

- Q- A person stands 4.0 meters in front of a floor-to-ceiling mirror. Her eyes are 1.9 meters above the floor. She sees the reflection of light from her shiny toe of shoe.
- At what angle of incident must the light from the toe of her shoe strike the mirror so the light will reach her eyes?
  - How high above the floor does the incident ray from her toe strike the mirror.

The incident and reflected rays are shown in the figure.

In triangles TMN and EMN

As the mirror and the person both are vertical the normal to the mirror MN will also be normal to the height of the person, hence the angles TNN and ENM both are right angles.

According to laws of reflection the angle of incident  $i$  is equal to the angle of reflection  $r$ .

The normal MN is common to both triangles.

Thus the two triangles are congruent and hence

$$TN = EN = h/2$$

(A)

In triangle TMN

$$\tan i = \frac{\text{perp}}{\text{base}} = \frac{NT}{MN} = \frac{h/2}{d} = \frac{h}{2d} = \frac{1.9}{2 \times 4} = 0.2375$$

$$\text{Hence } i = \tan^{-1}(0.2375) = 13.36^\circ$$

This is the required angle of incidence.

(B)

It is clear from the diagram that the height of point of incidence is half the height of the eye hence

$$h' = h/2 = 1.9/2 = 0.95 \text{ m.}$$

