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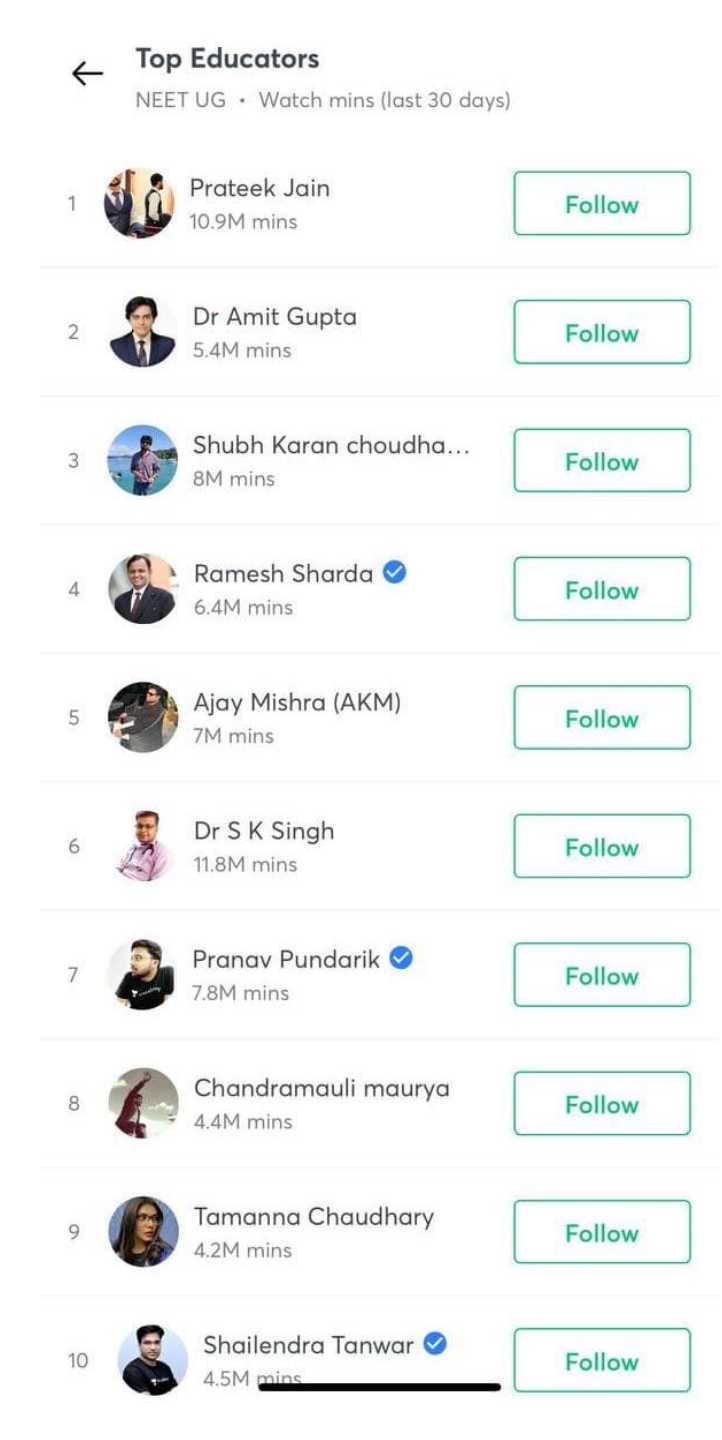

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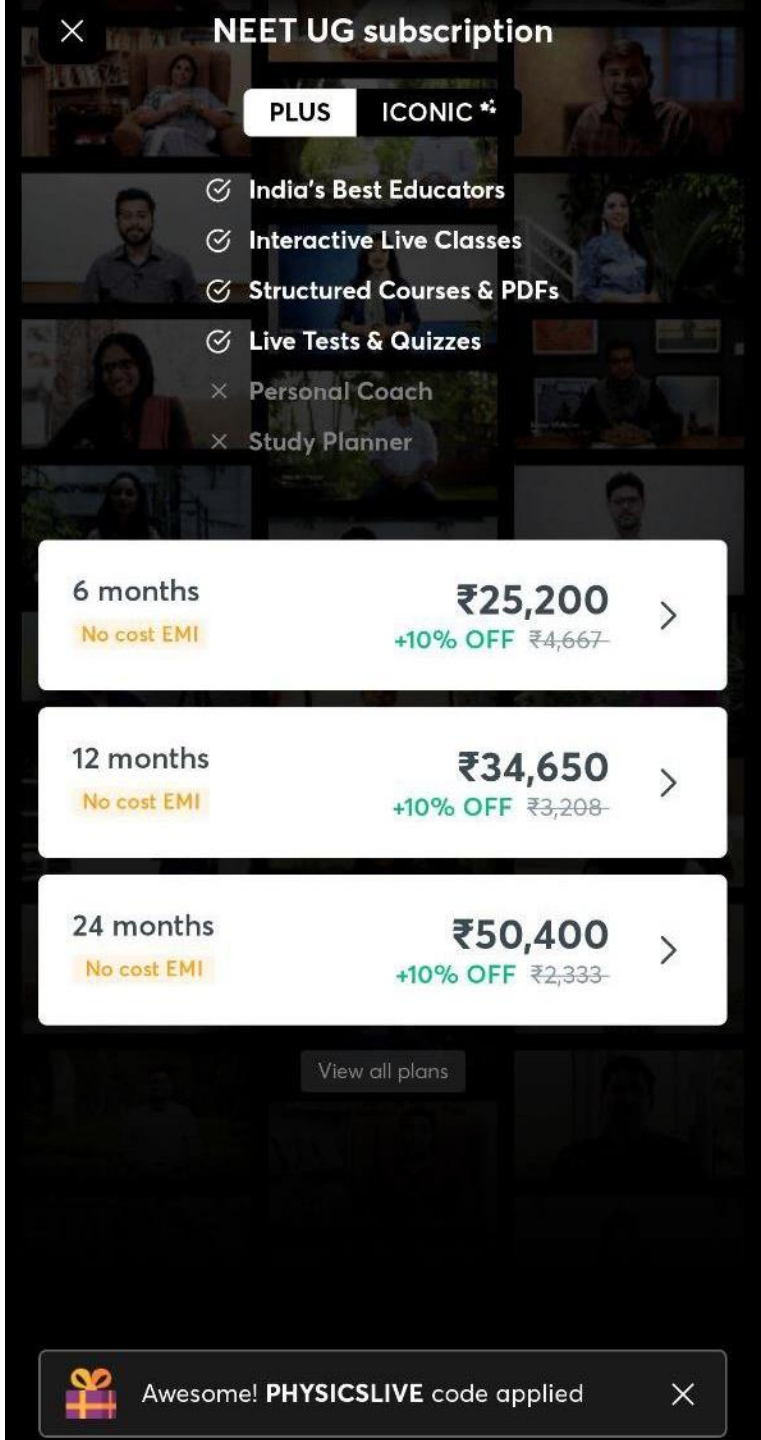

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NEET
Physics DPP

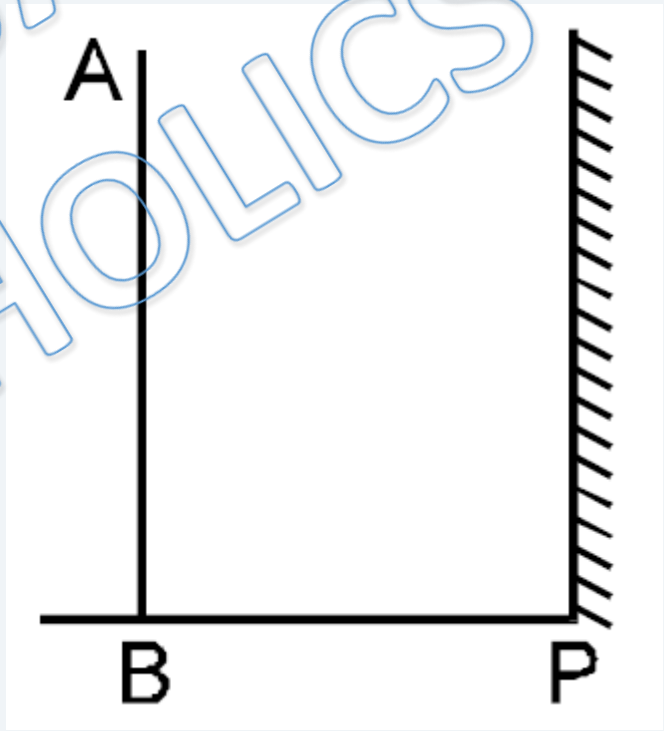
DPP-2 Plane Mirror (Image formation, Multiple Reflections & Number of images)

By PRATEEK JAIN SIR

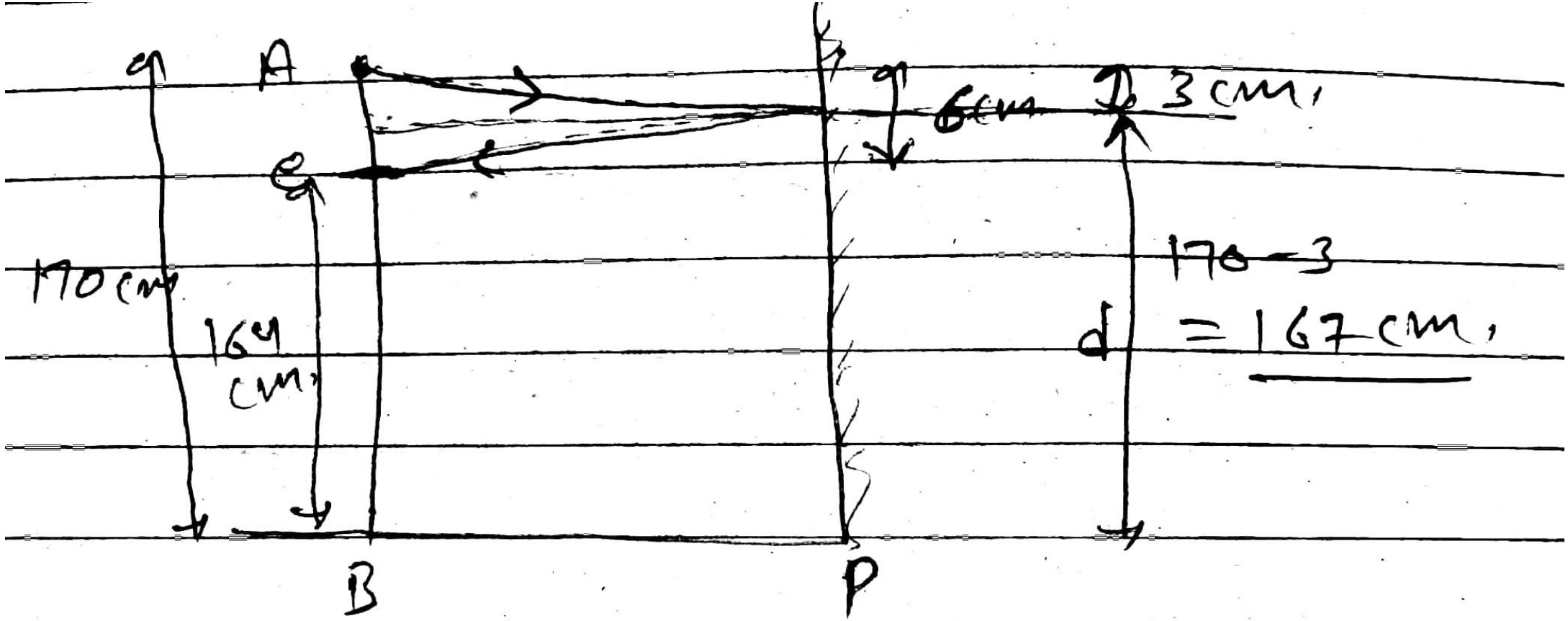
Q) A person AB of height 170 cm is standing in front of a plane mirror. His eyes are at height 164 cm. At what height from P should a hole be made in the mirror so that he cannot see the top of his head.

(a) 167 cm (b) 161 cm

(c) 163 cm (d) none of these



Ans. a



if light coming from head does not reach to eye, then head will not be visible.

Q) Two plane mirrors are inclined to each other at 90º. A ray of light is incident on one mirror and the reflected light goes to the other mirror. The ray will undergo a total deviation of :

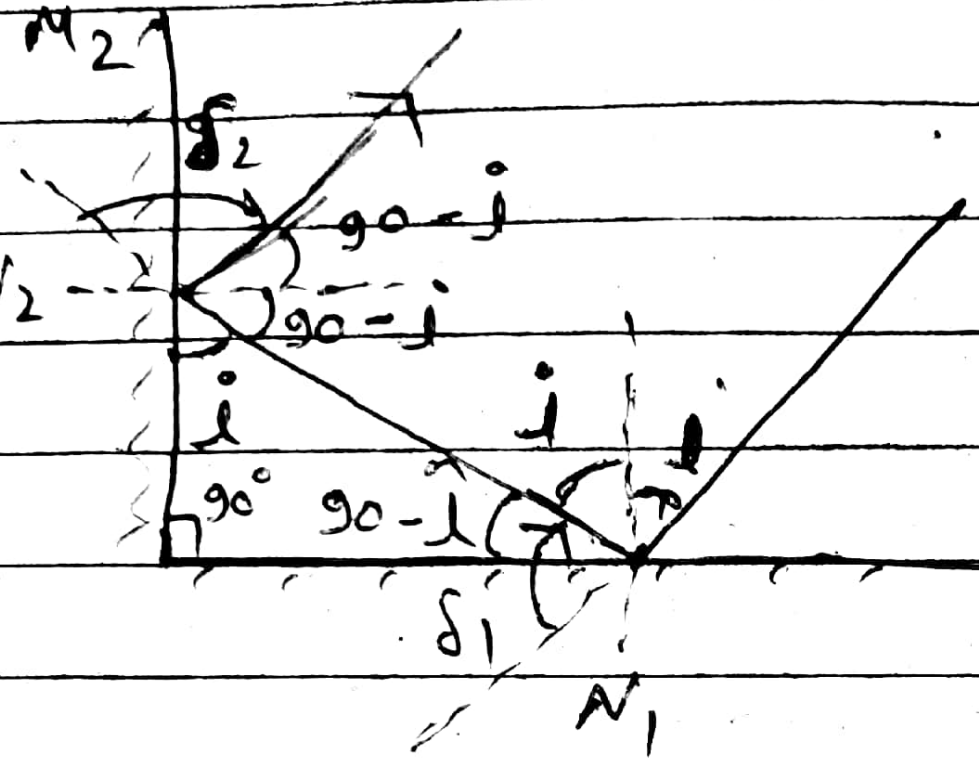
(a) 180º

(b) 90º

(c) 45º

(d) cannot be found because angle of incidence is not given.

Ans. a



Total deviation.

$= \delta_1 + \delta_2$

$\delta_1 = 180^\circ - 2i$

$\delta_2 = 180^\circ - 2(90^\circ - i)$

$\delta = \delta_1 + \delta_2 = 180^\circ - 2i + 180^\circ - 2(90^\circ - i)$

$= 180^\circ - 2i + 180^\circ - 180^\circ + 2i$

$= 180^\circ$

Q) Find the number of images formed by two mutually perpendicular mirrors –

(a) 3 (b) 4 (c) 1 (d) 2

Ans. a

$$n = \frac{360^\circ}{90^\circ} = 4 \in \text{even}.$$

number of images $= 4 - 1$

$= 3$ Images.

Q) The angle θ between two plane mirrors producing five images of a given object is given by.

(a) $30^o \leq \theta \leq 72^o$ (b) $45^o \leq \theta \leq 72^o$

(c) $60^o \leq \theta \leq 72^o$ (d) $15^o \leq \theta \leq 72^o$

Ans. c

number of Images = 5

Let angle = θ

then; $n = \frac{360^\circ}{\theta} \Rightarrow$

for n = even, $\theta = \frac{360^\circ}{n}$

number of Images = $n+1$

If n is odd

Images = $n-1$ (object on Angle bisector)

Images = n (not on Angle bisector)

no. of Images = n

no. of Images = $n-1$

for numb. Images; $= n$

$n = 5$

$\theta = \frac{360^\circ}{5} = 72^\circ$

for numb. Images; $= n-1$

$n-1 = 5 \Rightarrow n = 6$

$\theta = \frac{360^\circ}{6} = 60^\circ$

$\therefore \theta$ is between 60° to 72°

$60^\circ \leq \theta \leq 72^\circ$

Q) Two mirrors are inclined at an angle of 60º. Then what is the number of images formed for an object placed in between the mirrors ?

(a) 3 (b) 5 (c) 1 (d) 7

Ans. b

$$n = \frac{360^\circ}{\theta}$$

$$n = \frac{360^\circ}{60^\circ} = 6 \quad (\text{even})$$

number of images $= 6 - 1 = 5$

Q) Two plane mirrors are inclined at an angle θ. A ray of light incident on one mirror at an angle of incidence i. The ray is reflected from this mirror, falls on the second mirror from where it is reflected parallel to the first mirror. What is the value of i, the angle of incidence in terms θ ?

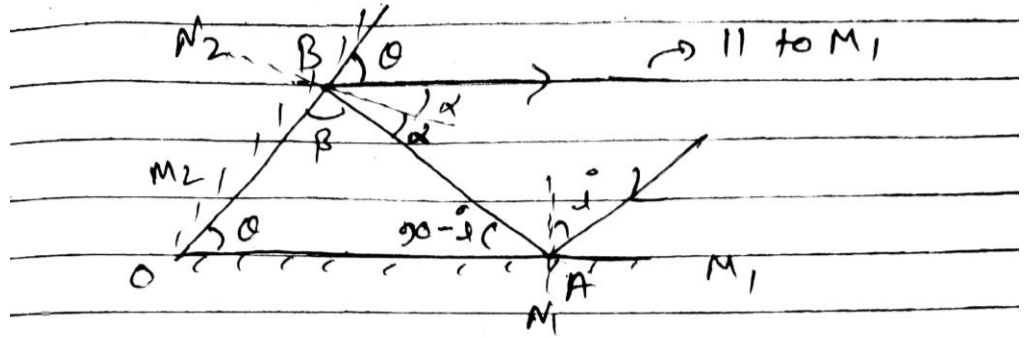
(a) $2\theta - 90^{o}$

(b) $4\theta - 90^{o}$

(c) $\theta - 90^{o}$

(d) $3\theta - 90^{o}$

Ans. a



$\boxed{\beta + \alpha = 90^\circ}$ [∵ N_2 is ⊥ to M_2]

—①

at Point B

$\beta + 2\alpha + \theta = 180^\circ$

$\beta + \alpha + \alpha + \theta = 180^\circ$

$90^\circ + \alpha + \theta = 180^\circ$

$\boxed{\alpha + \theta = 90^\circ}$ —②

$\therefore \Rightarrow \boxed{\beta = \theta}$ (from eq^{n} ① & ②

in Δ AOB

$\theta + 90 - i + \beta = 180^\circ$

$\theta + 90 - i + \theta = 180^\circ$

[∵ $\beta = \theta$]

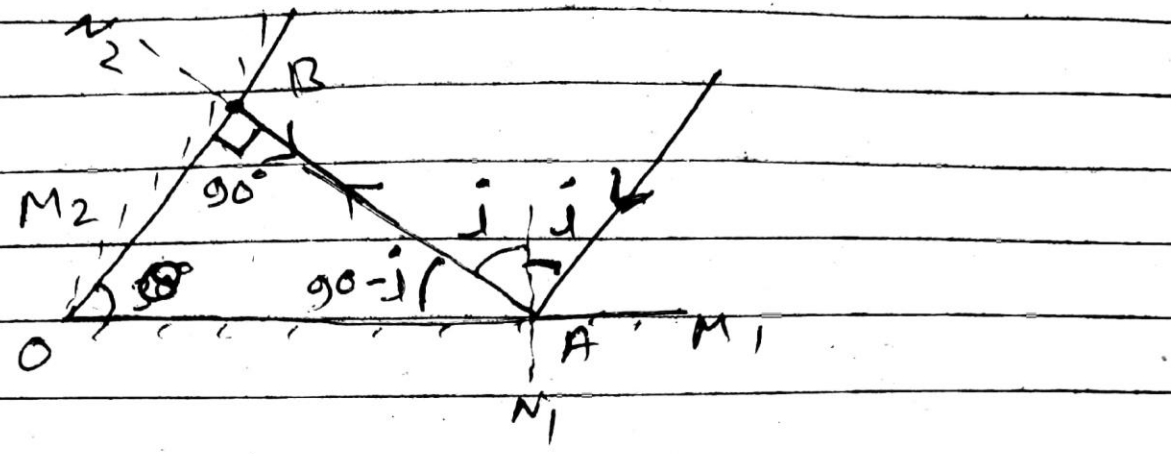
$\therefore 2\theta + 90^\circ - i = 180^\circ$

$\boxed{i = 2\theta - 90^\circ}$

Q) Two plane mirrors are inclined to each other at some angle. A ray of light incident at 30º (from normal) on one, after reflection from the other it retraces its path. The angle between the mirrors is

(a) 30º (b) 45º (c) 60º (d) 90º

Ans. a



to retrace it's path ~~from~~ after reflection from M_2, it should incident ⊥ to M_2

$\therefore \angle OBA = 90°$

$\therefore$ in $\triangle OBA$

$\theta + 90° + 90 - j = 180°$

$\boxed{j = \theta}$

$\therefore j = 30°$

$\therefore \boxed{\theta = 30°}$

Q) A boy of length 10 m, to see his own complete image, requires a mirror of length (in meter) at least equal to:

(a) 10/4 (b) 10/3 (c) 10/2 (d) 4

Ans. c

$H = 10\ m.$

To see full image on Mirror, required size of mirror:

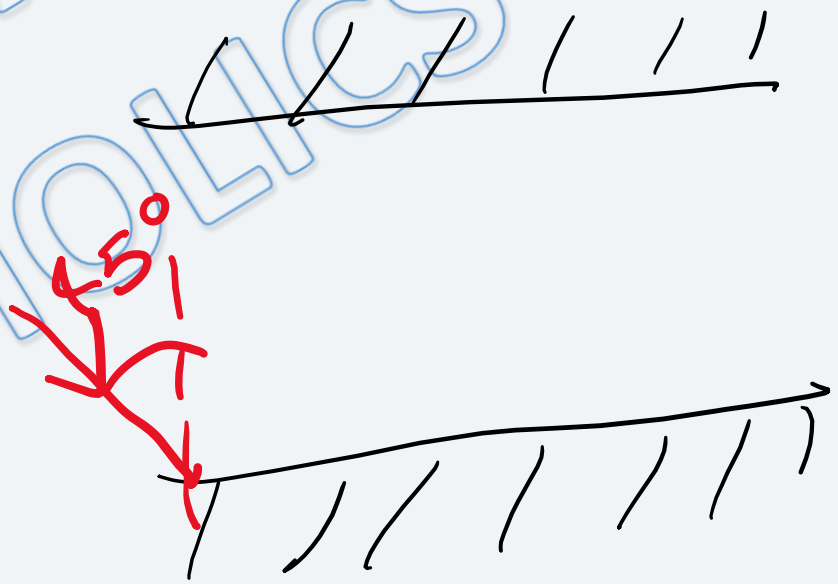
is $h = \frac{H}{2}$

$$h = \frac{10}{2} = 5\ m.$$

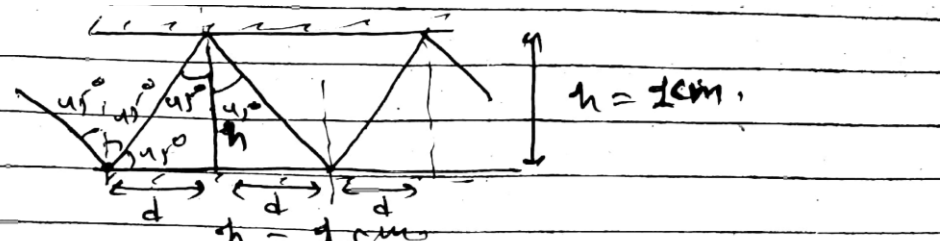
Q) Two plane mirrors M_1 and M_2 each have length 1 m are separated by 1 cm. A ray of light is incident on one end of mirror M_1 at angle 45°. How many reflections the ray will have before going out from the other end?

(a) 50 (b) 51

(c) 100 (d) 101



Ans. d



$h = 1\,cm$

$d = h$ [$\because$ angles $= 45°$]

$d = 1\,cm$,

after each reflection light travels 1cm,

so, to go out from the mirrors. (let's 'n' reflections required.

$l = (n-1)\,d$

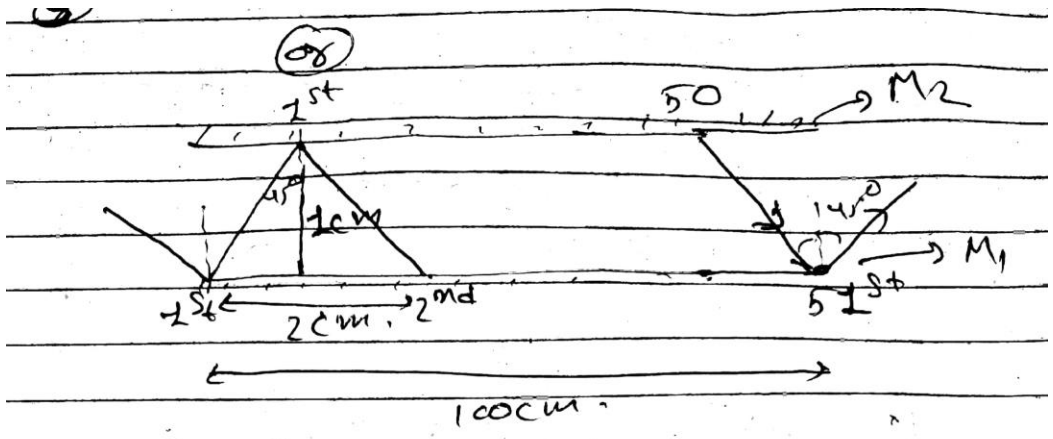
[$\because$ after n^{th} reflection it will goes out from the mirrors, so will not cover distance between mirrors)

$\therefore \quad l = (n-1)\,d$

$1m = (n-1)\,1cm. = (n-1) \times 10^{-2}$

$n - 1 = 100$

$n = 101$



on mirror M_1 when 2nd reflection, distance covered $= 2\,cm$

when 3rd reflection, distance covered $= 4\,cm$.

will be

so, for distance $= 100\,cm$.

reflection should be 51st

if reflection of Mirror M_1 are 51 then reflection on mirror M_2 will be 50

$\therefore$ Total reflection $= 50 + 51$

$= 101\,cm.$

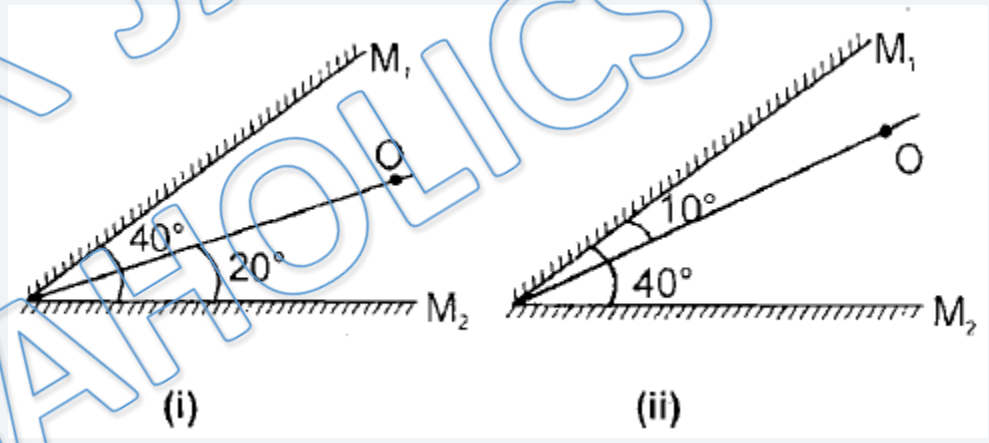
Q) Find number of images formed according to given case

(a) 8, 9

(b) 9, 8

(c) 9, 9

(d) 8, 8



Ans. a

(i) $n = \frac{360^\circ}{40^\circ} - 9$

n = odd

∴ object is symmetric line on or on algle bisector

∴ Images = $n - 1$

$= 9 - 1 = 8$

(ii) $n = \frac{360^\circ}{40} - 9$

n = odd

∴ object IS not on ~~forward~~ Angle bisector

∴ Images = n

$= 9$

Chalo Niklo