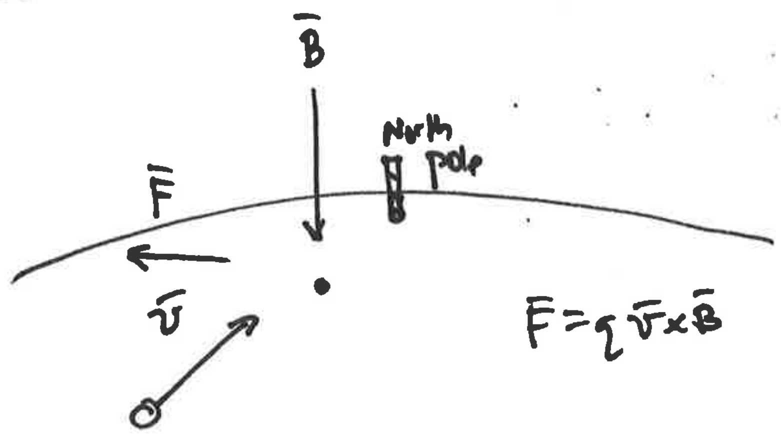
a) $W_g = \bar{F}_g \cdot \bar{d} = (F_g)(d)(\cos(90-\theta))$

$= (100\text{grams})(10\,m/s^2)(1\text{ meter})(\cos 60°)$

$W_g = 0.5$ Joules

b) Since the force exerted by the ~~block~~ ramp on the block is ⊥ to $\bar{d}$, it does zero work

ASG v3 Ex A.4 (Vector multiplication, part 2)



$F = q\,\bar{v} \times \bar{B}$

a) $|\bar{F}| = (q_{electron})\left(\frac{400\,km}{sec}\right)(5 \times 10^{-9}\ Tesla)$

$$\boxed{F = 3.2 \times 10^{-22}\ Newtons}$$

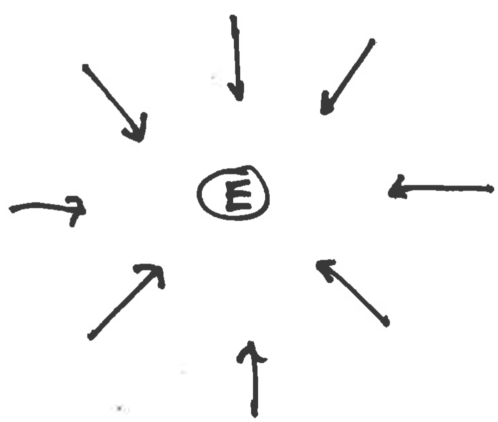
b) The trajectory is curved **westward**

c) Since the force is always perpendicular to the velocity, the Lorentz force can do **zero work**. So the speed & kinetic energy remain unchanged.

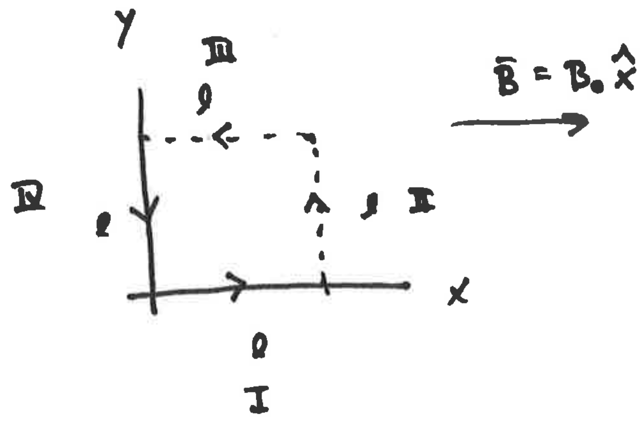
ASG v3 EX A.5 (vector fields)

$$\bar{g}(\bar{r}) = \frac{F_g}{m_2}(-\hat{r}) = \frac{G\, m_1 m_2}{r^2\, m_2}(-\hat{r})$$

$$\bar{g}(\bar{r}) = \frac{G M_{earth}}{r^2}(-\hat{r})$$



ASGv3 Ex A.6 (vector calculus, part 1)



Along I : $\int \bar{B} \cdot d\bar{s} = \int B_0 \hat{x} \cdot dx\, \hat{x} = \int_{x=0}^{x=l} B_0\, dx = B_0 l$

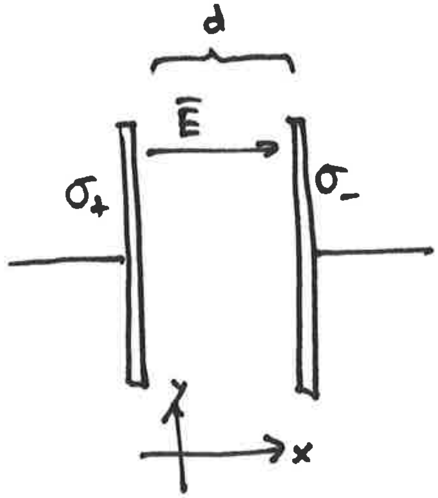
II : $\int \bar{B} \cdot d\bar{s} = \int B_0 \hat{x} \cdot dy\, \hat{y} = 0$

III : $\int \bar{B} \cdot d\bar{s} = \int_{x=l}^{x=0} B_0 \hat{x} \cdot dx\, \hat{x} = -B_0 l$

IV : $\int \bar{B} \cdot d\bar{s} = \int_{y=l}^{y=0} B_0 \hat{x} \cdot dy\, \hat{y} = 0$

So around the whole loop, $\int_{\text{closed loop}} \bar{B} \cdot d\bar{s} = 0$

ASG v3 EX A.7 (Electric fields and electric potential)



$$\Delta V = -\int \vec{E} \cdot d\vec{s}$$

$$= -\int \left(\frac{\sigma}{2\epsilon}\right) \hat{x} \cdot dx\, \hat{x}$$

$$= -\int_{x=0}^{d} \frac{\sigma}{2\epsilon}\, dx$$

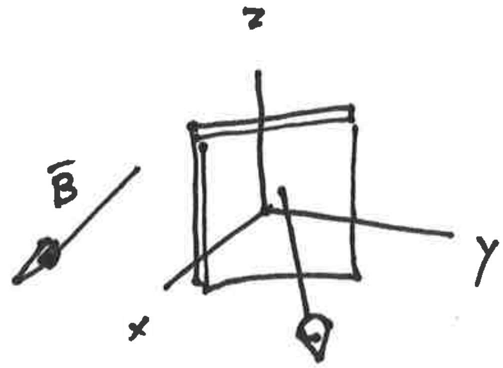
a) the potential difference is $\boxed{\Delta V = -\dfrac{\sigma d}{2\epsilon}}$

b) If the gap of the capacitor is filled w/ mylar, then $\epsilon > \epsilon_0$. For fixed ΔV (when you hook it up to a battery), the charged stored is.

$$\sigma = \frac{2\epsilon \Delta V}{d}$$

So if ϵ is larger, the charge stored is larger.

ASG V3 Ex A.8 (vector calculus, part 2)



$$\int \bar{B} \cdot d\bar{A}$$

$$= \int (B_0 \hat{x}) \cdot (dA)(a\hat{x} + b\hat{y})$$

$$= \int B_0 \, a \, dA$$

$$= B_0 \, a \, A$$

$$\Phi = B_0 \, a \, l^2$$