



PHYSICS

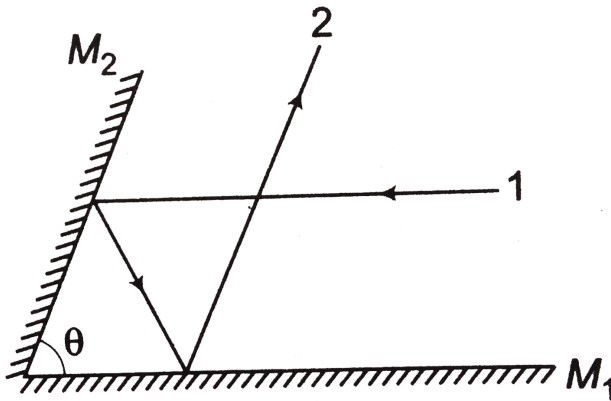
BOOKS - DC PANDEY PHYSICS (HINGLISH)

REFLECTION OF LIGHT

Example Type 1

1. Two plane mirror M_1 and M_2 are inclined at angle θ as shown. A ray of light 1, which is

parallel to M_1 strikes M_2 and after two reflection , the ray 2 become parrallel to M_2 .Find the angle θ



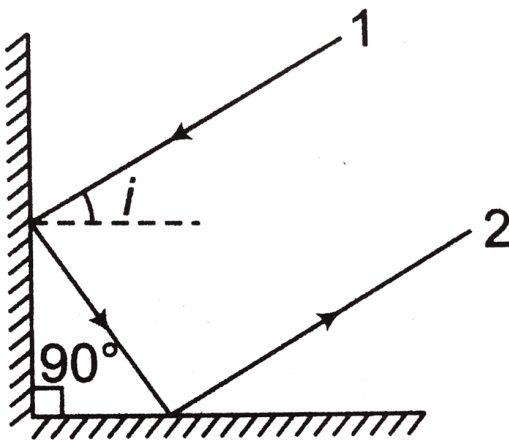
- A. $\theta = 60^\circ$
- B. $\theta = 90^\circ$
- C. $\theta = 45^\circ$
- D. $\theta = 120^\circ$

Answer: A



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2. Prove that for any value of angle i , rays 1 and 2 are parallel

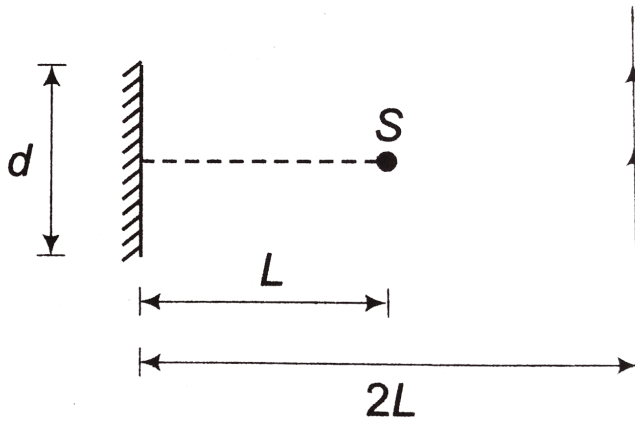


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3. A point source of light S , placed at a distance L in front of the centre of a mirror of width d , hangs vertically on a wall. A man walks in front of the mirror along a line parallel to the mirror at a distance $2L$ from it as shown. The greatest distance over which he can see the image of the light source in the

mirror is

(a) $d/2$ (b) d (c) $2d$ (d) $3d$.



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Type 2

1. A pole of height 4 m is kept in front of a vertical plane mirror

of length 2m. The lower end of the mirror is at a height of 6m from the ground

.the horizontal distance between the mirror and the pole is 2m. Up to what

minimum and maximum heights a man can see the image of top of the pole at a

horizontal distance of 4m (from the mirror) standing on the same horizontal

line which is passing through the pole and the horizontal point below the

mirror?



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2. Find the distance of object from a concave mirror of focal length 10 cm so that image size is four times the size of the object.



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Example Type 2

1. A plane mirror is lying in x-y plane .Object velocity is

$V_0 = (2\hat{i} - 3\hat{j} + 4\hat{k})m/s$. Find the image velocity.

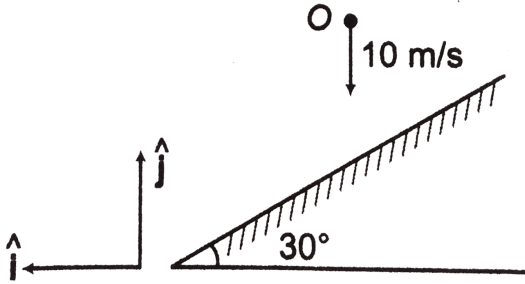


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Example Type 3

1. An object is falling vertically downwards with velocity $10m/s$. In terms of \hat{i} and \hat{j} find the

image velocity. M



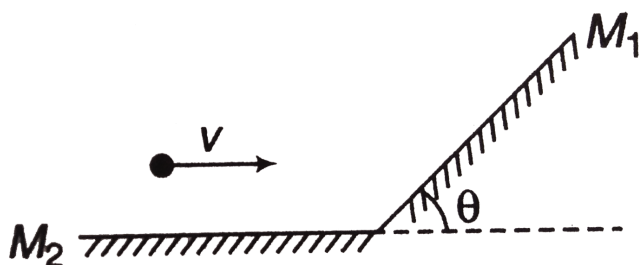
- A. $(5\sqrt{3}\hat{i} - 5\hat{j})\text{ m/s}$
- B. $(5\sqrt{3}\hat{i} + 5\hat{j})\text{ m/s}$
- C. $(\sqrt{3}\hat{i} + 2\hat{j})\text{ m/s}$
- D. none

Answer: B



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2. A point object is moving with a speed v before an arrangement of two mirrors as shown in figure. Find the magnitude of velocity of image in mirror M_1 with respect to image in mirror M_2



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3. An object is placed at a distance of 30 cm from a concave mirror of focal length 20 cm .find image distance and its magnification. Also ,draw the ray diagram.

A. +2

B. +4

C. $-\frac{1}{2}$

D. -2

Answer: D



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Type 1

1. An object is placed at a distance of 40 cm from a convex mirror of focal length 40cm. Find image position and its magnification. Also, draw its ray diagram.



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Type 3

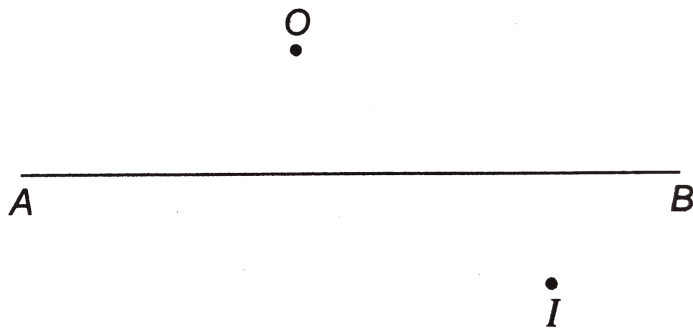
1. Find the condition under which a convex mirror can make a real image .



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Example Type 4

1. An image I is formed of a point object O by a mirror whose principal axis is AB as shown in figure.



(a) State whether it is a convex mirror or a concave mirror .

(b) Draw a ray diagram to locate the mirror and its focus . Write down the step of construction of the ray diagram. Consider the possible two cases.

(1) When distance of I from AB is more than the distance of O from AB and

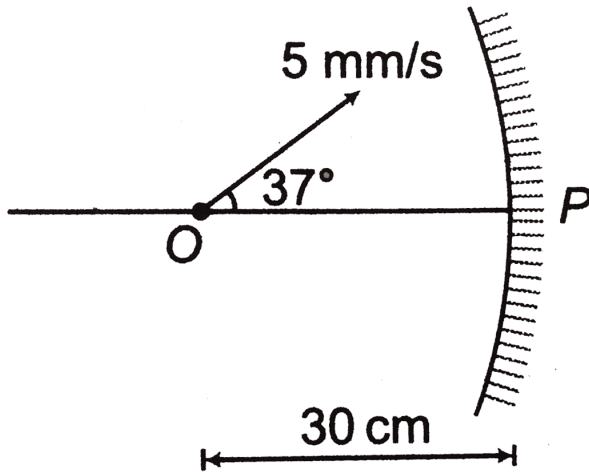
(2) When distance of O from AB is more than the distance of I from AB



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Example Type 5

1. Focal length of the mirror shown in figure is 20cm. Find the image position and its velocity.



- A. $\sqrt{272}) m / s$ and $\theta = \tan^{-1} \left(\frac{5}{8} \right)$
- B. $\sqrt{292}) m / s$ and $\theta = \sin^{-1} \left(\frac{3}{8} \right)$
- C. $\sqrt{292}) m / s$ and $\theta = \tan^{-1} \left(\frac{3}{8} \right)$

D. none

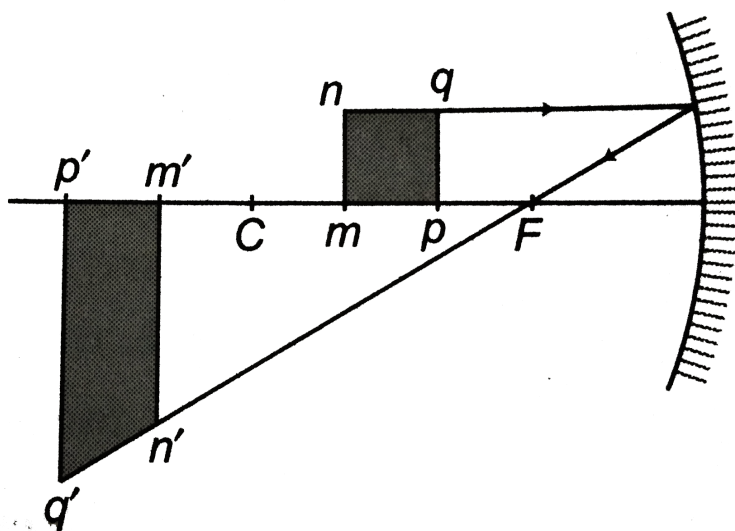
Answer: C



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Example Type 6

1. A square $mnpq$ is kept between F and C on the principal axis of a concave mirror as shown in figure . Find a rough image of this object.

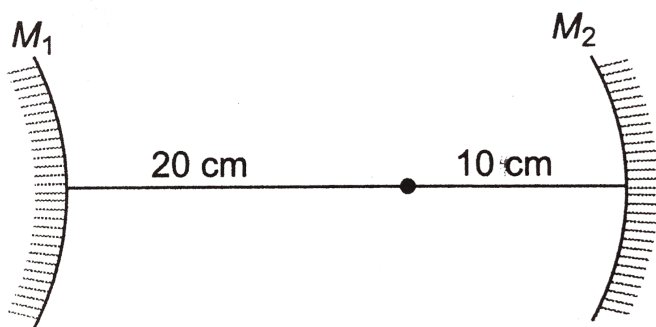




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Example Type 7

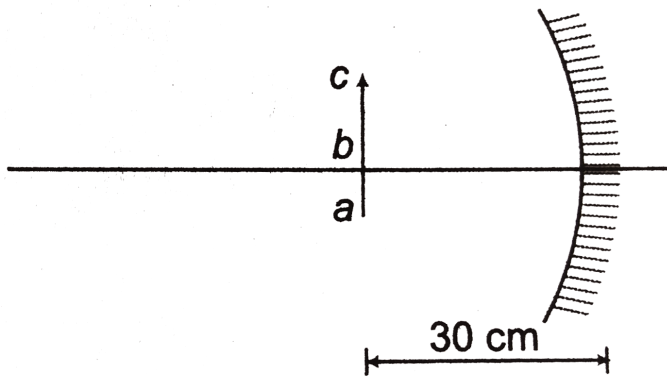
1. Focal length of convex mirror M_1 is 20 cm and that of concave mirror M_2 is 30 cm .Find position of second image I_2 .Take first reflection from M_1 .





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Example Type 8



1.

Focal length of the concave mirror shown in figure is 20 cm.

$$ab = 1mm$$

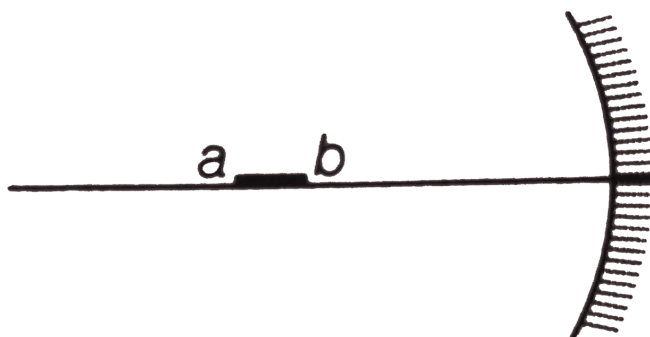
and $bc = 2mm$

For the given situation, make its image.



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Example Type 9



1.

A small object ab of size $1mm$ is kept at a

distance of 40 cm from a concave mirror of focal length 30 cm. Make image of this object.



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2. A thin rod of length $\left(\frac{f}{3}\right)$ is lying along the principal axis of a concave mirror of focal length f . Image is real, magnified and inverted and one of the end of rod coincides with its image itself. Find length of the image.



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Miscellaneous examples

1. An object is 30.0 cm from a spherical mirror, along the central axis.

The absolute value of lateral magnification is $\frac{1}{2}$, The image produced is inverted .

What is the focal length of the mirror?



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2. A concave mirror has a radius of curvature of 24 cm. How far is an object from the mirror if an image is formed that is:

- (a) virtual and 3.0 times the size of the object,
- (b) real and 3.0 times the size of the object and
- (c) real and $\frac{1}{3}$ the size of the object?.



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3. A ray of light is incident on a plane mirror along a vector $\hat{i} + \hat{j} - \hat{k}$.

The normal on incidence point is along $\hat{i} + \hat{j}$

.Find a unit vector along the reflected ray.



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4. A gun of mass M fires a bullet of mass m with a horizontal speed V . The gun is fitted with a concave mirror of focal length f facing

towards the receding bullet. Find the speed of separation of the bullet and the image just after the gun was fired.



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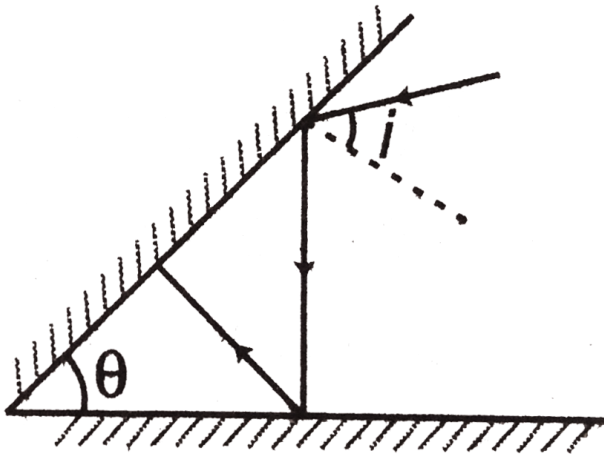
Exercise 30 1

1. A man approaches a vertical plane mirror at speed of two m/s. At what rate does he approach his image?



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2. In terms of θ find the value of i , show that ray of light retraces its path after third reflection



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Introductory Exercise

1. An object M is placed at a distance of 3 m from a mirror with its lower end at 2 m from ground as shown in Fig. There is a person at a distance of 4 m from object. Find minimum and maximum height of person to see the image of object



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Exercise Level 1 Assertion And Reason

1. Assertion : A convex mirror can never make a real image

Reason : For all real objects image formed by a convex mirror is virtual

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct

explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: D



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2. Assertion : Focal length of a convex mirror is 20 cm. If a real object is placed at distance 20 cm from the mirror, its virtual erect and diminished image will be formed.

Reason : If a virtual object is placed at 20 cm distance, its image is formed at infinity.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: B



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3. Assertion : In case of a concave mirror if a point object is moving towards the mirror along its principal axis, then its image will move away from the mirror.

Reason : In case of reflection (along the principal axis of mirror) object and image always travel in opposite directions.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: A



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4. Assertion : Real view mirror of vehicles is a convex mirror.

Reason : It never makes real image of real objects.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: B



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5. Assertion : If magnification of real object is -2 . Then, it is definitely a concave mirror.

Reason : Only concave mirror can make real images of real objects.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: A::B



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6. Assertion : Any ray of light suffers a deviation of $(180^\circ - 2i)$ after one reflection.

Reason : For normal incidence of light deviation is zero.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: C



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7. Assertion : Two plane mirrors kept at right angles deviate any ray of light by 180° after two reflection.

Reason : The above condition is satisfied only for angle of incidence $i = 45^\circ$.

A. (a) If both Assertion and Reason are true
and the Reason is correct explanation of

the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: C



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8. Assertion : In reflection from a denser medium, any ray of light suffers a phase difference of π .

Reason : Denser medium is that medium in which speed of wave is less.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: B



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9. Assertion : For real objects, image formed by a convex mirror always lies between pole and focus.

Reason : When object moves from pole to infinity, its image will move from pole to focus.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct

explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: A::B



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10. Assertion : Light converges on a virtual object.

Reason : Virtual object is always behind a mirror.

A. (a) If both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.

C. (c) If Assertion is true, but the Reason is false.

D. (d) If Assertion is false but the Reason is true.

Answer: B



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Exercise Level 1 Objective

1. A plane mirror reflects a beam of light to form a real image, The incident beam should be

A. parallel

B. convergent

C. divergent

D. not possible

Answer: B



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2. When an object lies at the focus of a concave mirror, then the position of the image formed and its magnification are

A. pole and unity

B. infinity and unity

C. infinity and infinity

D. centre of curvature and unity

Answer: C



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3. Two plane mirror are inclined to each other at 90° . A ray of light is incident on one mirror.

The ray will undergo a total deviation of

A. 180°

B. 90°

C. 45°

D. data insufficient

Answer: A



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4. A concave mirror cannot form

A. virtual image of virtual object

B. virtual image of real object

C. real image of real object

D. real image of virtual object

Answer: A



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5. Two plane mirrors are inclined at 70° . A ray incident on one mirror at incidence angle θ after reflection falls on the second mirror and is reflected from there parallel to the first mirror, The value of θ is

A. 50°

B. 45°

C. 30°

D. 25°

Answer: A



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6. The radius of curvature of a convex mirror is 60cm. When an object is A, its image is formed at B. If the size of image is half that of the object, then the distance between A and B is

A. 30cm

B. 60cm

C. 45 cm

D. 90 cm

Answer: C



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7. A boy of height 1.5m with his eye level at 1.4m stands before a plane mirror of length 0.75 m fixed on the wall. The height of the lower edge of the mirror above the floor is 0.8 m. Then ,

A. the boy will see his full image

B. the boy cannot see his hair

C. the boy cannot see his feet

D. the boy can see neither his hair nor his feet.

Answer: C



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8. A spherical mirror forms an erect image three times the size of the object, If the distance between the object and the image is

80 cm. The nature and the focal length of the mirror are

A. concave, 30 cm

B. convex, 30cm

C. concave, 15 cm

D. convex, 15 cm

Answer: A



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9. A convex mirror of focal length f produced an image $(1/n)^{th}$ of the size of the object. The distance of the object from the mirror is

A. nf

B. f/n

C. $(n + 1)f$

D. $(n - 1)f$

Answer: D



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10. An object is moving towards a concave mirror of focal length 24 cm. When it is at a distance of 60 cm from the mirror, its speed is $9\text{ cm} / \text{s}$. The speed of its image at that instant, is

- A. $4\text{ cm} / \text{s}$ towards the mirror
- B. $6\text{ cm} / \text{s}$ towards the mirror
- C. $4\text{ cm} / \text{s}$ away from the mirror
- D. $6\text{ cm} / \text{s}$ away from the mirror

Answer: C



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11. All the following statements are correct except (for real objects)

A. the magnification produced by a convex mirror is always less than one

B. a virtual, erect and same sized image can be obtained using a plane mirror

C. a virtual, erect, magnified image can be formed using a concave mirror

D. a real, inverted same sized image can be formed using a convex mirror

Answer: D



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12. A particle moves perpendicular towards a plane mirror with a constant speed of $4\text{cm} / \text{s}$. What is the speed of the image observed by an observer moving with $2\text{cm} / \text{s}$ along the same direction? Mirror is also moving with a

speed of $10\text{cm} / \text{s}$ in the opposite direction.

(All speeds are with respect to ground frame of reference)

A. $4\text{cm} / \text{s}$

B. $12\text{cm} / \text{s}$

C. $14\text{cm} / \text{s}$

D. $26\text{cm} / \text{s}$

Answer: D



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Exercise Level 1 Subjective

1. Figure shows two rays P and Q being reflected by a mirror and going as P' and Q'.

State which type of mirror is this? 



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2. A candle 4.85 cm tall is 39.2 cm to the left of a plane mirror. Where does the mirror form the image, and what is the height of this image?



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3. A plane mirror lies face up, making an angle of 15° with the horizontal. A ray of light shines down vertically on the mirror. What is the angle of incidence? What will be the angle between the reflection ray and the horizontal?

A. 15°

B. 60°

C. 45°

D. 30°

Answer: B



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4. Two plane mirrors are placed parallel to each other and 40 cm apart. An object is placed 10 cm from one mirror. What is the distance from the object to the image for each of the five images that are closest to the object?



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5. If an object is placed between two parallel mirrors ,an infinite number of images result .Suppose that the mirror are a distance $2b$ apart and the object is put at the mid-point between the mirrors ,Find the distance of the image from the object.



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6. Show that a ray of light reflected from a plane mirror rotates through an angle 2θ when the mirror is rotated through an angle θ about its axis perpendicular to both the incident ray and the normal to the surface.



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7. Two plane mirrors each 1.6 m long, are facing each other. The distance between the mirrors is 20 cm. A light incident on one end of one of the mirrors at an angle of incidence of 30° . How many times is the ray reflected before it reaches the other end?



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8. Two plane mirrors are inclined to each other at an angle θ . A ray of light is reflected at one mirror and then at the other. Find the total deviation of the ray.



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9. Assume that a certain spherical mirror has a focal length of -10.0 cm. Locate and describe the

image for object distances of (a) 25.0 cm (b) 10.0 cm (c) 5.0 cm.



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10. A ball is dropped from rest 3.0 m directly above the vertex of a concave mirror that has a radius

of 1.0 m and lies in a horizontal plane.

(a) Describe the motion of ball's image in the mirror

(b) At what time do the ball and its image coincide?



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11. An object 6.0 mm is placed 16.5 cm to the left of the vertex of a concave spherical mirror having a radius of curvature of 22.0 cm.

(a) Draw principal ray diagram showing formation of the image.

(b) Determine the position, size, orientation, and nature (real or virtual) of the image.



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12. An object 9.0 mm tall is placed 12.0 cm to the left of the vertex of a convex spherical mirror

whose radius of curvature has a magnitude of 20.0 cm.

(a) Draw a principal ray diagram showing formation of the image.

(b) Determine the position, size, orientation, and nature (real or virtual) of the image.



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13. How far should an object be from a concave spherical mirror of radius 36 cm to form a real image one-ninth its size?



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14. An object is placed 42 cm, in front of a concave mirror of focal length 21 cm. Light from the concave mirror is reflected onto a small plane mirror 21 cm in front of the concave mirror. Where is the final image?



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15. Prove that for spherical mirrors the product of the distance of the object and the

image to the

principal focus is always equal to the square of the principal focal length.



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16. Convex and concave mirrors have the same radii of curvature R . The distance between the mirrors is $2R$. At what point on the common optical axis of the mirrors should a point source of

light A be placed for the rays to converge at

the point A after being reflected first on the convex
and then on the concave mirror?



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17. A spherical mirror is to be used to form on a screen 5.0 m from the object an image five times the size of the object.

(a) Describe the type of mirror required.

(b) Where should the mirror be positioned relative to the object?

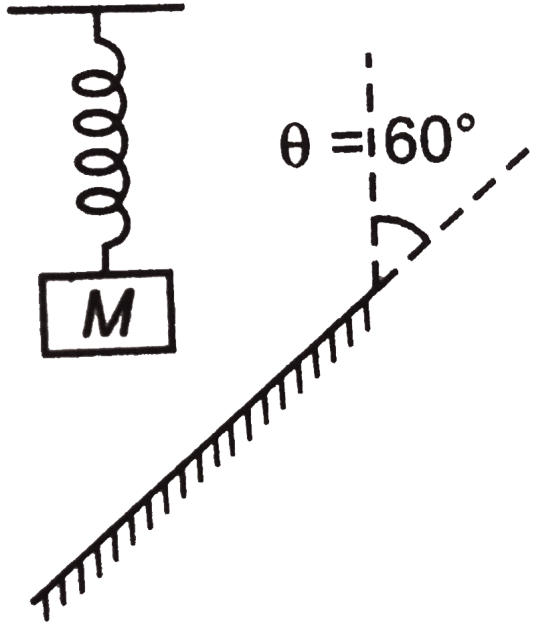


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Level 2 Single Correct

1. An insect of negligible mass is sitting on a block of mass M , tied with a spring of force constant k . The block performs simple harmonic motion with amplitude A in front of a plane mirror as shown, the maximum speed

of insect relative to its image will be



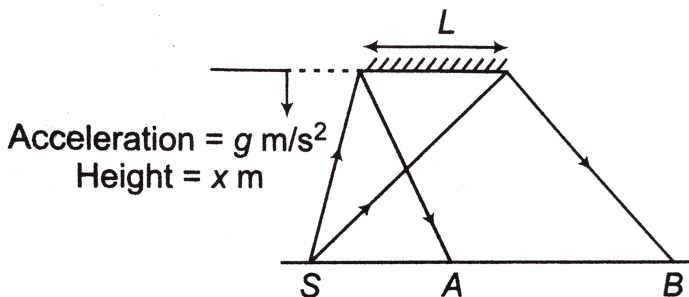
- A. $A \left(\sqrt{\frac{k}{M}} \right)$
- B. $\frac{A(\sqrt{3})}{2} \left(\sqrt{\frac{k}{M}} \right)$
- C. $A(\sqrt{3}) \left(\sqrt{\frac{k}{M}} \right)$
- D. $2a \left(\sqrt{\frac{M}{k}} \right)$

Answer: C



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2. A plane mirror is falling vertically as shown in the figure. If S is a point source of light, the rate of increase of the length AB is



A. directly proportional to x

B. constant but not zero

C. inversely proportional to x

D. zero

Answer: D



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3. A point object is placed at a distance of 10 cm and its real image is formed at a distance of 20 cm from a concave mirror. If the object is

moved by 0.1 cm towards the mirror. The image will shift by about

- A. 0.4 cm away from the mirror
- B. 0.4 cm towards the mirror
- C. 0.8 cm away from the mirror
- D. 0.8cm towards the mirror

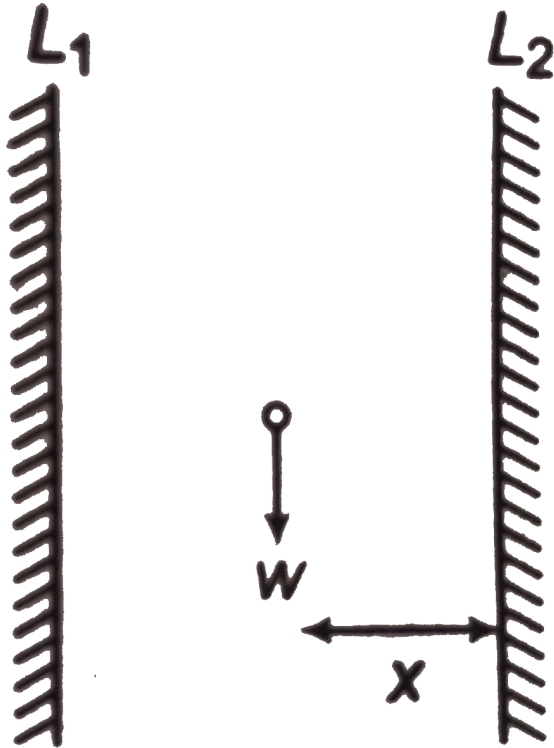
Answer: A



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4. two plane mirror L_1 and L_2 are parallel to each other and 3m apart. A person standing x m from the right mirror L_2 looks into this mirror and sees a series of images, The distance between the first and second image

is 4 m. Then, the value of x is



A. $2m$

B. $1.5m$

C. $1m$

D. $2.5m$

Answer: C



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5. A piece of wire bent into an L shape with upright and horizontal portion of equal lengths 10 cm each is placed with the horizontal portion along the axis of the concave mirror towards pole of mirror whose radius of curvature is 0 cm. If the bend is 20

cm from the pole of the mirror, then the ratio of the lengths of the images of the upright and horizontal portion of the wire is

A. 1 : 2

B. 1 : 3

C. 1 : 1

D. 2 : 1

Answer: C



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6. A point object at 15 cm from a concave mirror of radius of curvature 20 cm is made to oscillate along the principal axis with amplitude 2 mm. The amplitude of its image will be

A. 2mm

B. 4mm

C. 8mm

D. None of these

Answer: C



7. A ray of light falls on a plane mirror. When the mirror is turned, about an axis at right angle to the plane of the mirror through 20° , the angle between the incident ray and new reflected ray is 45° . Find the angle between the incident ray and original reflected ray.

A. 35° or 50°

B. 25° or 65°

C. 45° or 5°

D. None of these

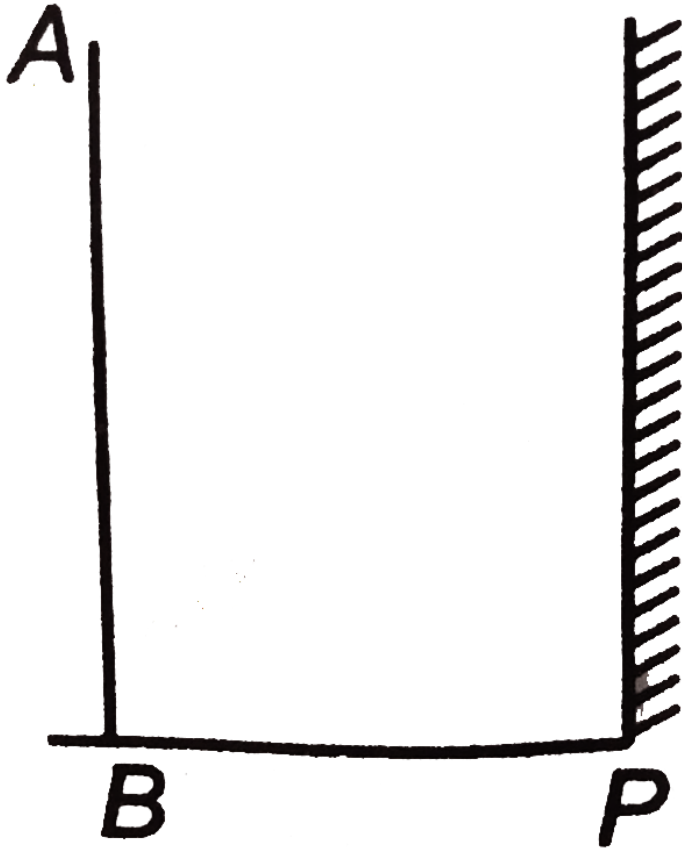
Answer: D



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

hair?



A. 167cm

B. 161cm

C. 163cm

D. 165cm

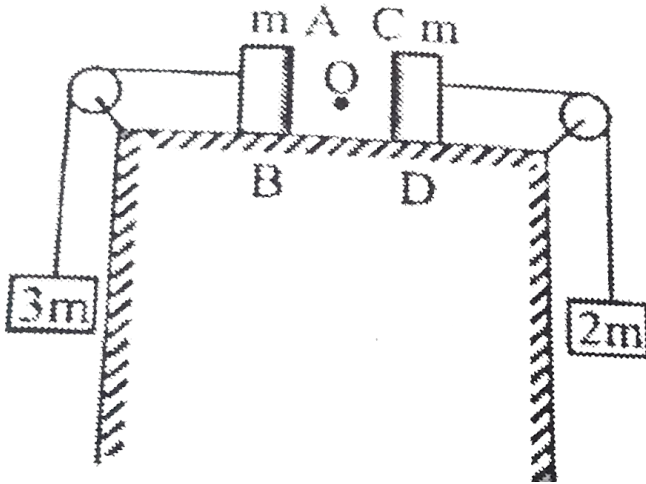
Answer: A



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9. Two blocks each of mass m lie on a smooth table. They are attached to two other masses as shown in the figure. The pulleys and strings are light. An object O is kept at rest on the table. The sides AB & CD of the two blocks are

made reflecting. The acceleration of two images formed in those two reflecting surfaces w.r.t. each other is:



- A. $\frac{5g}{6}$
- B. $\frac{5g}{3}$
- C. $\frac{17g}{12}$
- D. $\frac{17g}{6}$

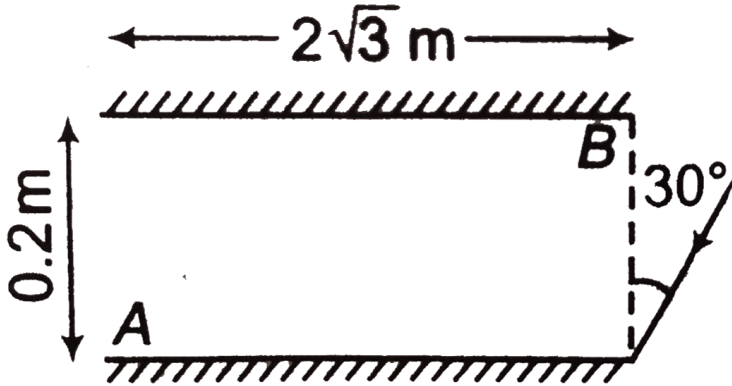
Answer: D



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10. Two plane mirrors A and B are aligned parallel to each other as shown in the figure. A light ray is incident at an angle of 30° at a point just inside one end of A. The number of times the ray undergoes reflections (including

the first one) before it emerges out is

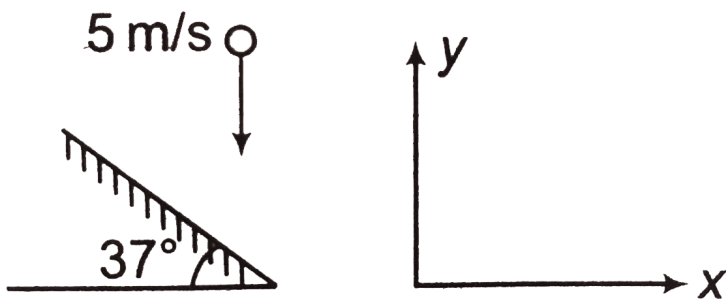


- A. 29
- B. 30
- C. 31
- D. 32

Answer: C



11. An object O is just about to strike a perfectly reflecting inclined plane of inclination 37° . Its velocity is 5 m/s . Find the velocity of its image.



A. $3(\hat{i}) + 4(\hat{j})$

B. $4(\hat{i}) + 3(\hat{j})$

C. $4.8(\hat{i}) + 1.4(\hat{j})$

D. $1.4(\hat{i}) + 4.8(\hat{j})$

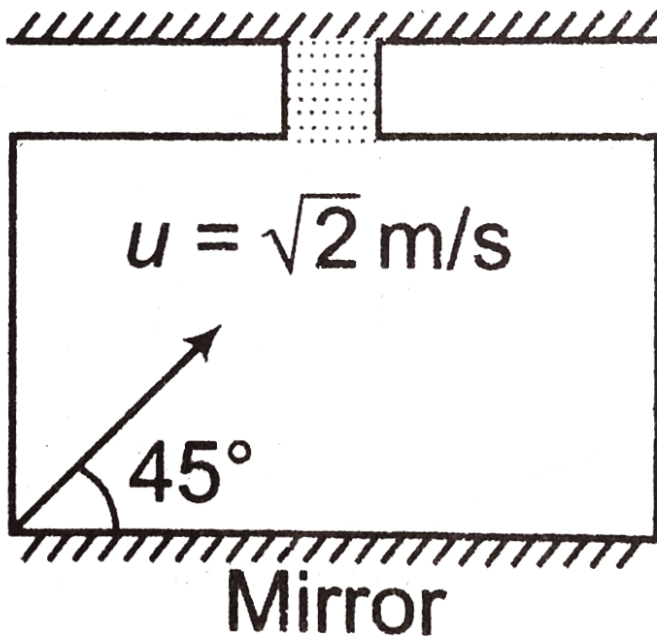
Answer: C



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12. An elevator at rest which is at 10th floor of a building is having a plane mirror fixed to its floor. A particle is projected with a speed $(\sqrt{2})\text{ m/s}$ and at 45° with the horizontal as shown in the figure. At the very instant of

projection, the cable of the elevator breaks and the elevator starts falling freely. what will be the separation between the particles and is image 0.5 s after the instant of projection?



A. $0.5m$

B. $1m$

C. $2m$

D. $1.5m$

Answer: B



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13. A plane mirror is moving with velocity $4(\hat{i}) + 5(\hat{j}) + 8(\hat{k})$. A point object in front of the mirror moves with a velocity $3(\hat{i}) + 4(\hat{j}) + 5(\hat{k})$. Here, \hat{k} is along the

normal to the plane mirror and facing towards the object. The velocity of the image is

A. $-3(\hat{i}) - 4(\hat{j}) + 5(\hat{k})$

B. $3(\hat{i}) + 4(\hat{j}) + 11(\hat{k})$

C. $-4(\hat{i}) + 5(\hat{j}) + 11(\hat{k})$

D. $7(\hat{i}) + 9(\hat{j}) + 3(\hat{k})$

Answer: B



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14. Point A (0, 1 cm) and B (12 cm, 5 cm) are the coordinates of object and image x-axis is the principal axis of the mirror. The, this object image pair is

A. due to a convex mirror of focal length

2.5 cm

B. due to concave mirror having its pole at

(2 cm, 0)

C. due to a concave mirror having its pole

at (-2 cm, 0)

D. Data is insufficient

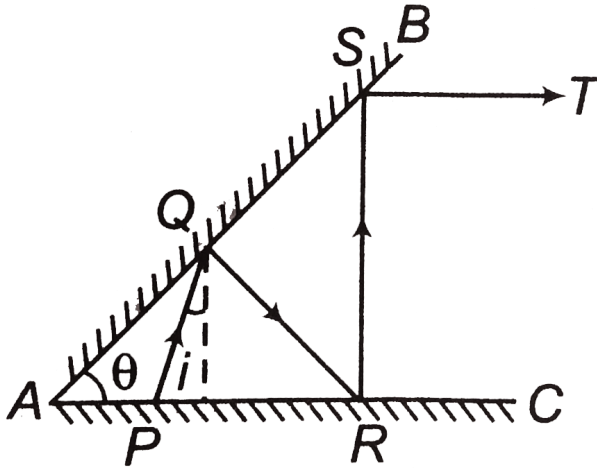
Answer: B



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15. Two plane mirrors AB and AC are inclined at an angle $\theta = 20^\circ$. A ray of light starting from point P is incident at point Q on the mirror AB, then at R on mirror AC and again on S on AB. Finally the ray ST goes parallel to mirror AC. The angle which the ray makes with the

normal at point Q on mirror AB is



A. 20°

B. 30°

C. 40°

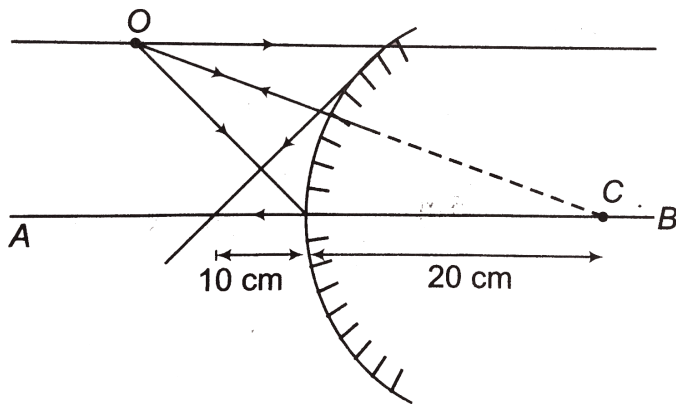
D. 60°

Answer: B



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16. A convex mirror of radius of curvature 20 cm is shown in figure. An object O is placed in front of this mirror. Its ray diagram is shown. How many mistakes are there in the ray diagram (AB is principal axis)



A. 3

B. 2

C. 1

D. 0

Answer: B



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Level 2 More Than One Correct

1. The image formed by a concave mirror is twice the size of the object. The focal length of the mirror is 20 cm. The distance of the object from the mirror *is / are*

A. 10cm

B. 30cm

C. 25cm

D. 15cm

Answer: A



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2. Magnitude of focal length of a spherical mirror is f and magnitude of linear magnification is $\frac{1}{2}$

A. If image is inverted, it is a concave mirror

B. If image is erect, it is a convex mirror

C. Object distance from the mirror may be

$$3f$$

D. Object distance from the mirror may be

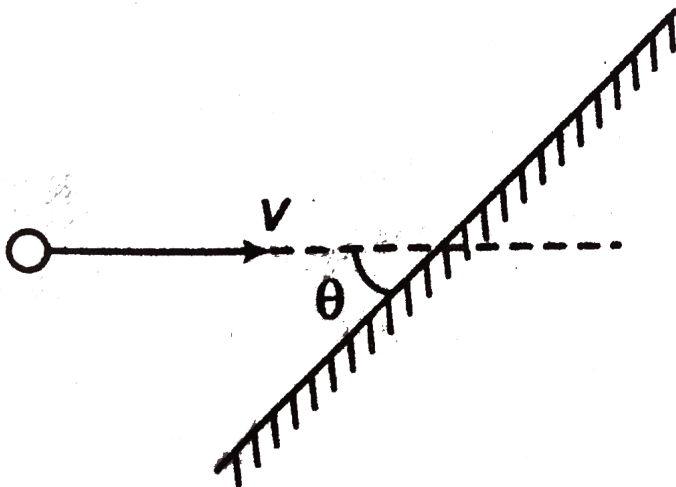
$$f.$$

Answer: A::B::C::D



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3. A point object is moving towards a plane mirror as shown in figure. Choose the correct options.



A. Speed of image is also v

B. Image velocity will also make an angle θ
with mirror

C. Relative velocity between object and
image is $2v$

D. Relative velocity between object and
image is $2v \sin(\theta)$

Answer: A::B::D

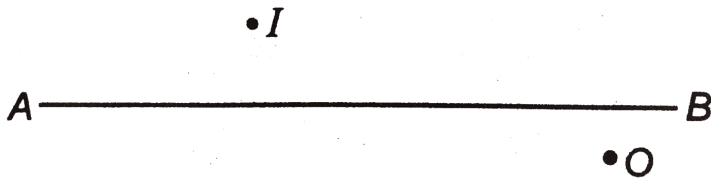


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4. AB is the principal axis of a spherical mirror.

I is the point image corresponding to a point

object O. Choose the correct options.



A. Mirror is lying to the right hand side of

O

B. Focus of mirror is lying to the right hand

side of O

C. Centre of curvature of mirror is lying to the right hand side of O

D. Centre of curvature of mirror is lying between I and O

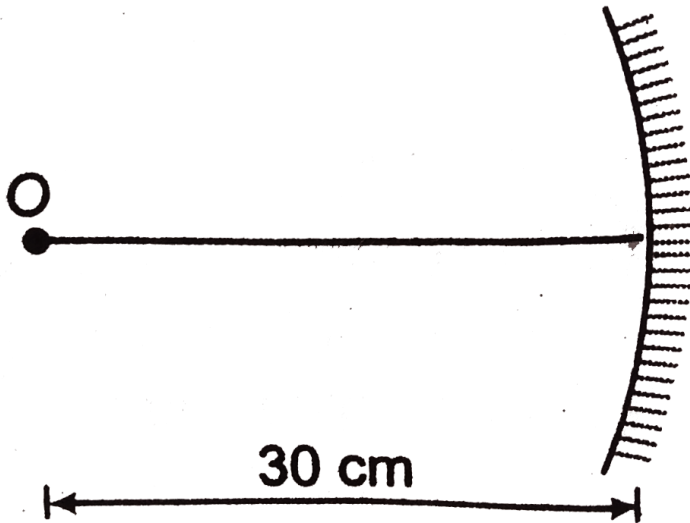
Answer: B::C



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5. A point object is placed on the principal axis of a concave mirror of focal length 20 cm. At this instant object is given a velocity v towards

the axis (event-1) or perpendicular to axis (event-2). Then, speed of image



- A. In event-1 is $2v$
- B. In event-1 is $4v$
- C. In event-2 is $2v$
- D. In event-2 is $4v$

Answer: A::B::C



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6. A point object is placed at equal distance $3f$ in front of a concave mirror, a convex mirror and plane mirror separately (event-1). Now, the distance is decreased to $1.5f$ from all the three mirror (event-2). Magnitude of focal length of convex mirror and concave mirror is f . Then choose the correct options.

- A. Maximum distance of object in event-1
from the mirror is from plane mirror
- B. Minimum distance of object in event-1
from the mirror is from convex mirror.
- C. Maximum distance of object in event-2
from the mirror is from concave mirror
- D. Minimum distance of object in event-2
from the mirror is from plane mirror

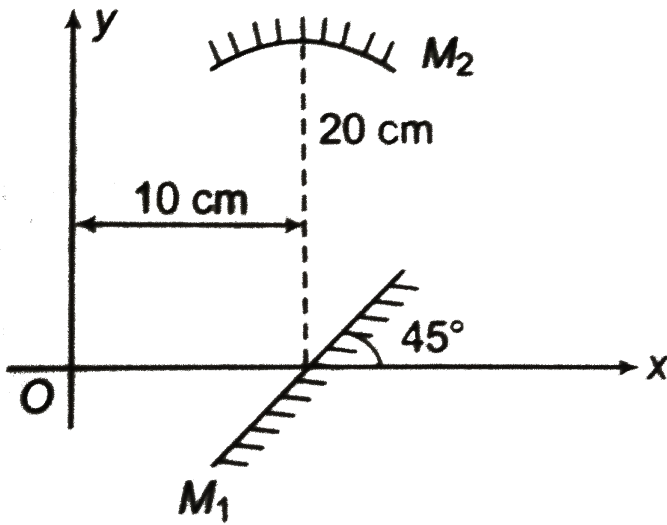
Answer: A



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Level 2 Comprehensive Based

1. A plane mirror (M_1) and a concave mirror (M_2) of focal length 10 cm are arranged as shown in figure. An object is kept at origin. Answers the following questions. (consider image formed by single reflection in all cases).



The coordination of image formed by plane mirror are

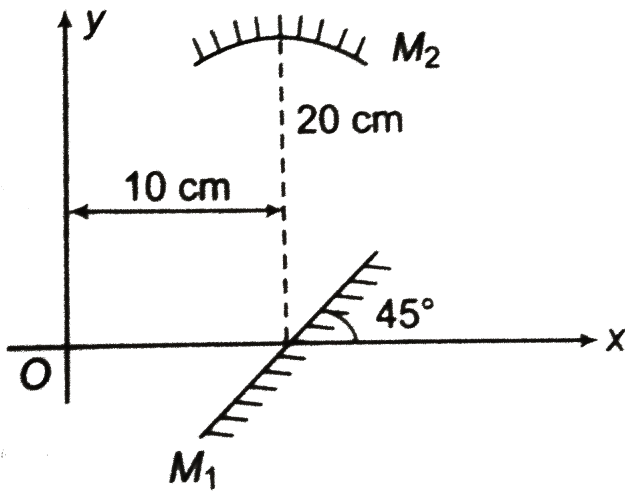
- A. $(-20\text{cm}, 0)$
- B. $(10\text{cm}, -60\text{cm})$
- C. $(10\text{cm}, -10\text{cm})$
- D. $(10\text{cm}, 10\text{cm})$

Answer: C



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2. A plane mirror (M_1) and a concave mirror (M_2) of focal length 10 cm are arranged as shown in figure. An object is kept at origin. Answers the following questions. (consider image formed by single reflection in all cases).



The coordination of image formed by concave mirror are

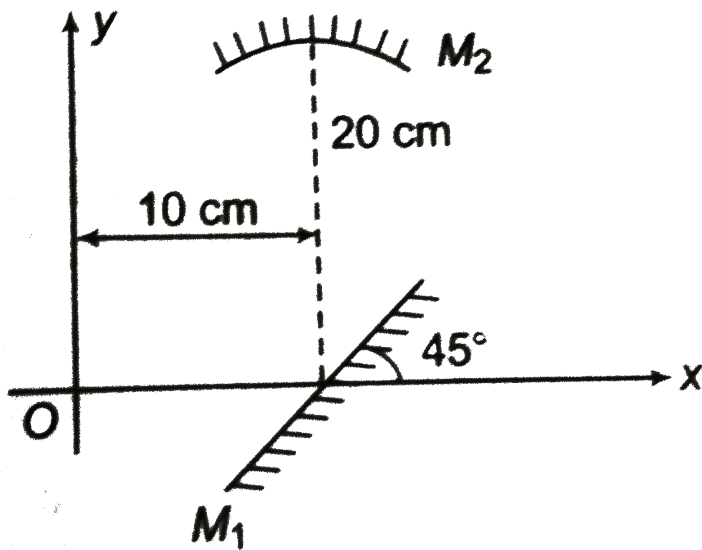
- A. $(10\text{cm}, -40\text{cm})$
- B. $(10\text{cm}, -60\text{cm})$
- C. $(10\text{cm}, 8\text{cm})$
- D. None of these

Answer: D



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3. A plane mirror (M_1) and a concave mirror (M_2) of focal length 10 cm are arranged as shown in figure. An object is kept at origin. Answers the following questions. (consider image formed by single reflection in all cases).



If concave mirror is replaced by convex mirror of same focal length then coordinates of image formed by (M_2) will be

- A. (10cm, 12cm)
- B. (10cm, 22cm)
- C. (10cm, 8cm)

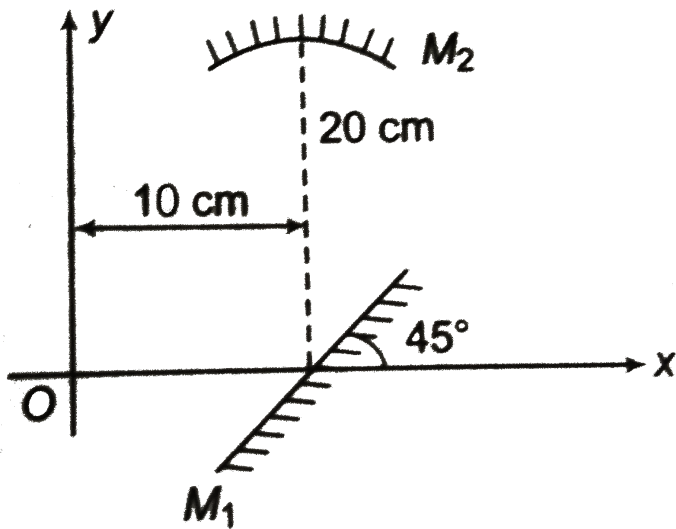
D. None of these

Answer: D



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4. A plane mirror (M_1) and a concave mirror (M_2) of focal length 10 cm are arranged as shown in figure. An object is kept at origin. Answers the following questions. (consider image formed by single reflection in all cases).



if concave mirror is replaced by another plane mirror parallel to x -axis, then coordinates of image formed by (M_2) are

- A. $(40\text{cm}, 20\text{cm})$
- B. $(20\text{cm}, 40\text{cm})$
- C. $(-20\text{cm}, 20\text{cm})$

D. None of these

Answer: D

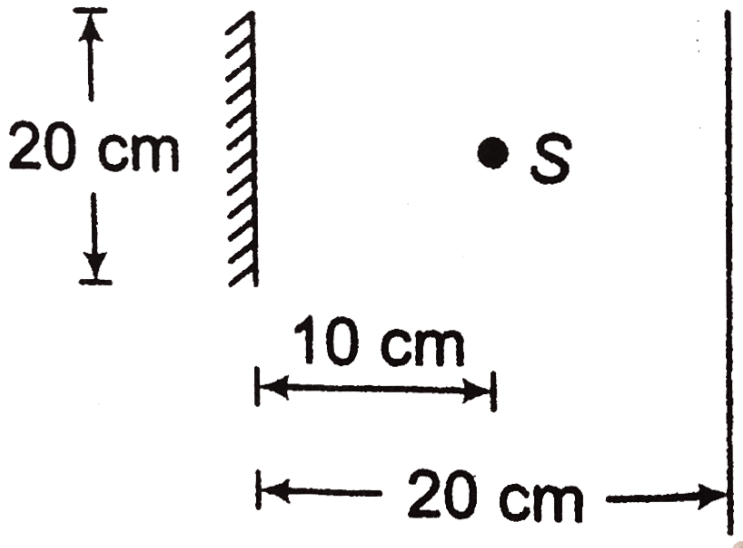


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Subjective

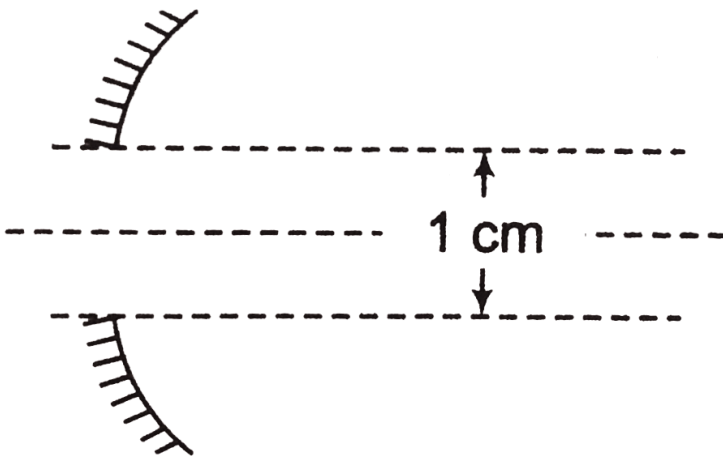
1. A point source of light S is placed at a distance 10 cm in front of the centre of a mirror of width 20 cm suspended vertically on a wall. An insect walks with a speed $10\text{ cm} / \text{s}$ in

front of the mirror along a line parallel to the mirror at a distance 20 cm from it as shown in figure. find the maximum time during which the insect can see the image of the source S in the mirror.



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2. Concave mirror forms the real image of a point source lying on the optical axis at a distance of 50 cm from the mirror. The focal length of the mirror is 25 cm. The mirror is cut into and its halves are drawn a distance of 1 cm apart in a direction perpendicular to the optical axis. How will the image formed by the halves of the mirror be arranged?





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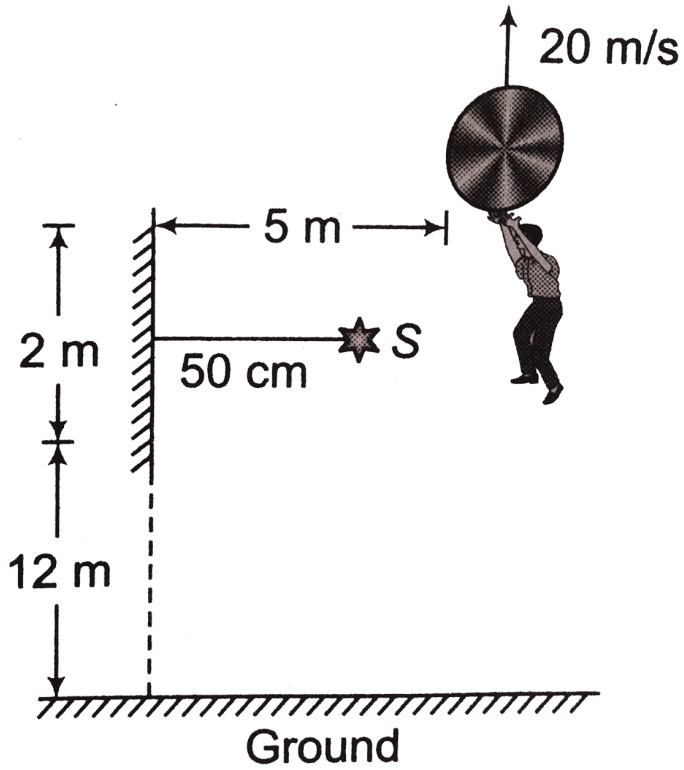
3. A point source of light S is placed on the major optical axis of the concave mirror at a distance of 60 cm. At what distance from the concave mirror should a flat mirror be placed for the rays to converge again at the point S having been reflected from the concave mirror and then from the flat one? Will the position of the point where the rays meet change if they are first reflected from the flat mirror? The radius of the concave mirror is 80 cm.



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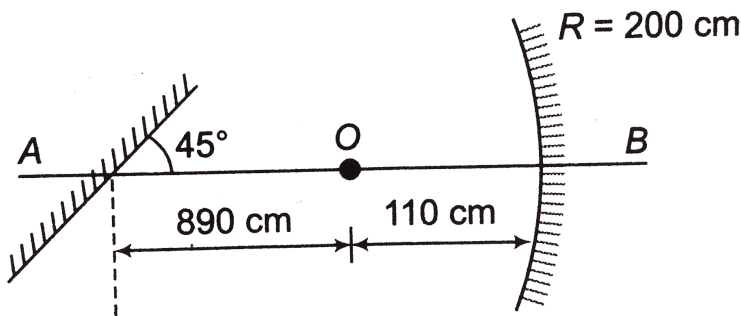
4. A balloon is moving upwards with a speed of 20 m/s . When it is at a height of 14 m from ground in front of a plane mirror in situation as shown in figure, a boy drops himself from the balloon. Find the time duration for which he will see the image of source S placed symmetrically before plane mirror during free

fall.



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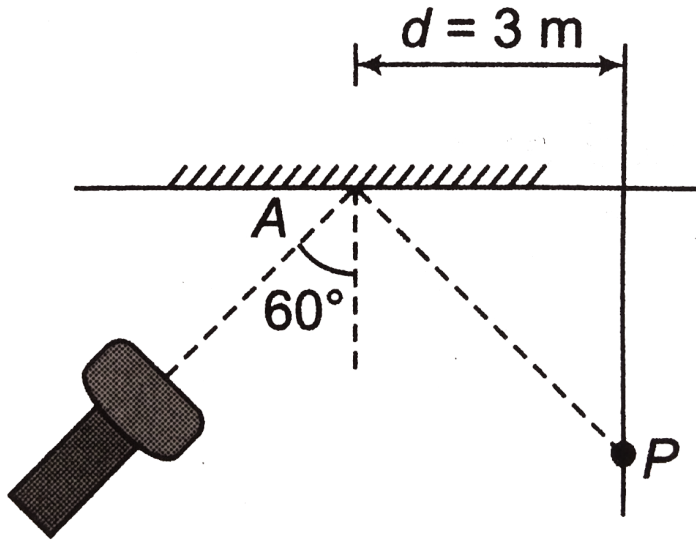
5. A plane mirror and a concave mirror are arranged as shown in figure and O is a point object, Find the position of image formed by two reflection, first one taking place at concave mirror.



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6. Figure shows a torch producing a straight light beam falling on a plane mirror at an angle 60° . The reflected beam makes a spot P on the screen along y-axis. If at $t=0$, mirror starts rotating about the hinge A with an angular velocity $(\omega) = 1^\circ$ per second clockwise. Find the speed of the spot on

screen after time $t = 15$ s.



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7. A thief is running away in a car with velocity of 20 m/s . A police jeep is following him,

which is sighted by thief in his rear view mirror, which is a convex mirror of focal length 10 m. He observes that the image of jeep is moving towards him with a velocity of $1\text{cm} / \text{s}$. if the magnification of mirror for the jeep at that time is $\frac{1}{10}$. Find

- (a) the actual speed of jeep,
- (b) rate at which magnification is changing.

Assume the police's jeep is on the axis of the mirror.



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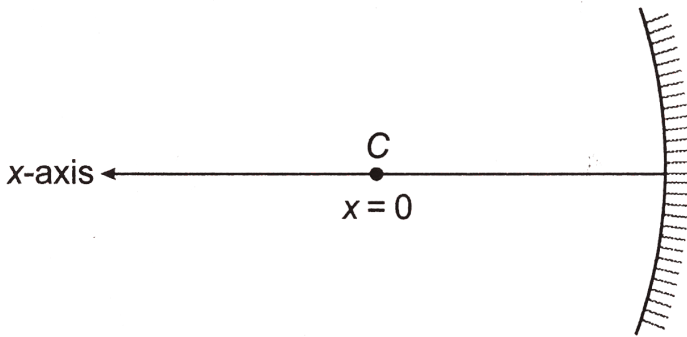
8. A ball swings back and forth in front of a concave mirror. The motion of the ball is described approximately by the equation $x = f \cos(\omega)t$, where f is the focal length of the mirror and x is measured along the axis of mirror. The origin is taken at the centre of curvature of the mirror.

(a) Derive an expression for the distance from the mirror of the image of the swinging ball.

(b) At what point does the ball appear to coincide with its image?

(c) What will be the lateral magnification of

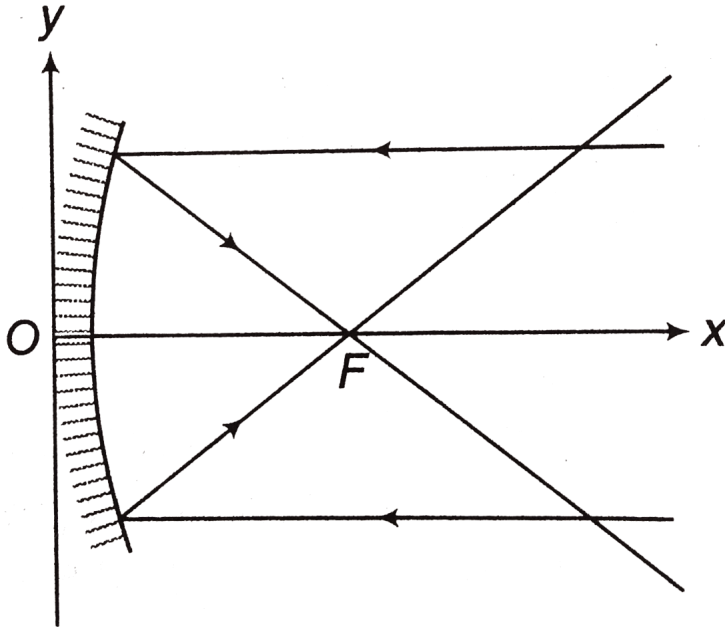
the image of the ball at time $t = \frac{T}{2}$, where T is time period of oscillation?



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9. Show that a parallel bundle of light rays parallel to the x-axis and incident on a parabolis reflecting surface given by $x = 2by^2$, will pass through a single point called focus of

the reflecting surface. Also, find the focal length.



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