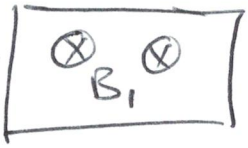
E+M #1

$$\mathcal{E} = -\frac{d\Phi_B}{dt} \qquad \Phi_B = B \cdot A$$

$$B = B_0(1-\alpha t)$$

$$\frac{dB}{dt} = -\alpha B_0 \qquad \mathcal{E} = +\alpha B_0 A = \alpha B_0 ab$$

$$RI = V = \mathcal{E}$$



$$I = \frac{\mathcal{E}}{R} = \frac{\alpha B_0 ab}{R}$$

① B_1 ⊗ Find initial B

② ΔB_1 ⊙ Find change

③ B_2 ⊗ Counter change

④ I_2 Induced current

⑤ I = constant ⇒ no back EMF

From $\frac{dI}{dt}$

E+M #2 (a) $\Phi_E = \oint E \cdot dA = \frac{Q_{enc}}{\varepsilon_0}$

$$E \cdot 4\pi r^2 = \frac{1}{\varepsilon_0} \rho_0 V = \frac{\rho_0}{\varepsilon_0} \frac{4}{3}\pi r^3$$

(V = volume)

$$E = \frac{\rho_0 r}{3\varepsilon_0}$$

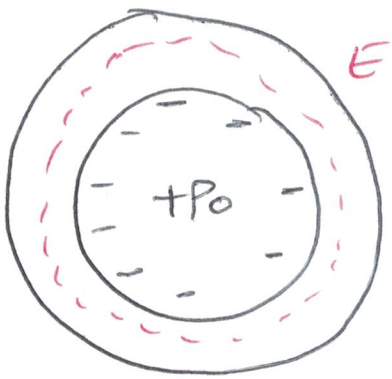
(b) $E = -\nabla V \Rightarrow E = -\frac{dV}{dr}$ or $V = \int -E\, dr$

$$V = -\frac{\rho_0 r^2}{6\varepsilon_0} + \text{const} \qquad \text{Note } V(R) = 0$$

so $$V = \frac{\rho_0}{6\varepsilon_0}(R^2 - r^2)$$

(c) Gauss: $E \cdot A = \frac{Q}{\varepsilon_0} \Rightarrow E = \frac{\sigma}{\varepsilon_0}$ $\sigma = \frac{Q}{A}$

$$\sigma = \varepsilon_0 E(R) = \frac{\rho_0 R}{3}$$ but let's check sign



$E = 0$ in conductor

IF $\rho_0 > 0$ positive

then surface charge is negative

so $Q_{enc} = 0$