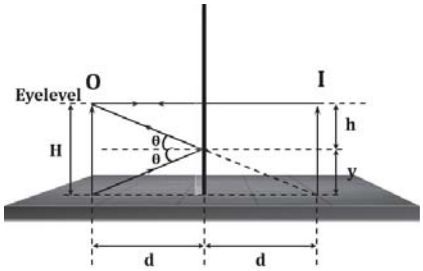
POSITION OF MIRROR

Minimum Length And Position Of Mirror To View Full Image



Note: Let's consider the eye level to be at the highest point.

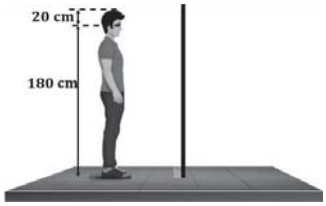
- Imagine a beam originating from the ground, striking the mirror, and bouncing back to the observer's eyes.
- A different beam travels directly from the level of the eyes toward the mirror and then rebounds.
- The space between the initial and subsequent beams represents the minimum necessary height.
- By geometry, $\triangle$ OAD $\cong \triangle$ CAD

$$OD = h = \frac{H}{2}$$

- The minimum length and placement of the plane mirror are not influenced by the object's distance from the mirror along the perpendicular.

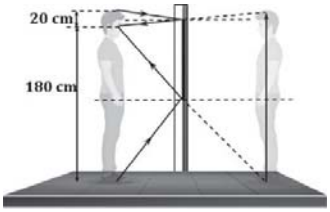
$$h = \frac{H}{2}$$

$$y = \frac{H}{2} \text{ from the ground}$$



Ex. Calculate the minimum length and position of the mirror from the ground such that a 2 m man standing in front of it can see his full image. Consider the eye level of the man to be 20 cm below the top of his head.

Sol. Draw a line perpendicular from the eye level.



Above the eye level, the minimum height of mirror required:

$$h_1 = \frac{20}{2} = 10 \text{ cm}$$

Below the eye level, the minimum height of mirror required:

$$h_2 = \frac{180}{2} = 90 \text{ cm}$$

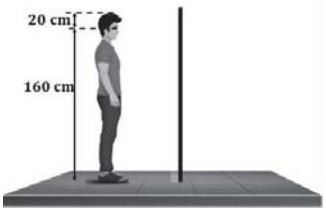
Minimum height of mirror required:

$$h = h_1 + h_2 = 10 + 90 = 100 \text{ cm}$$

Positon of the mirror from ground.

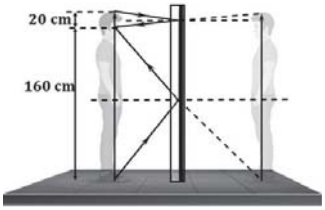
$$\text{Position} = \frac{\text{Height of eye level}}{2} = 90 \text{ cm}$$

Size $= 100$ cm Position $= 90$ cm



Ex. Calculate the minimum length and position of the mirror from the ground such that a 180 cm man standing in front of it can see his full image. Consider the eye level of the man to be 20 cm below the top of his head.

Sol. Draw a line perpendicular from the eye level.



Above the eye level, the minimum height of mirror required:

$$h_1 = \frac{20}{2} = 10 \text{ cm}$$

Below the eye level, the minimum height of mirror required:

$$h_2 = \frac{160}{2} = 80 \text{ cm}$$

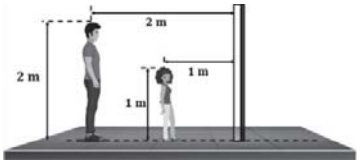
Minimum height of mirror required:

$$h = h_1 + h_2 = 10 + 80 = 90 \text{ cm}$$

Positon of the mirror from ground Position $= 80$ cm

Size $= 90$ cm Position $= 80$ cm

Ex. A 2 m tall Balak is standing behind a 1 m tall Sundar Kanya in front of a plane mirror as shown. Assuming the eyelevel at the top of the head for both, find the minimum length and the position of the plane mirror from the ground required so that the Balak could see the full image of the Sundar Kanya.



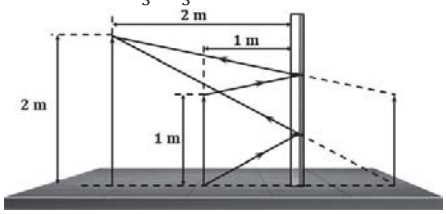
Sol. $\triangle$ EFG & $\triangle$ BAG are similar.

$$\frac{EF}{FG} = \frac{BA}{AG} \Rightarrow \frac{x}{1} = \frac{2}{3} \Rightarrow x = \frac{2}{3}$$

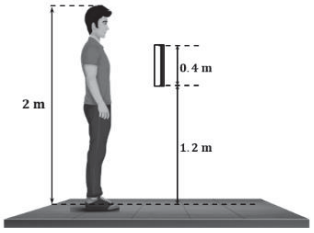
△ BKJ & △ BIH are similar.

$$\frac{kJ}{8k} = \frac{IH}{BI} \Rightarrow \frac{y}{2} = \frac{1}{3} \Rightarrow y = \frac{2}{3}$$

Minimum length $= 2 - x - y. = 2 - \frac{2}{3} - \frac{2}{3}$



Ex. A 2 m tall man is standing in front of a mirror of length 0.4 m positioned as shown. Find the length of the image of the man that he can view in this mirror. Assume the eyelevel at the top.



Sol. △ ACD& △ ABG.

$$\frac{AC}{CD} = \frac{AB}{BG} \Rightarrow \frac{2d}{x} = \frac{d}{0.4} x = 0.8 \text{ m}$$

$$\frac{\triangle ACE \& \triangle ABF}{\frac{AC}{CE} = \frac{AB}{BF}} \Rightarrow \frac{2d}{y} = \frac{d}{0.8}$$

$$y = 1.6 \text{ m}$$

$$y - x = 1.6 - 0.8 = 0.8\text{m}$$

$$y - x = 0.8\text{m}$$