1. 
   (a) Entrance pupil

   \[ \frac{1}{d_2} = \frac{1}{d} + \frac{1}{d_1} = \frac{1}{4} - \frac{1}{2} = \frac{1}{4} - \frac{2}{4} = -\frac{1}{4} \]

   \[ d_2 = -4 \text{ cm from the lens. (4 cm behind the lens.)} \]

   \[ M = \frac{-4}{2} = 2 \Rightarrow D(\text{Entrance Pupil}) = 12 \text{ cm} \]

   (b) Exit pupil

   Exit pupil is at the aperture stop, 2 cm behind the lens, 6 cm in diameter.

   \[ \frac{1}{d_i} = \frac{1}{d} + \frac{1}{d_0} = \frac{1}{4} + \frac{1}{20} = \frac{10}{40} - \frac{4}{40} = \frac{6}{40} \Rightarrow d_i = \frac{20}{6} \text{ cm} = 6.67 \text{ cm} \]

   (c) Last page

2. Use \( \frac{1}{f} = (n_e - 1) \left( \frac{1}{R_1} - \frac{1}{R_2} \right) \)

   For example, pick \( n = 1.6 \). \( R_1 = 2R \), \( R_2 = -R \)

   \[ \frac{1}{60} = (1.6 - 1) \left( \frac{1}{2R} - \frac{1}{-R} \right) \Rightarrow R = \frac{3}{2} (0.6) \times 6 = 54 \text{ cm} \]

   \[ \therefore R_1 = 108 \text{ cm}, \ R_2 = -54 \text{ cm}, \ n_e = 1.6 \]
3. Image formed by lens 1:
\[ \frac{1}{d_2} + \frac{1}{d_i} = \frac{1}{f} + \frac{1}{20} = \frac{1}{20} \]
\[ d_2 = 20 \quad \therefore \quad M_1 = -1 \]

For lens 2: total remaining distance from image to screen is 85cm.
\[ -d_1 + d_2 = 85 \quad \mathrm{cm} \]
\[ M_2 = -25 \]
\[ \therefore \quad \frac{d_2}{d_1} = -25 \]

\[ -d_1 - 25d_1 = 85 \quad \Rightarrow \quad d_1 = \frac{-85}{-26} = -3.27 \mathrm{cm} \]
\[ d_2 = -25d_1 = 81.725 \mathrm{cm} \]
\[ \frac{1}{f} = \frac{1}{d_2} - \frac{1}{d_1} = 81.725 - \frac{1}{-3.27} \]
\[ \boxed{f = 3.14 \mathrm{cm}} \]

Separation = \[ d_2 \text{ (lens 2)} - d_1 \text{ (lens 2)} \]
\[ = 20 - (-3.27) \]
\[ = 23.27 \mathrm{cm} \]
PR1. Part (c)