Understanding Reflection From Spherical Mirrors

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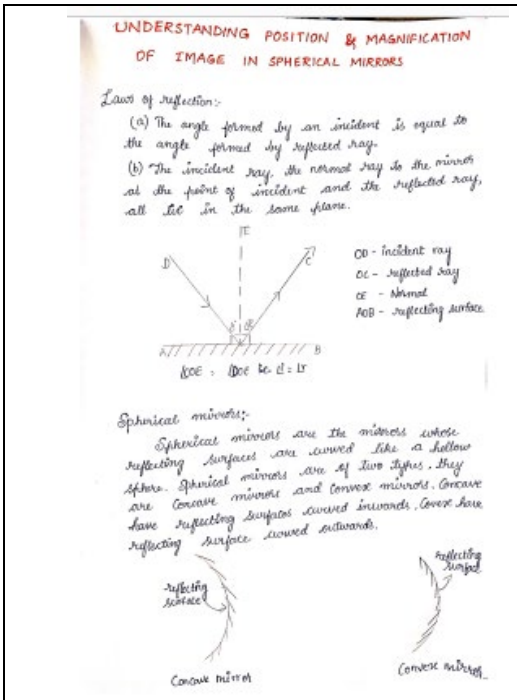
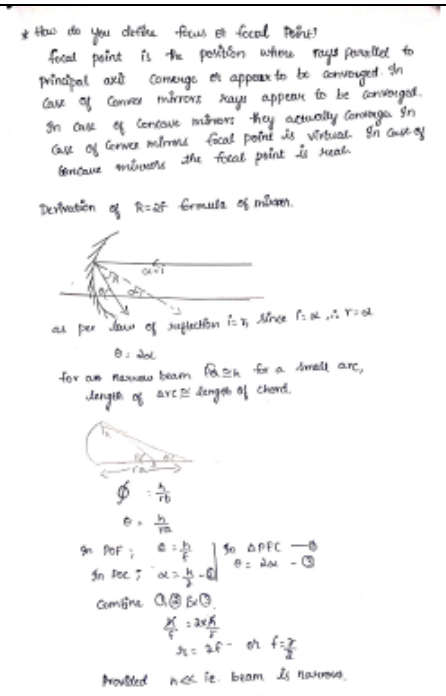
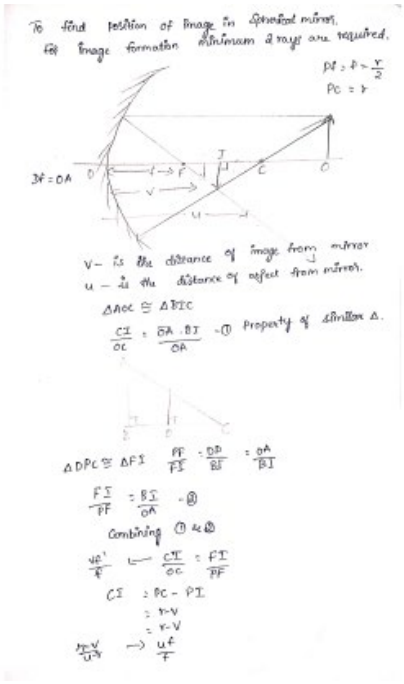






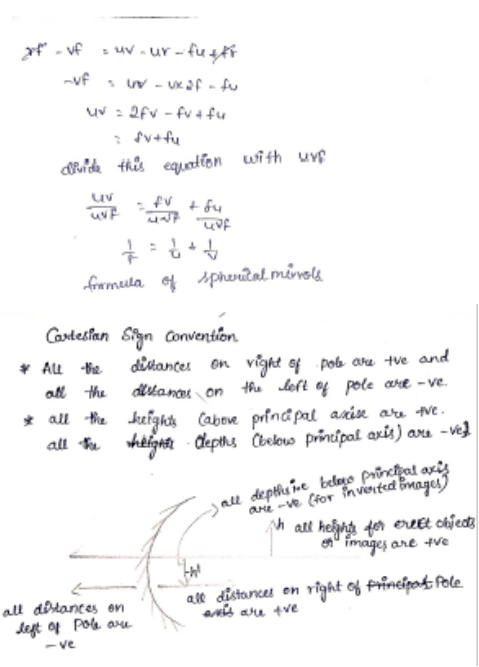
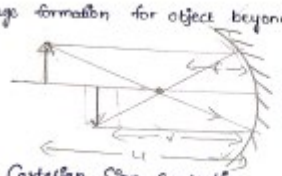


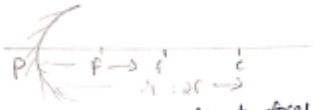
Image formation for object beyond C but not at infinity.



Cartesian Sign Convention.

Sign Convention in geometrical optics.

(i) Object at focal point.



when object is at focal point

$u = f$

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

$\frac{1}{v} = 0$

$\frac{1}{f} - \frac{1}{f} = \frac{1}{v} = 0$

or $v = \infty$

$u = f$ (+ve) $v = -\infty + \infty$

$f = (+ve)$

object is placed between P & F

Let $f = +10$ cm

$u = 5$ cm

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

$\frac{1}{10} = \frac{1}{5} + \frac{1}{v}$

$\frac{1}{v} = \frac{1}{10} - \frac{1}{5}$

$= \frac{1-2}{10} = \frac{-1}{10}$

$v = -10$

By using geometry and using algebraic formula with sign convention we get identical results.

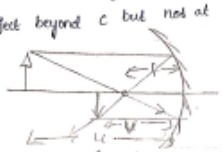
Image formation by Concave mirrors

Case I: Object at infinity

Characteristic of image:

* Image is formed at f
* It is a real image and inverted.

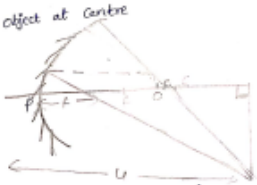
Case II) object beyond C but not at infinity.



Characteristic of image:

* Image is real, inverted F & 2F.
* Image is formed below

Case (III) object at Centre



Two rays are required to form an image. one ray will be take parallel to principal axis. one ray is parallel to principal axis, second ray is radial. either it is coming from the centre or passing through the Centre.

Characteristic of image:

a) position beyond C on principal axis.
b) Image is inverted.
c) Image can be obtained on a screen. i.e on real image.
d) Image is longer than object.

Case-4: Object at f.

Two rays

(1) parallel to principal axis.
(2) from radial.

These rays are parallel and meet & form image at infinity.

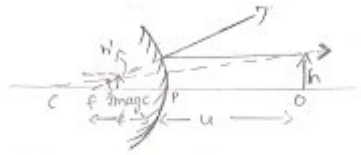
$\frac{1}{f} = \frac{1}{0} + \frac{1}{v}$

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

$\frac{1}{v} = 0$

This is possible when $v \to \infty$

Image formation by convex mirrors
Case i) object is in front of mirror.



Characteristic of image:
1. Image is formed behind the mirror.
2. Image is virtual, you can't take it on screen.
3. Image is erect.
4. Image is of reduced size.

Formula for magnification:

for calculating magnification
→ Create a ray diagram to find 'v' for a given u and f
(or)
use formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$
and $\frac{1}{v} = \frac{1}{f} - \frac{1}{v}$

$i = \frac{h}{u}$ — ①

$-r = \frac{i'}{v}$

and $r = \frac{-h'}{v}$ — ②

as per law of reflection $i = r$ — ③

Combining ① & ② in ③

$\frac{h}{u} = \frac{-h'}{-v} \Rightarrow \frac{h'}{h} = \frac{-v}{u}$

lateral magnification is $m = \frac{h'}{u} = \frac{-v}{u}$

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