RADIANT 2026

Physics

Light

Lecture - 04

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Topics *to be covered*

1. Ray Diagrams for Formation of Images in a Concave Mirror
2. Sign Convention For The Measurement of Distances
3. Formulae For The Spherical Mirror
4. Numerical

5) Image formation by Spherical mirror and uses of spherical mirror

Recap *of previous lecture*

1. Concave mirror
2. Convex mirror
3. Definition related to mirrors


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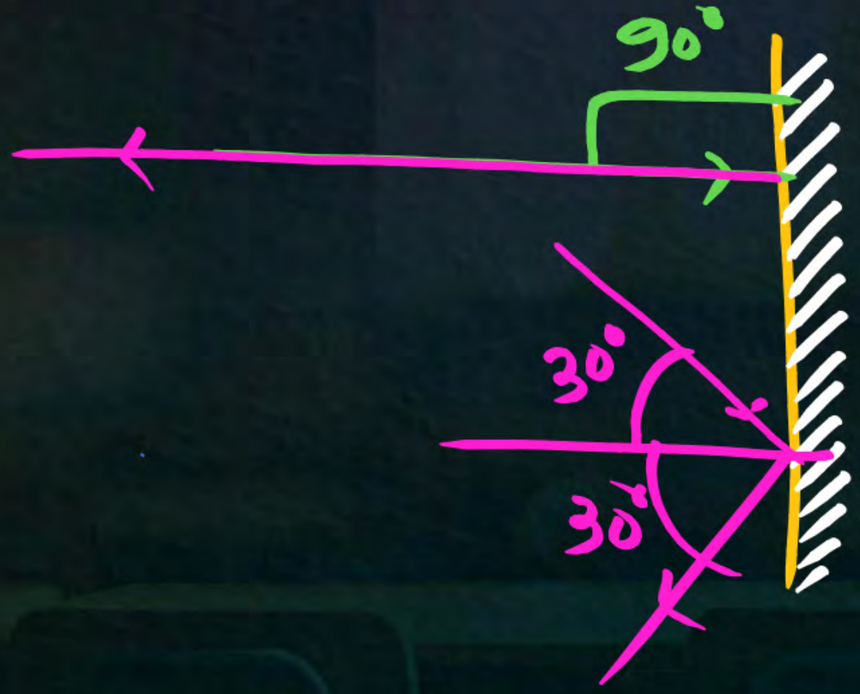
P
C
F
R


F
C
F
R

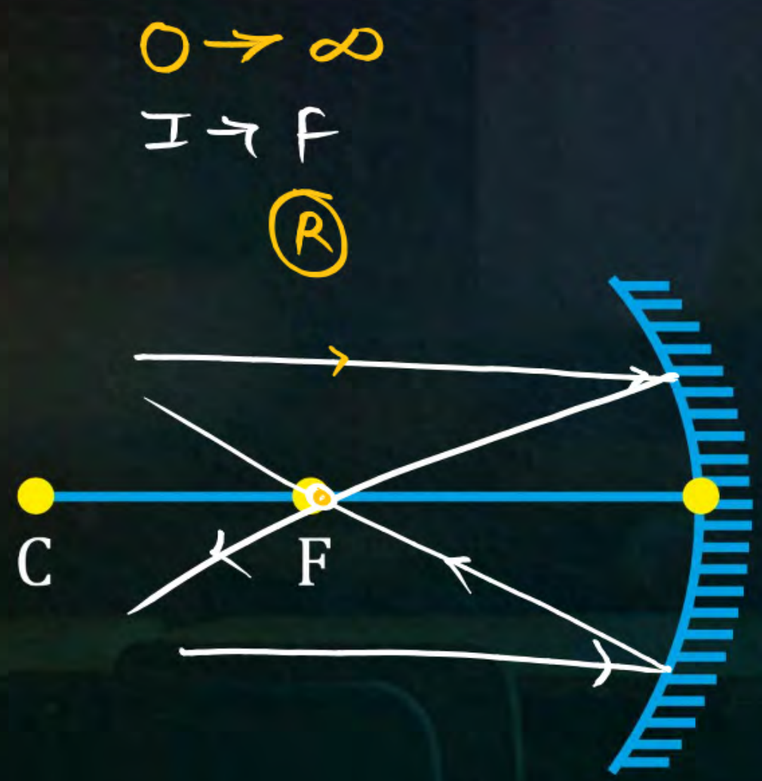
Reflection of a ray of light normally incident on a plane mirror

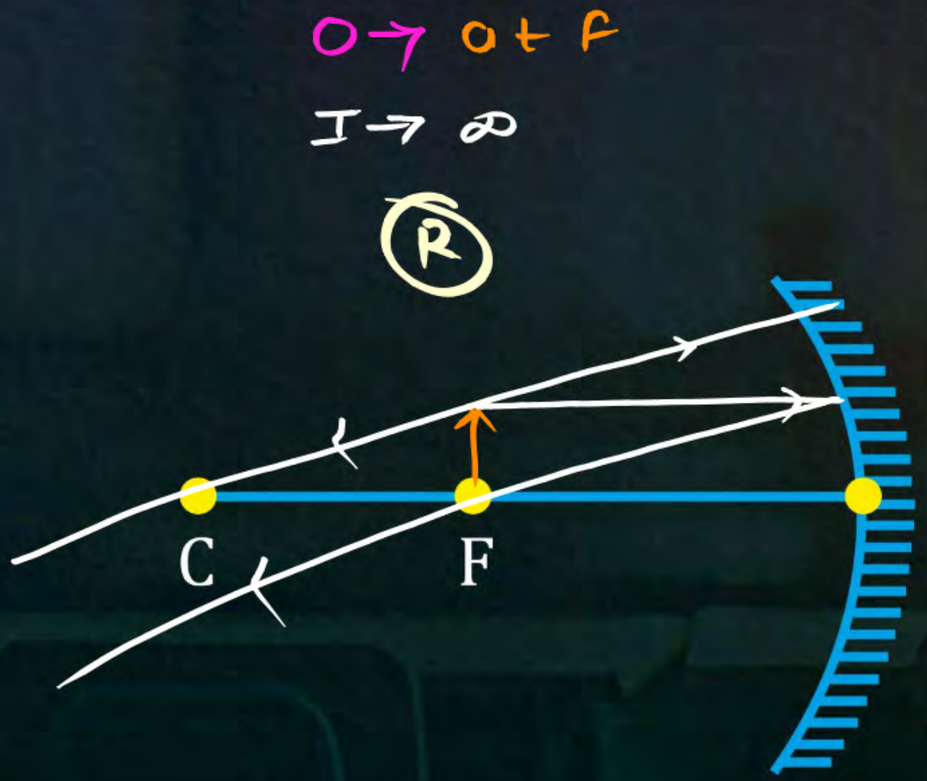


$\angle i = 0$

$\angle r = 0$

Ray Diagrams for Formation of Images in a Concave Mirror

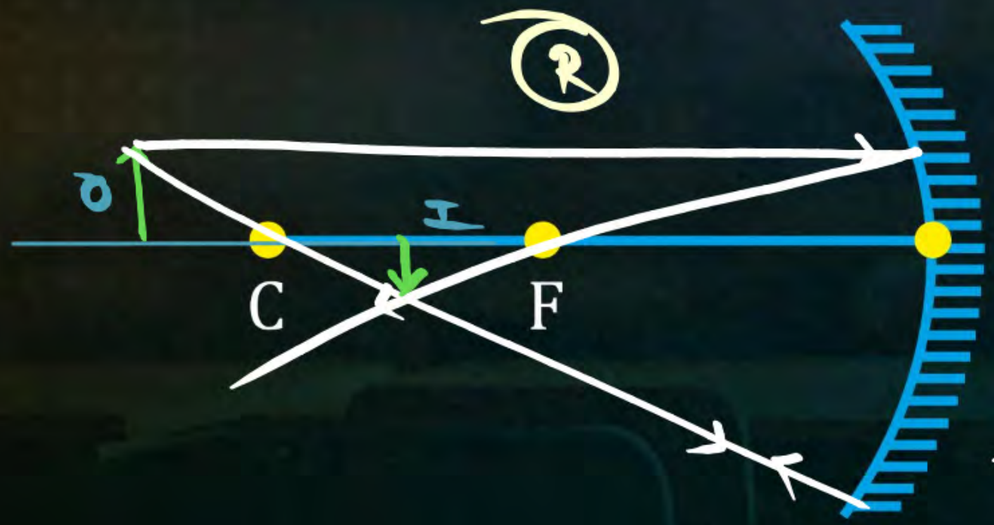




Ray Diagrams for Formation of Images in a Concave Mirror

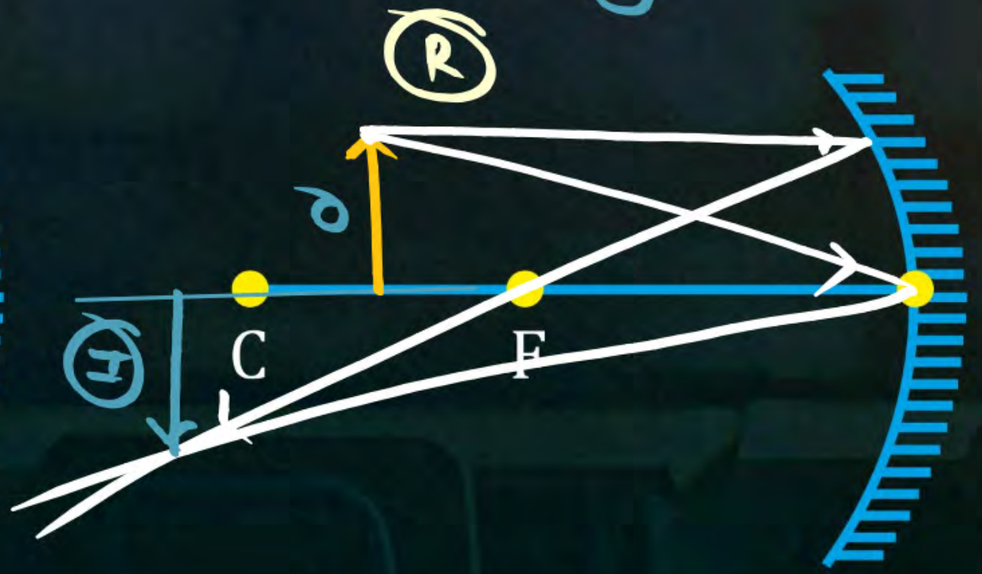
O → Beyond C

I → b/w C & F



O → b/w C & F

I → beyond C



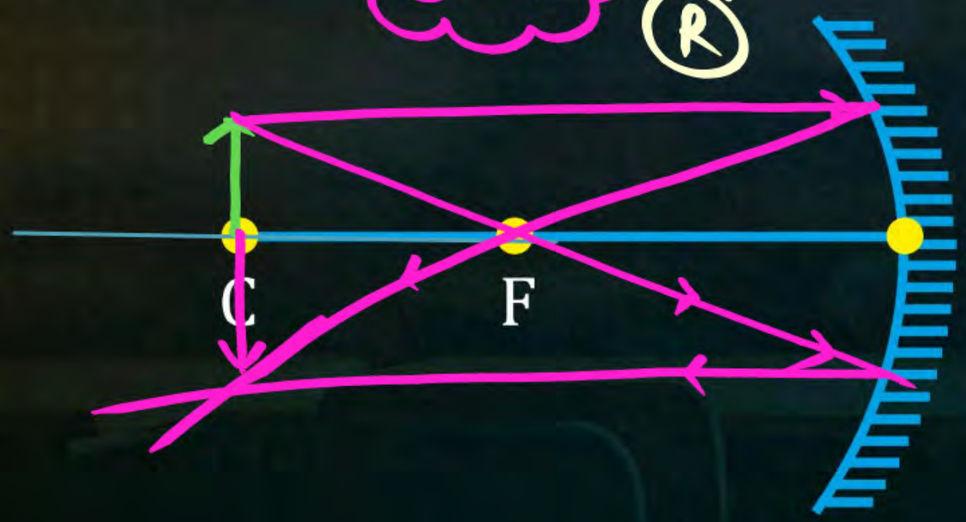
Ray Diagrams for Formation of Images in a Concave Mirror

O → at C

I → at C

O = I

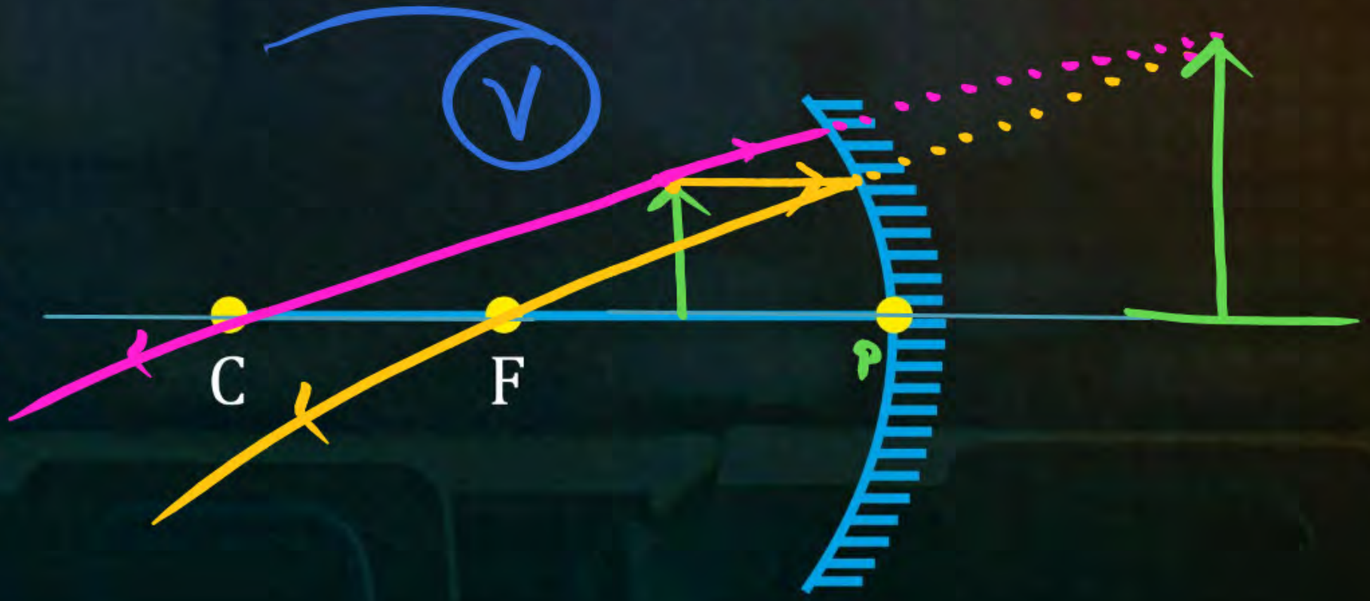
R



O → b/w P & F

I → Behind mirror

V



Position, size and nature of the image formed by a concave mirror for different positions of the object.

No.	Position of the object	Position of the image	Size of the image	Nature of the image
1.	At infinity	At the focus	Diminished to a point	Real & inverted
2.	At very far distance	In focal plane	Highly diminished	Real & inverted
3.	Beyond the centre of curvature	Between the centre of curvature and focus	Diminished	Real & inverted
4.	At the centre of curvature	At centre of curvature	Same size	Real & inverted
5.	Between the centre of curvature and focus	Beyond the centre of curvature	Magnified	Real & inverted
6.	At focus	At infinity	Highly magnified	Real & inverted
7.	Between the focus and pole	Behind the mirror	Magnified	Virtual and upright

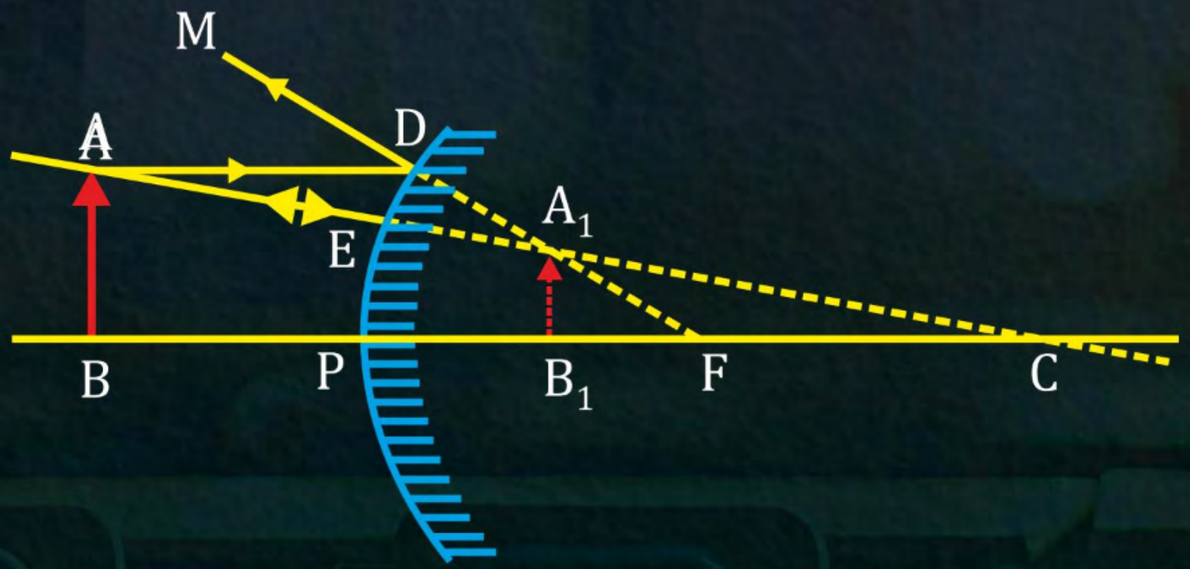
Ray Diagrams for Formation of mages in a Concave Mirror

O → ∞

I → at F

O → at axis

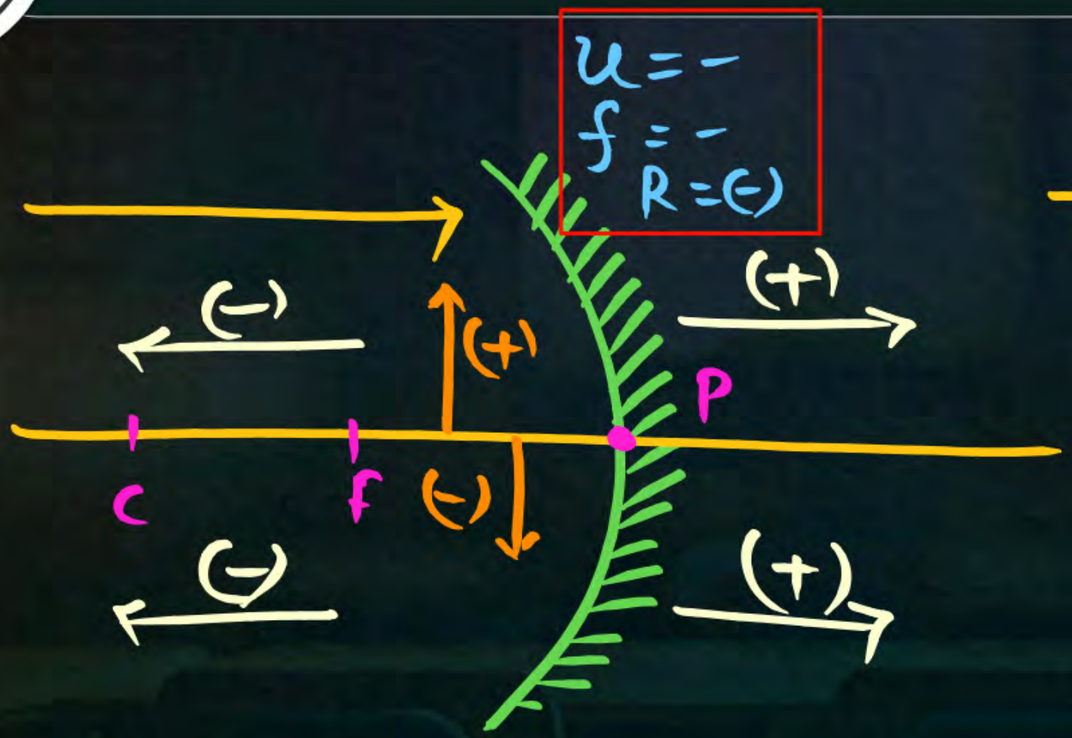
I → behind mirror

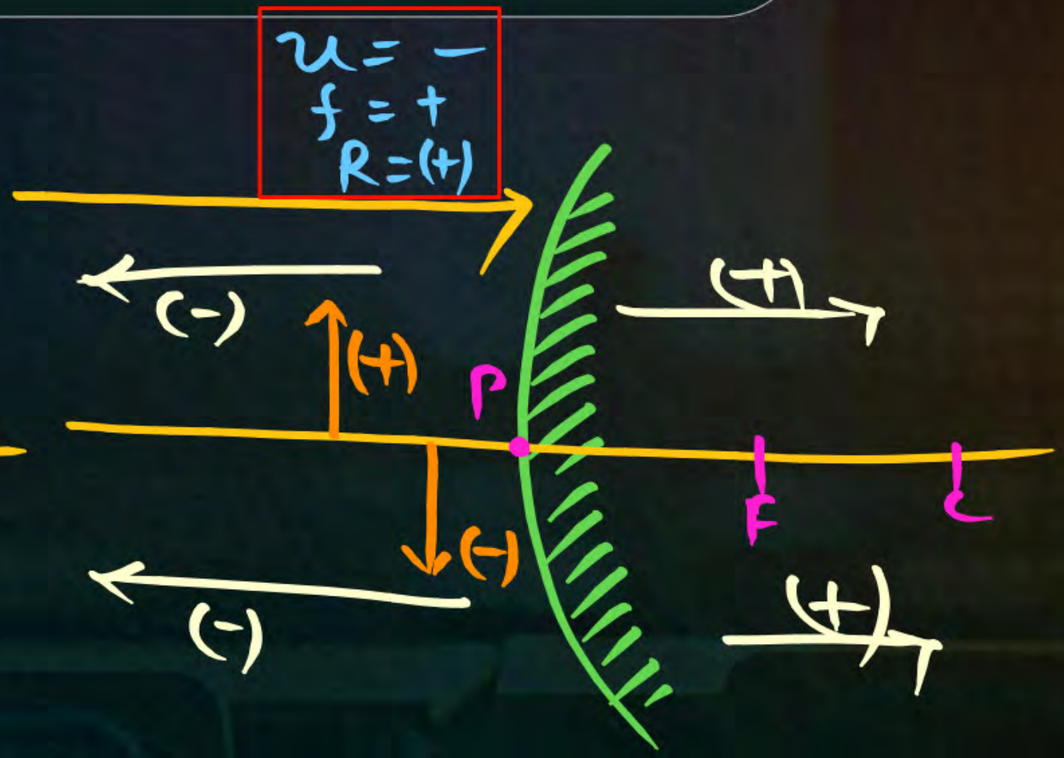

M
A
D
E
A_1
B
P
B_1
F
C

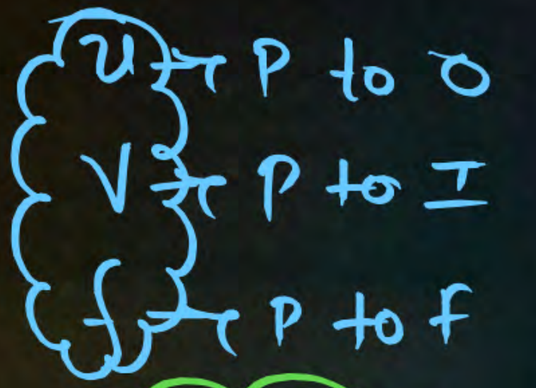
Position, size and nature of image formed by a convex mirror

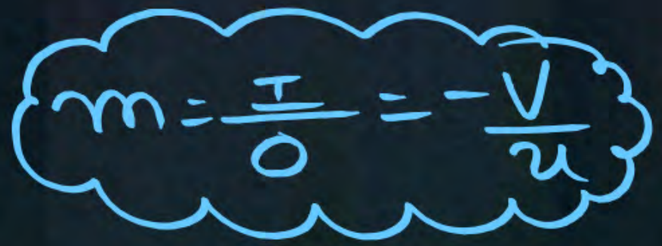
No.	Position of the object	Position of the image	Size of the image	Nature of the image
1.	At infinity	At focus	Diminished to a point	Virtual and upright
2.	At any other point	Between focus and pole	Diminished	Virtual and upright

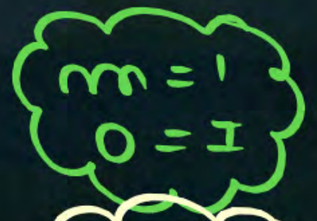
Sign Convention For The Measurement of Distances

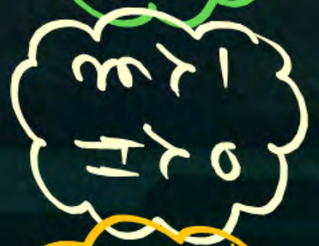




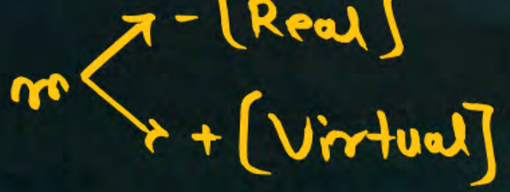

u → P to O
V → P to I
f → P to F
1/f = 1/V + 1/u


m = I/O = -V/u


m = 1
O = I


m > 1
I > O


m < 1
I < O


m
- [Real]
+ [Virtual]

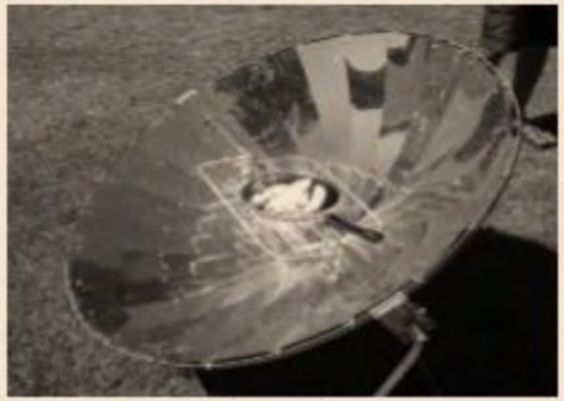
Unit less

Formulae For The Spherical Mirror

Testing of teeth by concave mirror

burning mirror

convave mirron in torch light



Solar cooker

head light of a car

Question

The image formed by a convex mirror is:

A erect and diminished

B erect and enlarged

C inverted and diminished

D inverted and enlarged

Question

The image formed by a convex mirror is:

A erect and diminished

B erect and enlarged

C inverted and diminished

D inverted and enlarged

Ans. **(A)** erect and diminished

Question

The focal length of a convex mirror is 10 cm. Find the radius of curvature of mirror.

$f = +10\,cm$

$R = ?$

$f = \frac{R}{2}$

$10 = \frac{R}{2}$

$R = 20\,cm$

Question

The focal length of a convex mirror is 10 cm. Find the radius of curvature of mirror.

Solution

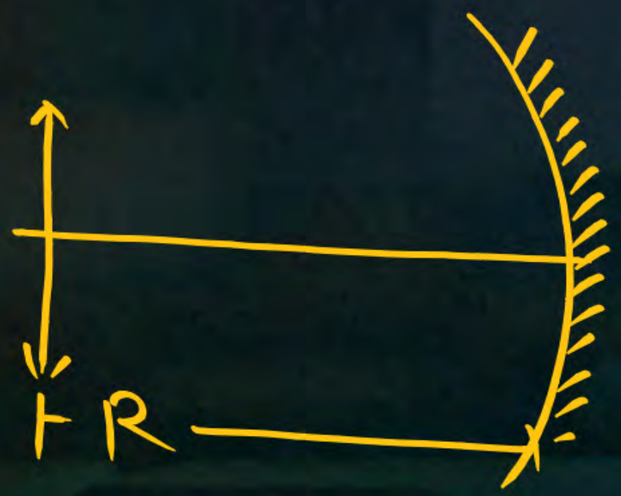
Given: Focal length f = 10cm

$\therefore$ Radius of curvature R = 2 × focal length f

= 2 × 10 = 20 cm

Question

For an object placed at a distance 20 cm from a concave mirror, the image is formed at the same position. What is the focal length of the mirror?



$R = -20\ cm$

$f = \frac{R}{2}$

$f = -\frac{20}{2}$

$f = -10\ cm$

Question

For an object placed at a distance 20 cm from a concave mirror, the image is formed at the same position. What is the focal length of the mirror?

Solution

For an object placed at the center of curvature of a concave mirror, the image is formed at the center of curvature itself. Thus radius of curvature R = 20 cm

$$\text{Focal length } f = \frac{\text{Radius of curvature R}}{2}$$

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

Question

The image of an object placed at a distance of 30 cm on the principal axis of a concave mirror from its pole, is formed on the object itself. Find (a) the focal length and (b) linear magnification of mirror.

$u = -30\,cm = R$

$V = -30\,cm$

$f = -15\,cm$

$m = -1$

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

$= -\frac{(-30)}{-30}$

Question

At what distance in front of a concave mirror of focal length 10 cm, an object be placed so that its virtual image of size five times that of the object is obtained?

$f = -10\ cm$

$u = ?$

$m = +5$

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

$5 = -\frac{v}{u}$

$-v = 5u$

$v = -5u$

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

$\frac{1}{-10} = \frac{1}{-5u} + \frac{1}{u}$

$= \frac{-1}{5u} + \frac{1}{u}$

$\frac{-1}{10} = \frac{1}{u}\left[\frac{-1}{5} + 1\right]$

$u = -8\ cm$

Solution

Given: $f = 10$ cm (negative),

$m = 5$ (positive for the virtual image)

But $m = -\frac{v}{u} \therefore 5 = -\frac{v}{u}$ or $v = -5u$

Now from relation $\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$,

$$\frac{1}{u} + \frac{1}{(-5u)} = \frac{1}{10}$$

or $$\frac{4}{5u} = \frac{-1}{10}$$

or $$u = -8 \text{ cm}$$

Thus the object should be placed at a distance 8 cm in front of the mirror.

Question

If the focal length of a convex mirror is 15 cm, what is its radius of curvature?

A 30 cm

B 15 cm

C 7.5 cm

D 45 cm


Thank You