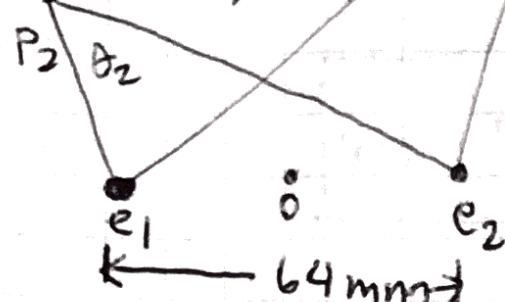
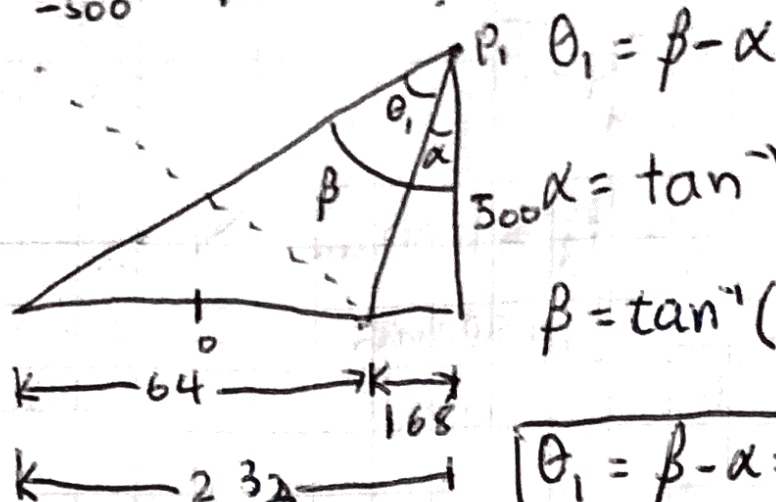


1) i)

a)  $(-200, -250)$



$(200, 500)$   $P_1$ : not to scale



$$\alpha = \tan^{-1}\left(\frac{168}{500}\right) \approx 18.5723^\circ$$

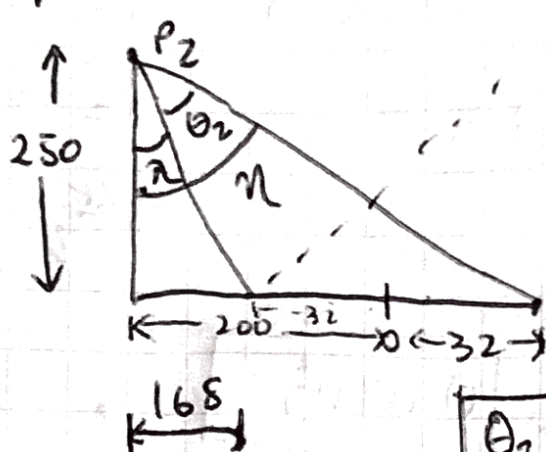
$$\beta = \tan^{-1}\left(\frac{232}{500}\right) \approx 24.8913^\circ$$

$$\theta_1 = \beta - \alpha = 6.319^\circ$$

$$\theta_1 \approx 6.319^\circ$$

$$\theta_2 \approx 8.960^\circ$$

$P_2$ : \*not to scale



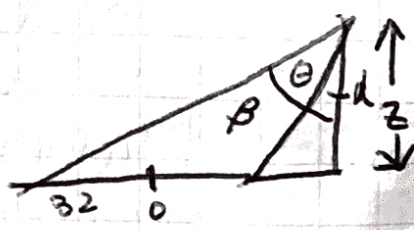
$$\theta_2 = \eta - \lambda$$

$$\lambda = \tan^{-1}\left(\frac{168 \text{ mm}}{250 \text{ mm}}\right) \approx 33.9011^\circ$$

$$\eta = \tan^{-1}\left(\frac{232 \text{ mm}}{250 \text{ mm}}\right) \approx 42.861^\circ$$

$$\theta_2 = \eta - \lambda \approx 8.960^\circ$$

b)  $\theta = \beta - \alpha$



$$\theta = \tan^{-1}\left(\frac{x+32}{z}\right) - \tan^{-1}\left(\frac{x-32}{z}\right)$$

$$\theta = \tan^{-1}\left(\frac{\frac{x+32}{z} - \frac{x-32}{z}}{1 + \frac{(x+32)(x-32)}{z^2}}\right) = \frac{64z}{x^2 + z^2 - 1024}$$

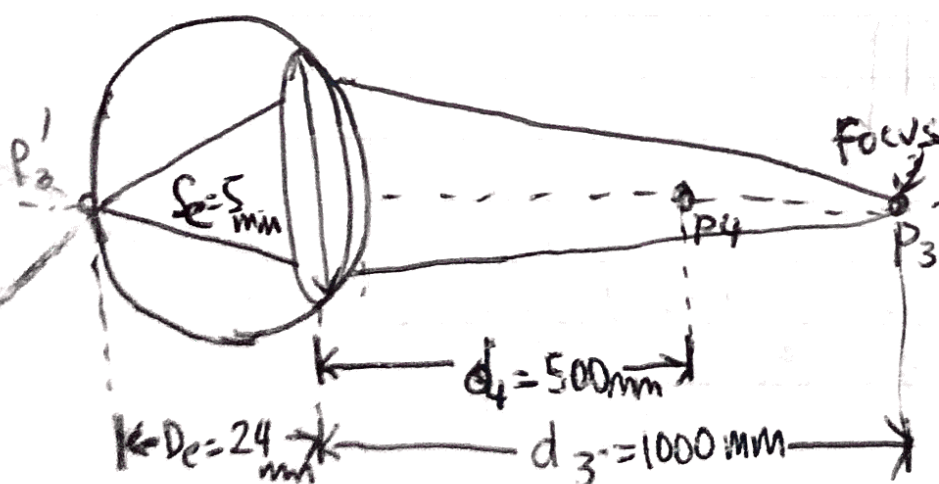
$$\frac{64z}{x^2 + z^2 - 1024} = \tan(\theta)$$

$$\Rightarrow Z = \frac{32 \cos(\theta) \pm \sqrt{1024 - \sin^2(\theta)x^2}}{\sin(\theta)}$$

for  $\theta = 6.31$ :

$$Z = \frac{-32}{\tan(6.31)} \pm \frac{\sqrt{1024 - \sin^2(6.31)x^2}}{\sin(6.31)}$$

ii)



$$\frac{1}{0} + \frac{1}{i} = \frac{1}{f} \text{ ie } \frac{1}{f} = \frac{1}{d_2} + \frac{1}{d_3}$$

$$\frac{1}{f} = \frac{1}{24 \text{ mm}} + \frac{1}{1000 \text{ mm}}$$

$$\frac{1}{f} = \frac{16}{375}$$

$$f = \frac{375}{16} \text{ mm}$$

$$\approx 23.44 \text{ mm}$$



$$C = M \cdot D \cdot \frac{|S - S_1|}{S}; \quad M = \frac{f}{S - f}$$

$$C = 0.024 \cdot 5\text{mm} \cdot \frac{|500\text{mm} - 1000\text{mm}|}{500\text{mm}}$$

$$M = \frac{23.44\text{mm}}{1000\text{mm} - 23.44\text{mm}} = 0.024$$

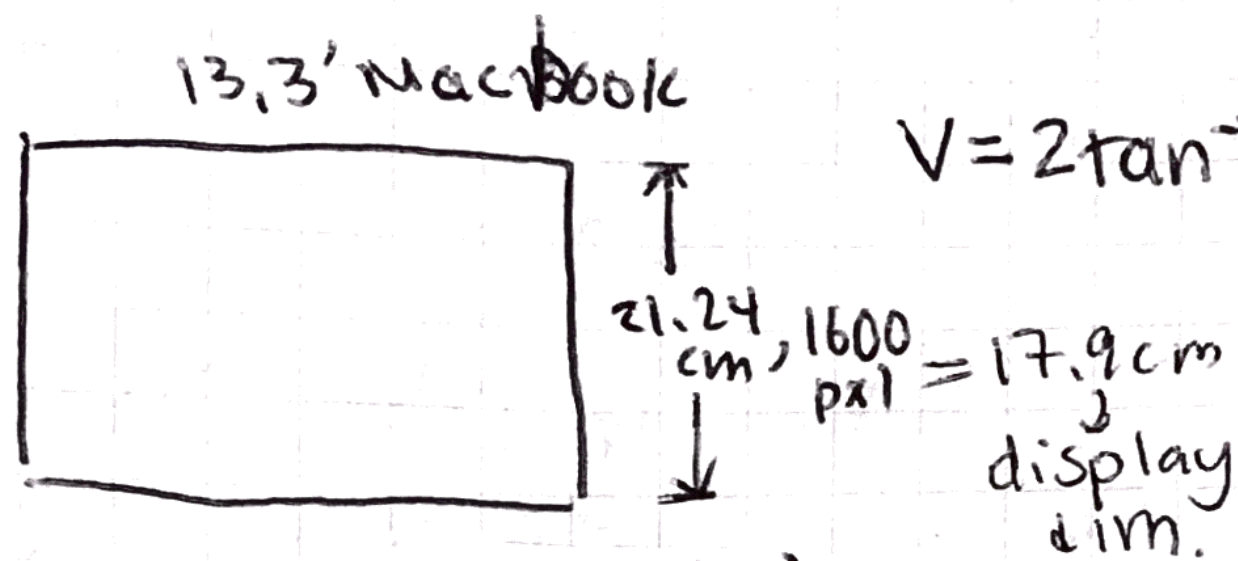
$$S_1 = d_3 = 1000\text{mm}$$

$$S = d_4 = 500\text{mm}$$

$$D = S_e = 5\text{mm}$$

$$C = 0.120 \text{ mm}$$

iii)



$$V = 2 \tan^{-1} \left( \frac{S}{2D} \right)$$

$$D = 50\text{cm} = 0.5\text{m}$$

$$S = 21.24$$

$$S \sqrt{= \frac{21.24}{1600} = 0.0013275}$$

$$V = \frac{2 \tan^{-1} \left( \frac{17.9\text{cm}}{2 \times 50\text{cm}} \right)}{1600} = 0.01269$$

$$\Rightarrow \text{cpd} : \frac{\text{cycle}}{\text{degree}}$$

$$\frac{1}{0.01269^\circ} = 78.80 \text{ cpd} > 30 \text{ cpd (human)}$$

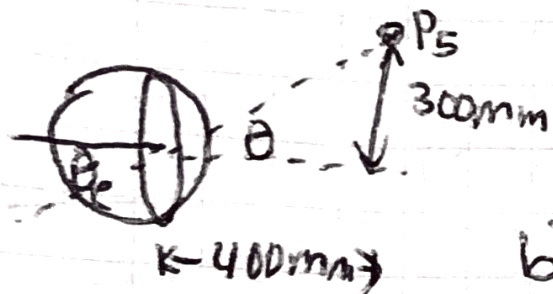
higher

~~20/16 or 30cpd~~  
~~farther i.e. higher~~  
~~than 30cpd~~

iv) MAR  
 $\omega = m \theta_e + \omega_0$   
 MAR slope

$m = 0.0275, \omega_0 = \frac{1}{48}^\circ$

a)  $\theta_e$ ?



$\theta_e = \theta = \tan^{-1}\left(\frac{300\text{mm}}{400\text{mm}}\right) = \boxed{36.870^\circ}$

b)

$\omega = m \theta_e + \omega_0$   
 $= 0.0275(36.870^\circ) + \left(\frac{1}{48}\right)^\circ$   
 $\approx 1.03476^\circ/\text{cycle}$

highest frequency =  $\frac{1}{\omega} \approx \boxed{0.966\text{cpd}}$

2.4.4)

The image might not really be developed properly depending on how much green/blue and red is in each image. (ie if <sup>left</sup> ~~the~~ image contains more gb and right ~~set~~ has more red, etc).