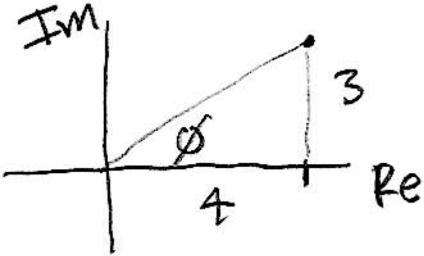
$\boxed{1}$ $Z = i\omega L + R$ $\quad \omega = 2\pi \cdot 10^4$

$$\omega L = 2\pi \cdot 10^4 \cdot \frac{3}{2\pi} \cdot 10^{-4} = 3\,\Omega$$

(a) $|Z| = \sqrt{(\omega L)^2 + R^2} = \sqrt{3^2 + 4^2} = 5\,\Omega$

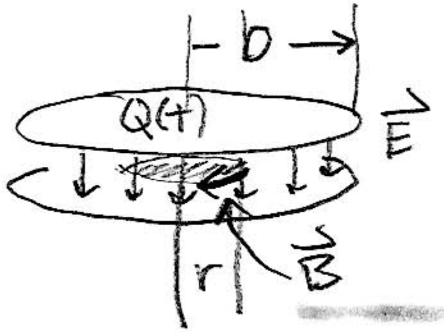
(b) $Z = R + i\omega L = 4 + 3i$



$$\tan\phi = \frac{3}{4} = 0.75$$

$$\phi = 0.643 \text{ Rad} = 36.9^\circ$$

$\boxed{2}$



$\sigma = \frac{Q}{\pi b^2}$ $E = \frac{4Q}{b^2}$

(Gauss: $A \cdot E = 4\pi \cdot \frac{Q}{\pi b^2} A$)

$E = \frac{4Q}{b^2}$

$$\underbrace{\int \vec{B} \cdot d\vec{s}}_{\text{perimeter}} = \frac{1}{c} \underbrace{\int \frac{\partial \vec{E}}{\partial t} \cdot d\vec{A}}_{\text{Area}} \qquad \frac{\partial E}{\partial t} = \frac{4}{b^2}\frac{dQ}{dt}$$

$$2\cancel{\pi} r B = \frac{4}{b^2 c} \cdot \frac{dQ}{dt} \cdot \cancel{\pi} r^2$$

$$B = \frac{2r}{cb^2} \cdot \frac{dQ}{dt}$$

$Q = Q_0 \cos(\omega t)$

$\frac{dQ}{dt} = -\omega Q_0 \sin(\omega t)$

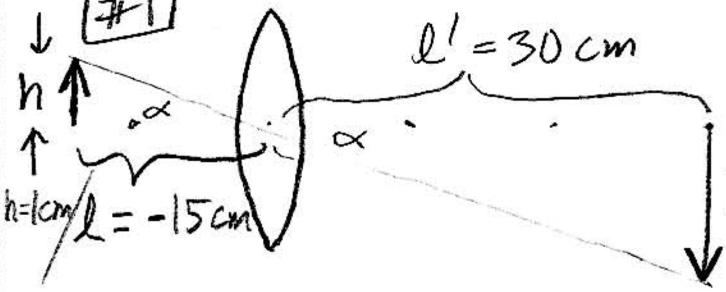
symbolically $\boxed{B = -\frac{2 r \omega Q_0}{c b^2} \sin(\omega t)}$

$$= \frac{-2 \cdot 1 \cdot \cancel{3 \cdot 10^8 \cdot 10^2}}{\cancel{3 \cdot 10^{10}} \cdot 2^2} \sin(3 \cdot 10^8 t)$$

numerically $\boxed{B = \left(-\frac{1}{2}\text{ Gauss}\right) \cdot \sin(3 \cdot 10^8 t)}$

3 Take this in two steps.

$\boxed{\#1}$



$$-\frac{1}{\ell} + \frac{1}{\ell'} = \frac{1}{f_1}$$

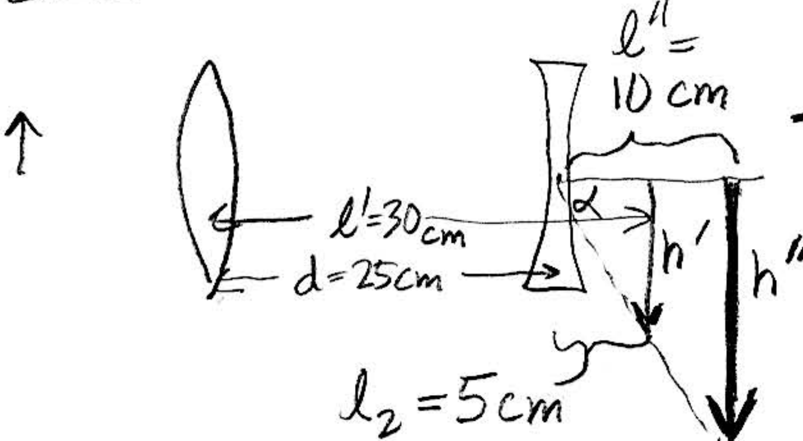
$$\frac{1}{\ell'} = \frac{1}{f_1} + \frac{1}{\ell}$$

$$\frac{1}{\ell'} = \frac{1}{10} - \frac{1}{15} = \frac{3}{30} - \frac{2}{30} = \frac{1}{30} \Rightarrow \underline{\ell' = 30cm}$$

look at the triangles

$$\frac{h'}{\ell'} = -\frac{h}{\ell} \qquad \underline{h' = -\frac{\ell'}{\ell} h = -3cm}$$

$\boxed{\#2}$



$$-\frac{1}{\ell_2} + \frac{1}{\ell''} = \frac{1}{f_2}$$

$$\frac{1}{\ell''} = -\frac{1}{10} + \frac{1}{5}$$

$$= -\frac{1}{10} + \frac{2}{10} = \frac{1}{10}$$

$$\boxed{\ell'' = 10cm} \text{ (a)}$$

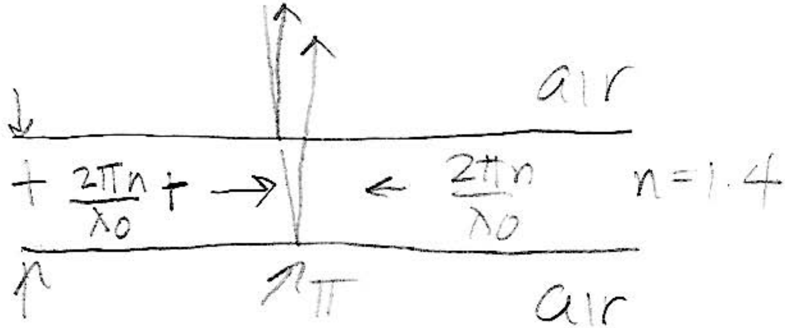
(b) look at the triangle to the right of the second lens

$$\frac{\ell''}{\ell_2} = \frac{h''}{h'} \rightarrow h'' = \frac{\ell''}{\ell_2} \cdot h'$$

$$= \frac{10}{5} \cdot (-3cm) = -6cm$$

$$\boxed{m = \frac{h''}{h} = \frac{-6 cm}{1 cm} = 6}$$

4



$$\phi = \frac{4\pi n t}{\lambda_0} + \pi$$

$$I \propto \cos^2\left(\frac{2\pi n t}{\lambda_0} + \frac{\pi}{2}\right) = \cos^2\frac{\phi}{2}$$

$$\text{maximum} \quad \frac{2\pi n t}{\lambda_0} = \frac{\pi}{2}$$

$$\boxed{\begin{aligned} t &= \frac{\pi}{4}\frac{\lambda_0}{n} \\ &= \frac{\pi}{4}\cdot\frac{630}{1.4} \\ t &= 353\ \text{nm} \end{aligned}}$$