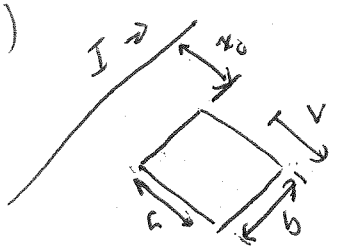
7.4)

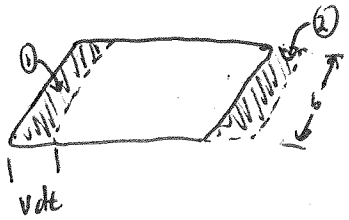


Calculate the Emf induced in the wire. Assume that the resistance is high enough that the induced current is negligible. Estimate this resistance.

$$\mathcal{E} = -\frac{d\Phi}{dt}$$

first we need the flux change in

consider how much the loop moves in time dt



moving away from wire $\Rightarrow$ flux decreasing $\Rightarrow$ Lenz's law says I_{ind} will counteract the change in flux $\Rightarrow$ induced B field will point up $\Rightarrow$ I

the change in flux is

$$d\Phi = -\Phi_1 + \Phi_2$$

$$\Phi_1 = B_1 \cdot b \cdot v\,dt$$

$$\Phi_2 = B_2 \cdot b \cdot v\,dt$$

$$d\Phi = (B_2 - B_1)\, b\, v\, dt$$

$$+\frac{d\Phi}{dt} = -(B_1 - B_2)\, b \cdot V$$

$$\mathcal{E} = -\frac{d\Phi}{dt} = (B_1 - B_2) \cdot b \cdot V$$

for a wire $B = \frac{\mu_0 I}{2\pi r}$

$$\mathcal{E} = \frac{\mu_0 I}{2\pi} b v \left(\frac{1}{x_0} - \frac{1}{x_0 + a}\right)$$

if $\mathcal{E} = IR$ then R should be $\approx 100 \cdot \mathcal{E}$ to make I small.