CLASS 10TH MID TERM

SCORE BOOSTER

PHYSICS

LIGHT

- REFLECTION

Reflection Of Light

- **Laws of reflection**
  - $\theta_i = \theta_r$

Spherical Mirror

- **Convex: Bulged outward**
- **Concave: Bulged inward**

Image Formation

- Convex mirror Always produce **virtual and diminished image.**
- Concave mirror can **produce virtual as well as real image**

Mirror Equation

- $\frac{1}{v} + \frac{1}{u} = \frac{1}{f} = \frac{2}{R}$
- $\mathrm{m} = -\frac{\mathrm{v}}{\mathrm{u}}$

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Basics of Light

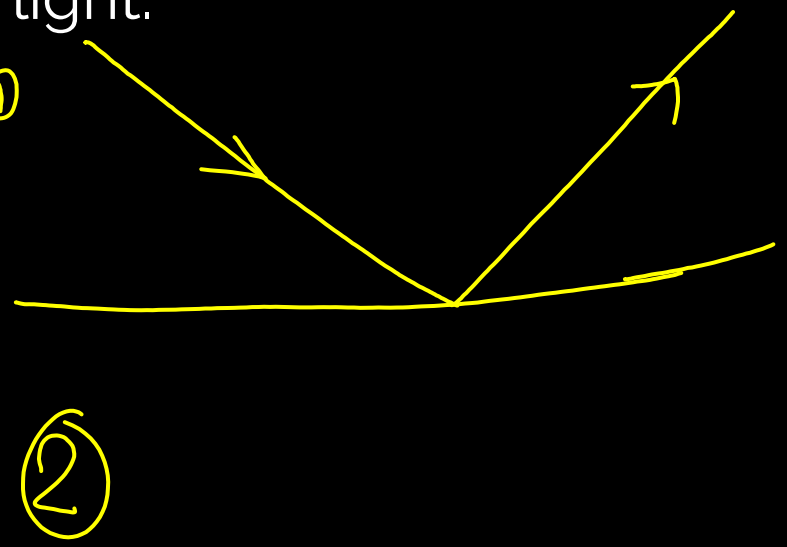
MCQ 1: Light is a **form of_____** that **gives us the sense of _____.**

a) force, impact
b) sound, hearing
c) energy , vision
d) particles, touch

Reflection of light

SA 1: What is reflection of light?

When light is travelling from one medium to another medium, a portion of the incident light **bounces back** to the first medium from the boundary separating the media. This is known as reflection of light.



Laws Of reflection of light

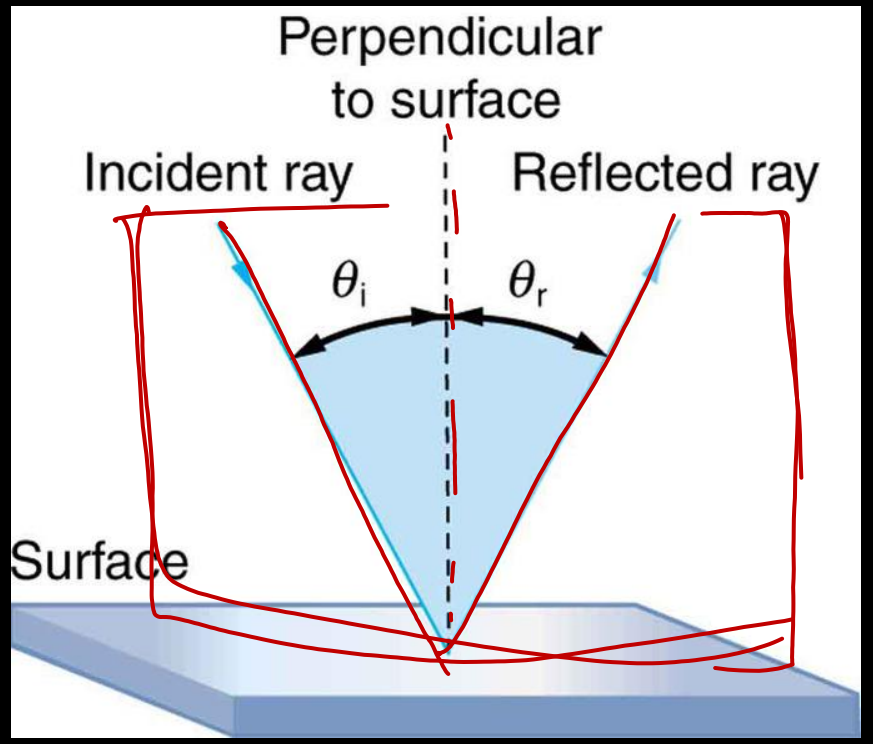
MCQ 2 : If θ_i is the angle of incidence and θ_f is the angle of refraction, then which of the following is correct?

a) $\theta_i = \theta_r$

b) $\theta_i = 2\theta_r$

c) $2\theta_i = \theta_r$

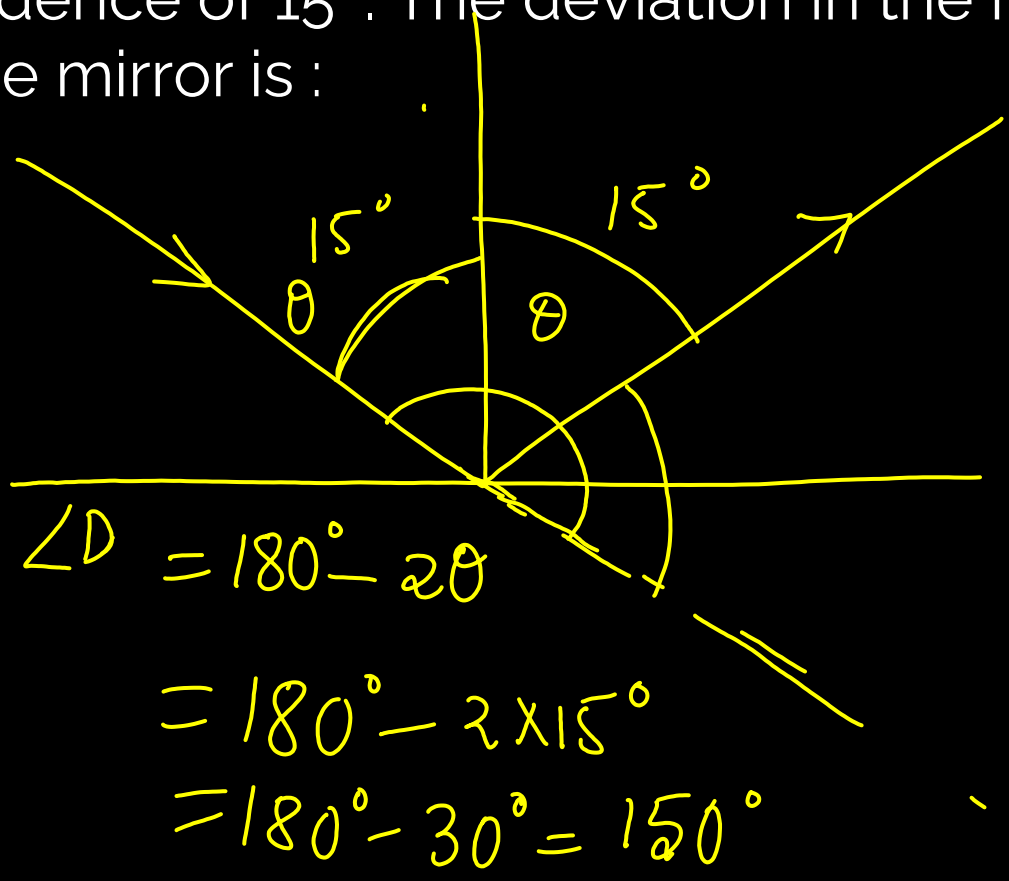
d) $\theta_i \geq \theta_r$



Laws Of reflection of light

MCQ 3 : A ray of light is incident on a plane mirror at an angle of incidence of 15°. The deviation in the ray produced by the mirror is :

a) 30°
b) 60°
c) 120°
d) 150°



Laws Of reflection of light

MCQ 4:

Assertion (A): The incident ray, the reflected ray and the normal drawn at the point of incidence, all lie on the same plane. (True)

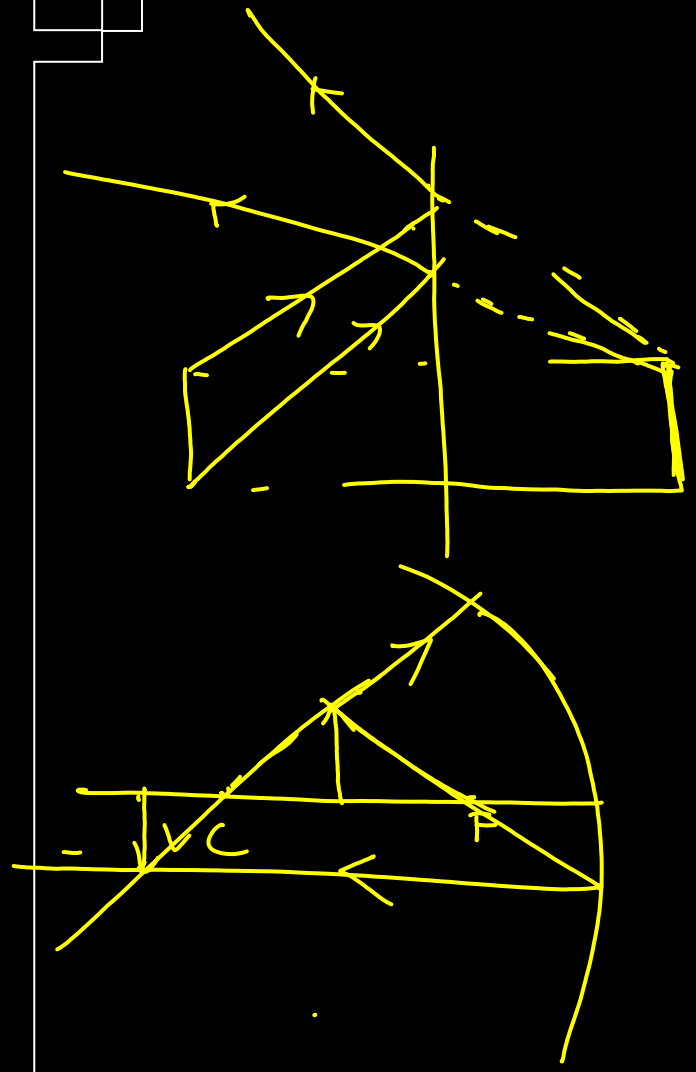
Reason (R): Law of reflection is not valid for rough surfaces. (False)

a) Both A and R are true, R is correct explanation of A

b) Both A and R are ture, but R is not correct explanation of A

c) A is true, R is false

d) A is false, R is true



Different types of images

SA 2: What is a Virtual image?

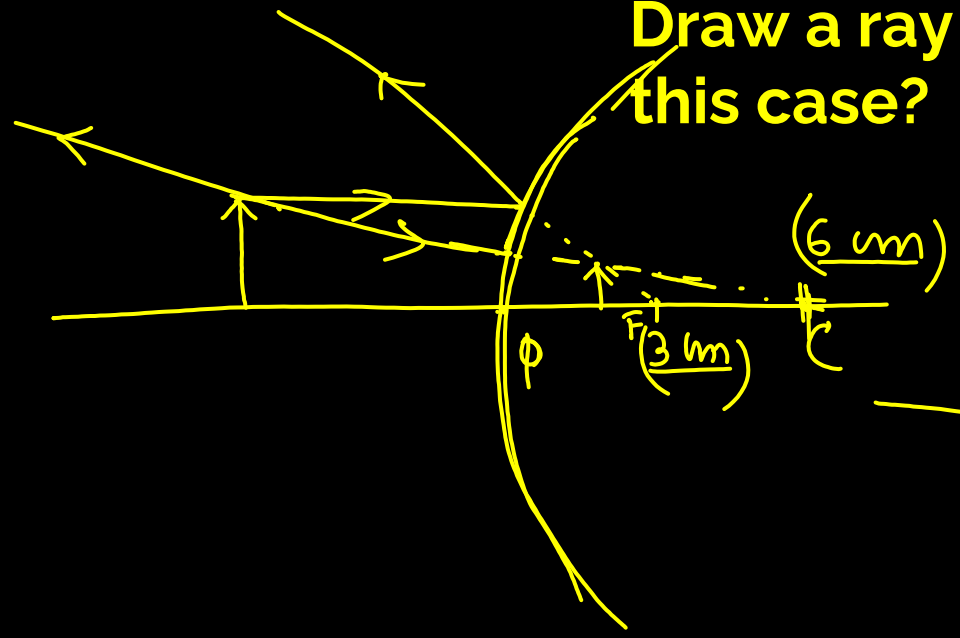
If the light rays **do not meet** after reflection/refraction but appear to meet when produced backwards then the formed image is called virtual image. The image can not be obtained on a screen.

SA 3: What is a Real image?

If the light rays **do meet** after reflection /refraction and the image can be obtained on a screen, then the formed image is called virtual image

Image formation by a Convex Mirror

SA 4: A mirror forms a virtual, erect and diminished image of an object. Identify the type of this mirror. Draw a ray diagram to show the image formation in this case?



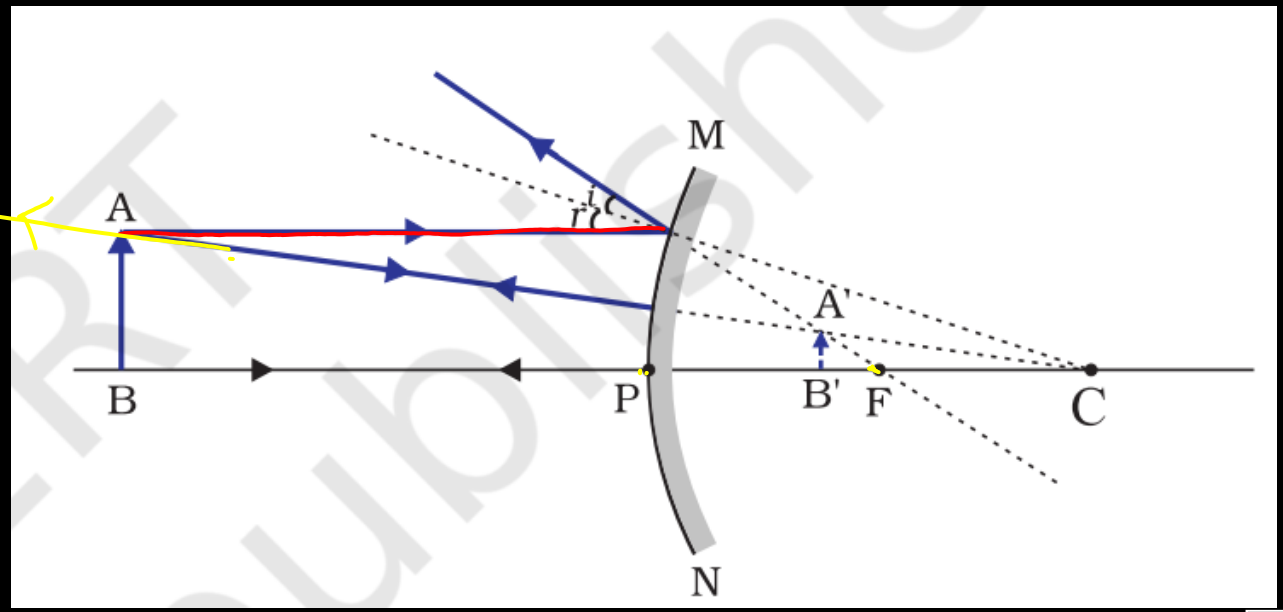


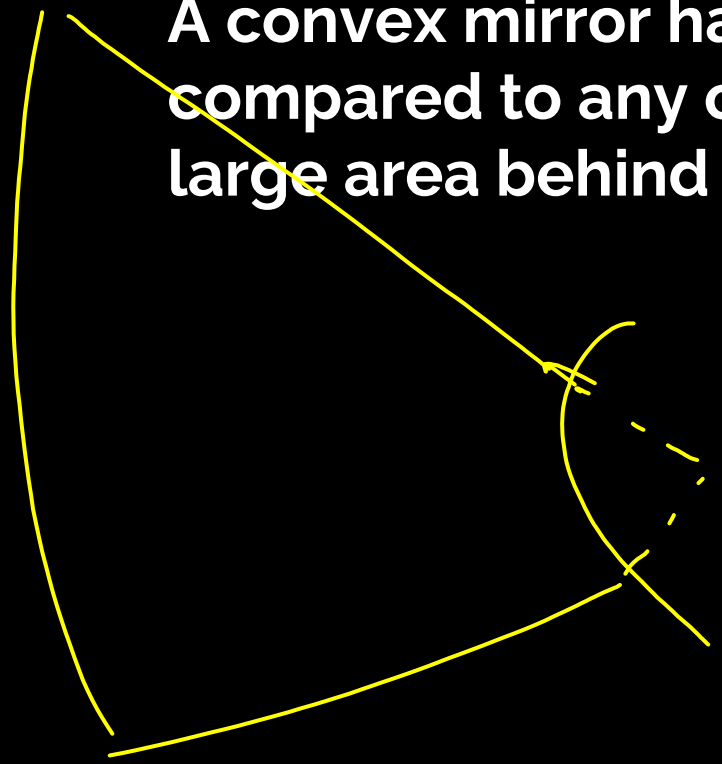
Image formation by a Convex Mirror

Position of the object	Position of the image	Size of the image	Nature of the image
At Infinity	At the focus F, behind the mirror	Highly diminished, Point sized	Virtual and erect
Between infinity and the pole P of the mirror	Between P and F, Behind the mirror	Diminished	Virtual and erect

Image formation by a Convex Mirror

VSA 1: Why do we prefer a convex mirror as a rear-view mirror in cars?

A convex mirror has a greater field of view as compared to any other mirrors. Thus, we can see a large area behind the car using a convex mirror.



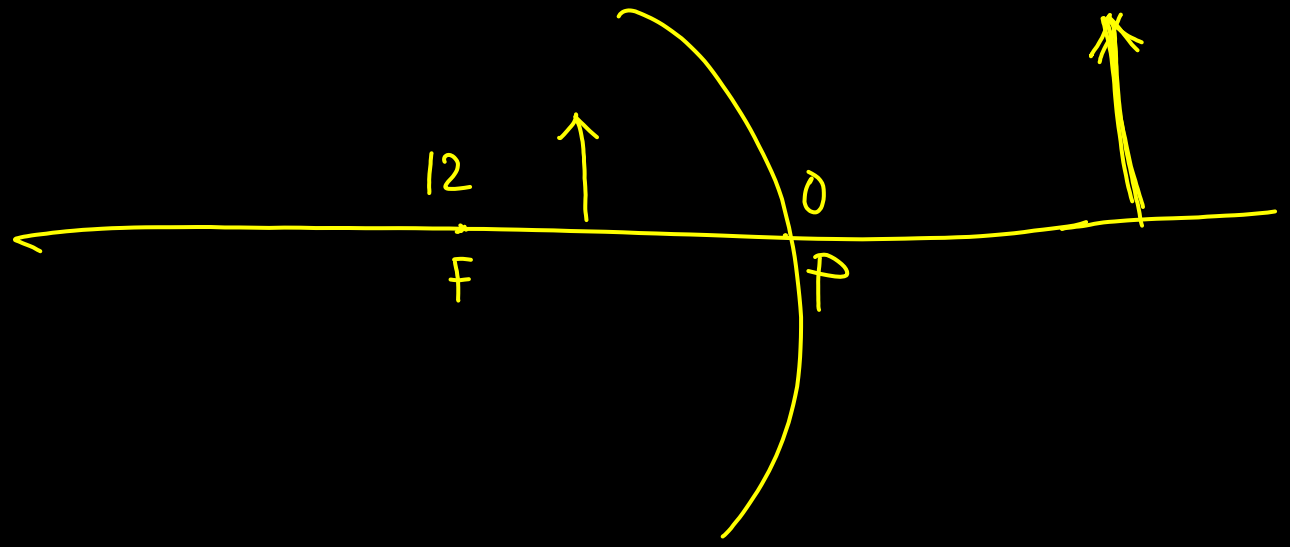
Example

LA 1: It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

i. What should be the range of the object distance in the above case?

Answer:

i. The range of the distance should be from 0 to 12 cm. From pole to principal focus.



Example

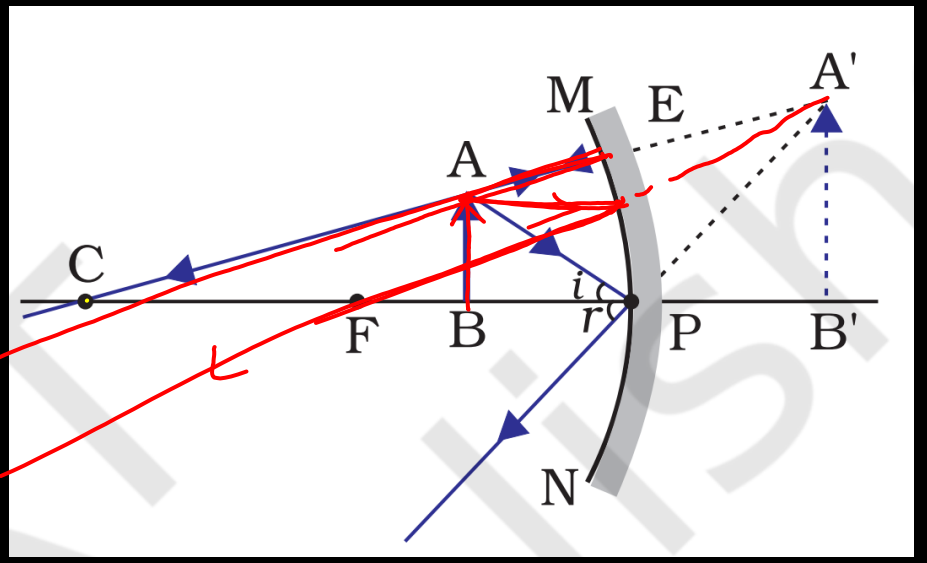
LA 1: It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

ii. Will the image be smaller or larger than the object? Draw a ray diagram to show the formation of image in this case.

Answer:

ii. The image will be larger.

Must use arrows in your ray diagram.



Example

LA 1: It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

iii. Where will the image of this object be, if it is placed 24 cm in front of the mirror?

Answer:

iii. The object distance is u=2f that is the object is at the centre of curvature. Thus, image will be at the centre of curvature. at a distance 24 cm

Image formation by a Concave Mirror

Object Beyond C: Common case

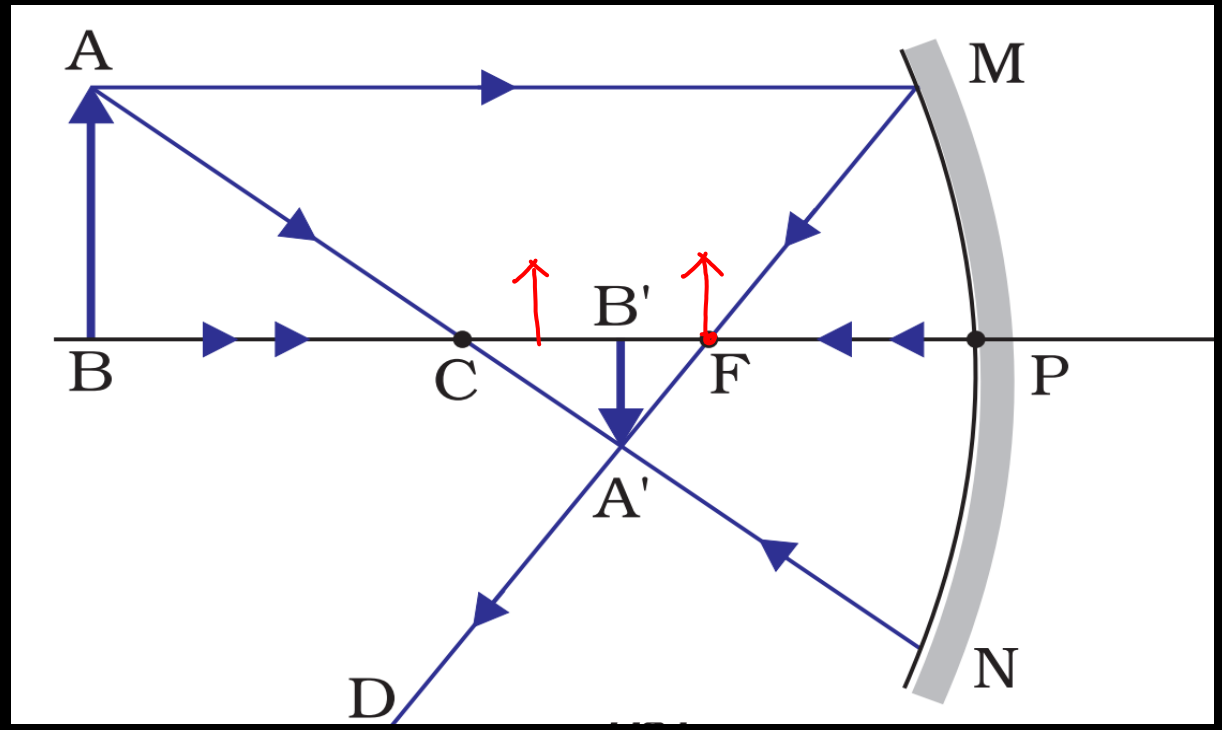
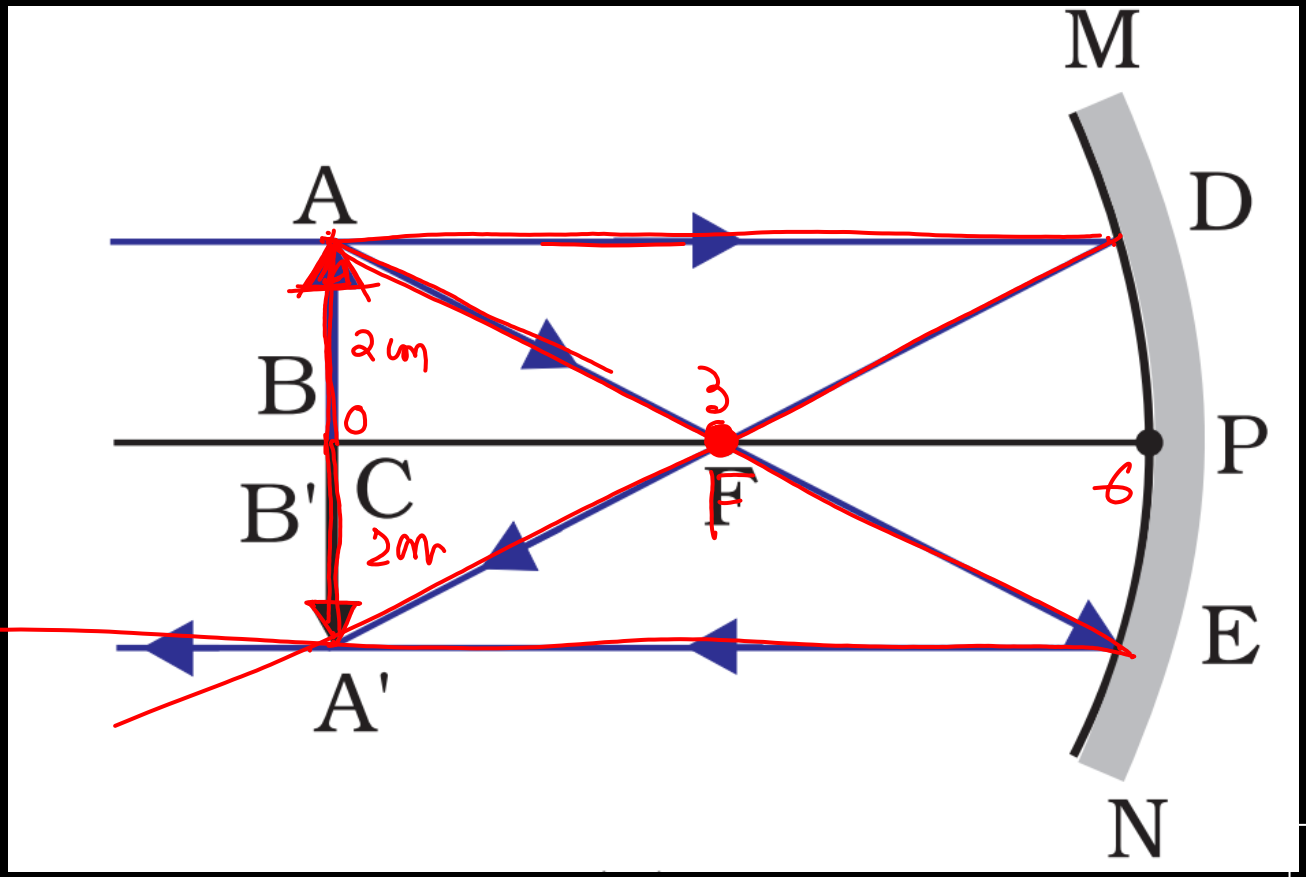


Image formation by a Concave Mirror

Object at C: Special case



Concave Mirror: Summery

Position of the object	Position of the image	Size of the image	Nature of the image
At Infinity	At the focus F	Highly diminished, Point sized	Real and Inverted
Beyond C	Between F and C	Diminished	Real and Inverted
At C	At C	Same size	Real and Inverted
Between C and F	Beyond C	Enlarged	Real and Inverted
At F	At Infinity	Highly enlarged	Real and Inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

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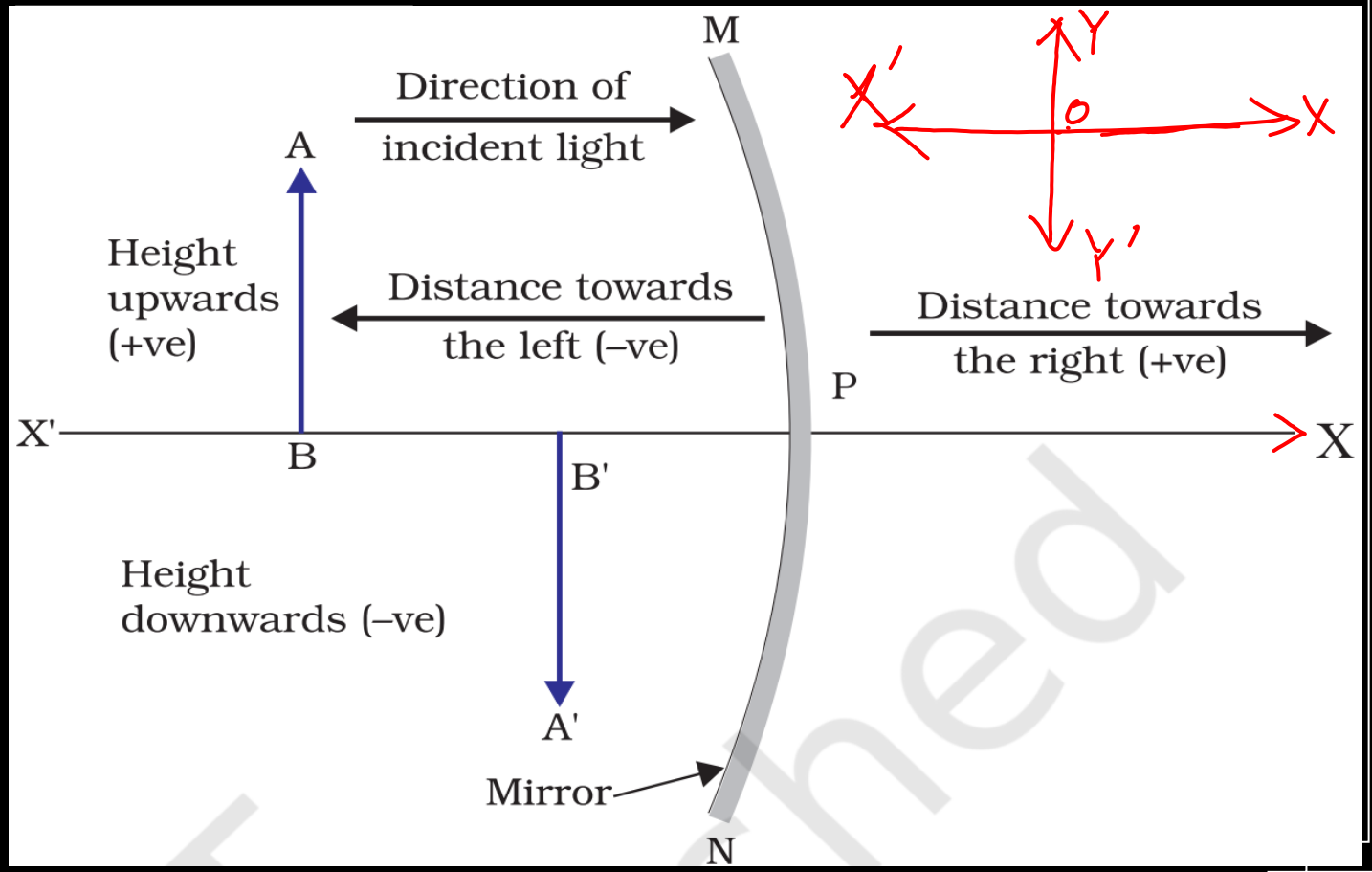
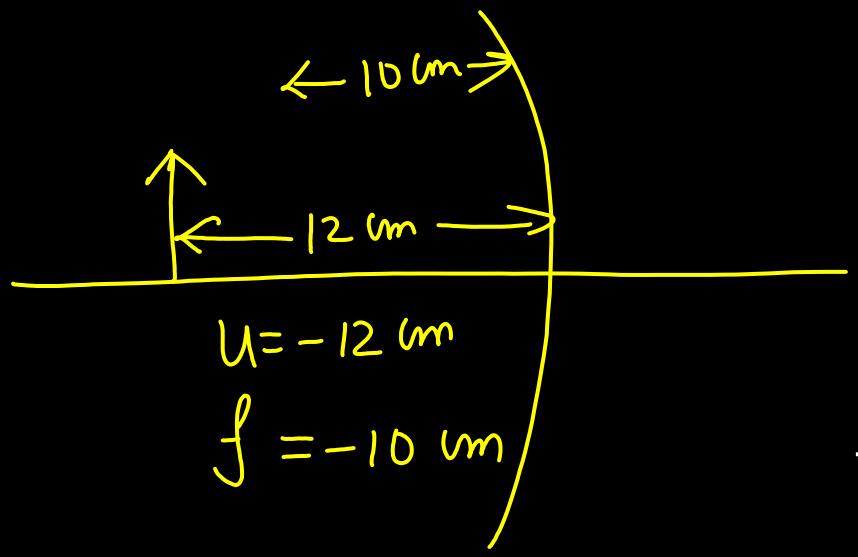
Sign Convention in Mirrors

SA 5: Explain with diagram about the sign convention of light.



Mirror Formula



$$\frac{1}{v} + \frac{1}{u} = \frac{1}{f} = \frac{2}{R}$$

This formula is valid in all situations for all spherical mirrors for all positions of the object.

You must use the New Cartesian Sign Convention while substituting numerical values for **u, v, f, and R** in the mirror formula for solving problems.

Magnification

Inverted Image
$m \rightarrow -ve$

Erect Image
$m \rightarrow +ve$

For Enlarged Image $m > 1$

MCQ 5: An object is kept at a distance u in front of a spherical mirror. An image is formed at distance v from the mirror. What is the magnification of image?

a) $-\frac{v}{u}$

b) $-uv$

c) $-\frac{u}{v}$

d) It depends on the type of the mirror

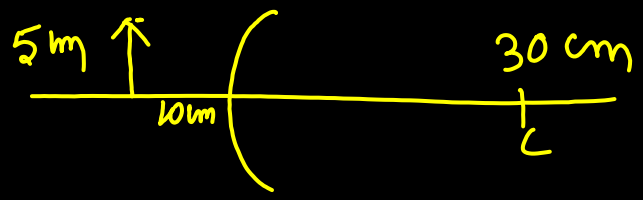
$$m = \frac{\text{Height of the image } (h')}{\text{Height of the object } (h)}$$

$$m = -\frac{v}{u}$$

Example

LA 2: An object 5 cm high is placed at 10 cm from a convex mirror of radius of curvature 30 cm. Find the nature, position, and size of the image.

Answer:



$$\frac{1}{v}+\frac{1}{u}=\frac{2}{R}$$

$$\Rightarrow \frac{1}{v}+\frac{1}{-10}=\frac{2}{30}=\frac{1}{15}$$

$$\Rightarrow \frac{1}{v}=\frac{1}{15}+\frac{1}{10}=\frac{2+3}{30}=\frac{1}{6}$$

$$\Rightarrow v=+6 \text{ cm}$$

1) Virtual as V is +ve

2) 6 cm behind the mirror

3) $m=\frac{h'}{h}=-\frac{v}{u}$

$h'=h\times 0.6$

$=5\times 0.6$

$=3$ cm

Size of the image 3 cm

$$m=-\frac{v}{u}$$

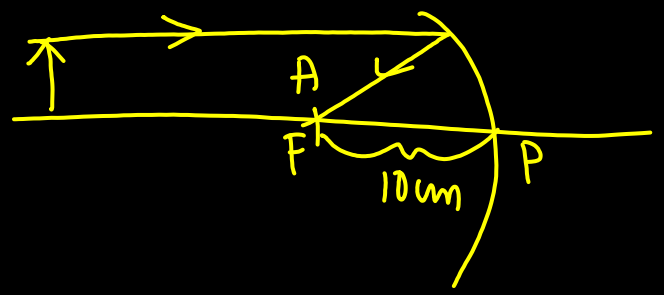
$$=+\frac{6}{+10}$$

$$=0.6$$

Example

LA 3(part): A ray of light is incident on a concave mirror, parallel to its principal axis. If this ray after reflection from the mirror passes through the principal axis from a point at a distance of 10 cm from the pole of the mirror, find the radius of curvature of the mirror.

Answer:



$f = 10\ cm$

$R = 2f = 2 \times 10 = 20\ cm$

Example

Homework #1

MCQ: At What distance from a concave mirror should an object be placed to get an image of the same size as the object? (1)

a) Beyond the centre of curvature of the mirror
b) At the principal focus of the mirror
c) At the centre of curvature of the mirror
d) Between the focus and pole of the mirror

Homework #2

MCQ: At What distance from a concave mirror should an object be placed to get an inverted and magnified image? (1)

a) Beyond the centre of curvature of the mirror
b) At the principal focus of the mirror
c) At the centre of curvature of the mirror
d) Between the focus and centre of curvature of the mirror

Homework #3

SA 1: A concave mirror produces three times magnified (enlarged) real image of an object placed at 10 cm in front of it. Where is the image located. (2)

SA 2: State laws of reflection of light. (2)

Homework #4

LA 1: An object of height 5·0 cm is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed, so that a focussed image is obtained on it ? Find the nature and the height of the image. (5)

Homework #5

LA 2: Study the data given below showing the focal length of three concave mirrors A, B and C and the respective distances of objects placed in front of the mirror.

Case	Mirror	Focal Length (cm)	Object Distance (cm)
1	A	20	45
2	B	15	30
3	C	30	20

i) In which cases, the mirror will form a diminished image of the object? Justify your answer. (1)

ii) List two properties of image formed in case 2. (2)

iii) What is the nature and size of the image formed by mirror c? Draw ray diagram to justify your answer. (2)

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