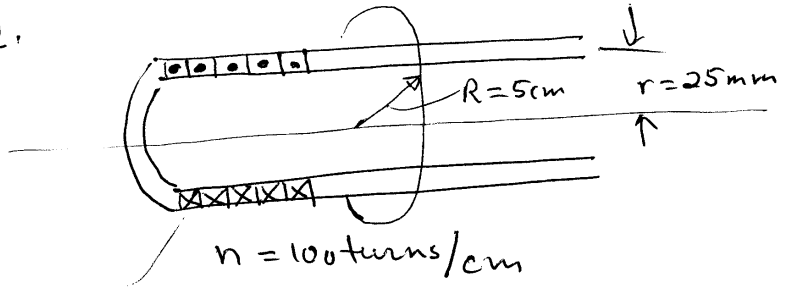
1.

a) $\Phi_B = 6.0t^2 + 7.0t$, in milliwebers

$$\mathcal{E} = \frac{d\Phi_B}{dt} = 2(6)(2) + 7 = 24 + 7 = 31 \text{ mVolts}$$

b) Right to left.

2.



$B = \mu_0 i n$, $\Phi_B = \mu_0 i n (\pi r^2)$

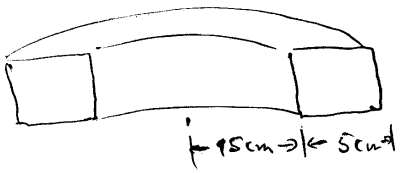
$$\mathcal{E} = \frac{\Delta\Phi_B}{\Delta t} = \mu_0 n(\pi r^2)\frac{\Delta i}{\Delta t}$$

$$= 4\pi \times 10^{-7}(10{,}000)(\pi(25\times10^{-3})^2\frac{1-0.5}{10\times10^{-3}}$$

$$= 1.23\times10^{-3} \text{ Volts}$$

$$\mathcal{E} = 1.23 \text{ mVolts.}$$

3.



$N = 500$ turns

$i = 0.800\,A$

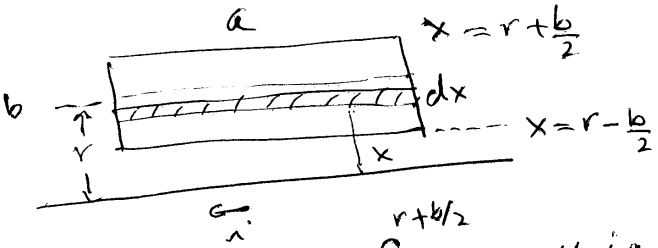
$$B = \frac{\mu_0 i N}{2\pi r}$$

$$\Phi_B = \int B\,dA = \frac{\mu_0 i N}{2\pi}\int_{r=15}^{r=15+5}\frac{a\,dr}{r} = \frac{\mu_0 i N a}{2\pi}\ln\frac{20}{15}$$

$$\Phi_B = \frac{(4\pi\times10^{-7})(0.800)(500)(0.05)}{2\pi}\ln\frac{20}{15}$$

$$\Phi_B = 1.15\times10^{-6}\ Wb \text{ or } 1.15\ \mu Wb.$$

4.

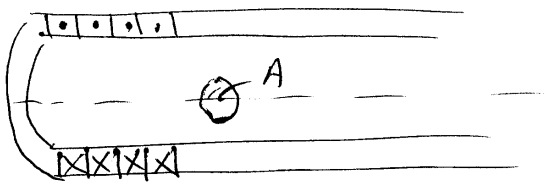


$$\Phi_B = \int B\,dA = \frac{\mu_0 i a}{2\pi}\int_{x=r-b/2}^{r+b/2}\frac{dx}{x} = \frac{\mu_0 i a}{2\pi}\ln\frac{r+b/2}{r-b/2} = \frac{\mu_0 i a}{2\pi}\ln\frac{2r+b}{2r-b}$$

$$i = \frac{\mathcal{E}}{R} = \frac{1}{R}\frac{d\Phi_B}{dt} = \frac{\mu_0 i a}{2\pi R}\cdot\frac{2r-b}{2r+b}\left(\frac{1}{2r-b}(2) + \frac{(2r+b)(-1)(2)}{(2r-b)^2}\right)\frac{dr}{dt}$$

$$i = \frac{2\mu_0 i a b v}{\pi R(4r^2-b^2)}, \quad v = \frac{dr}{dt}$$

5.



$$\Phi_B = BA = \mu_0 in\, A = \mu_0 n A i_0 \sin\omega t$$

$$\frac{d\Phi_B}{dt} = \mu_0 n A i_0 \omega \cos\omega t$$