Answer on Question #49230-Physics-Optics

Find the smallest size looking glass which a man with a face 24cm*16cm should purchase that enable him to see his whole face complete ly if

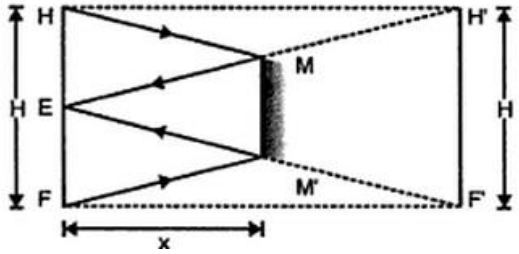
(1) man is one eyed

(2) man is two eyed

Given that the separation between his eyes is 8cm.

Solution

(1) The minimum size of mirror to see one's full the length of face or the breadth of face (H) is one half of the length of face or the breadth of face $\frac{H}{2}$. Smallest breadth or length of the mirror is calculated using the fact the rays from extreme part of face should reach one the eye after reflection from mirror.



From similar $\Delta MM'E$ and $\Delta H'F'E$

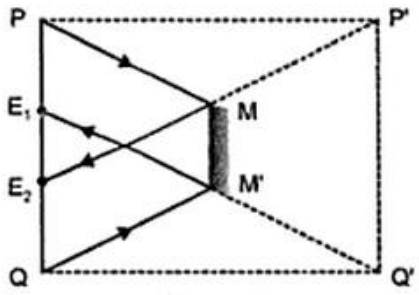
$$\frac{MM'}{x} = \frac{H}{2x} \rightarrow MM' = \frac{H}{2}.$$

For one eyed man, the required size is $12cm \times 8cm$.

(2) For two eyed man

Smallest length of the mirror = Half the length of face $= \frac{1}{2} \cdot 24 = 12\text{cm}$. (see part (1))

Smallest breadth of the mirror is calculated using the fact the rays from extreme part of face should reach one the eye after reflection from mirror. The common overlapping portion is required size. The ray diagram is shown in figure.



From figure,

$$MM' = \frac{1}{2}PQ - \frac{1}{2}E_1E_2 = \frac{1}{2}(16 - 8) = 4cm.$$

Hence the shortest size of mirror is 12cm by 4cm.