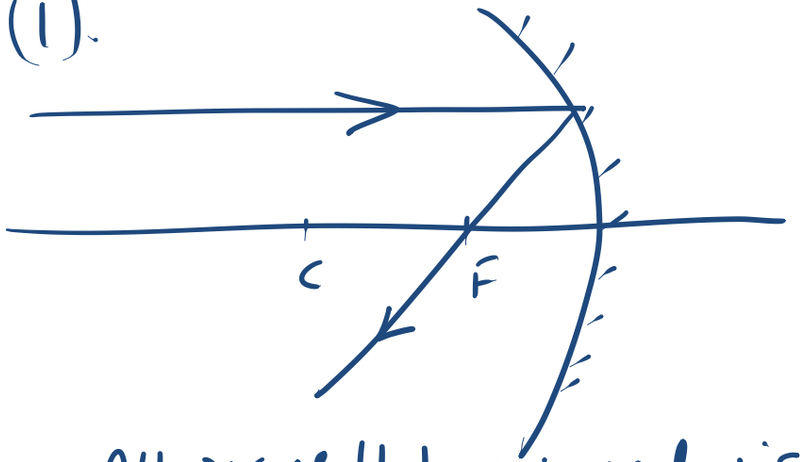
Session 18: Ray Optics – Reflection & Refraction @ curved surfaces

- Ray diagrams for concave & convex mirror
- Examples
- Visualizations
- Comparison between
  - plane mirror, concave mirror & convex mirror
- Newton's formula

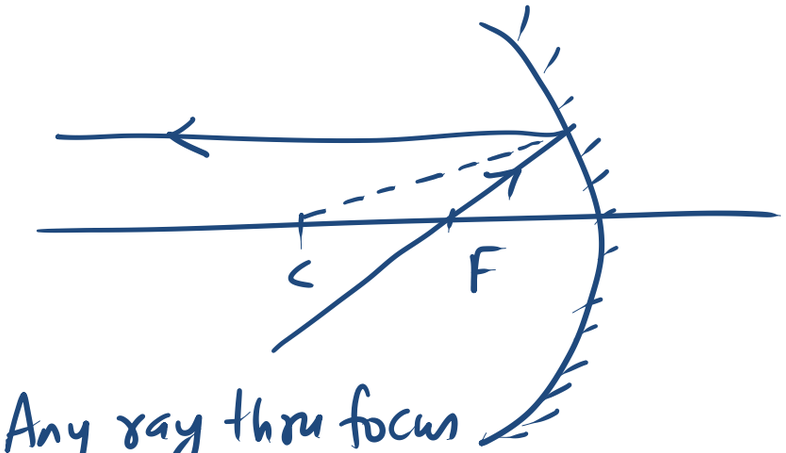
Ray diagrams (Rules) (4 rules)

(1).



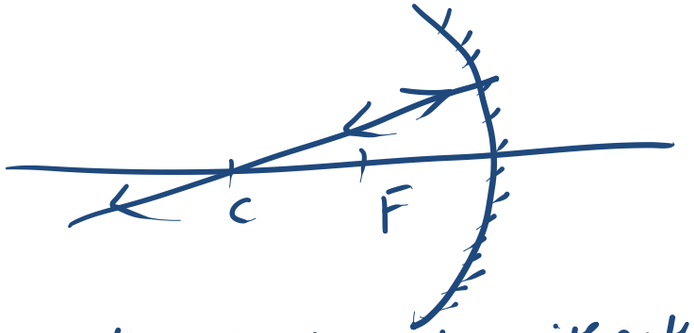
All rays ll to principal axis shall pass thru focus F.

(2).



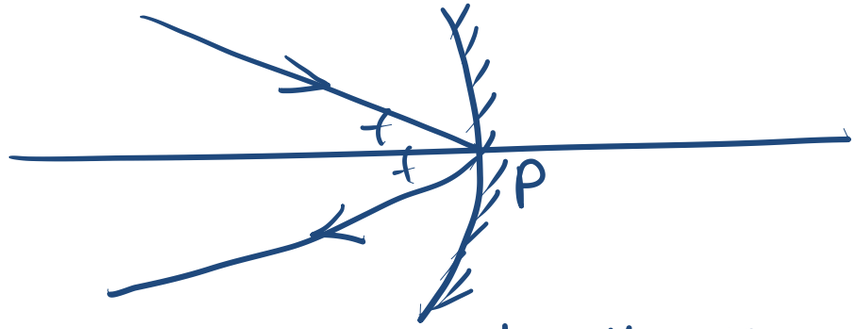
Any ray thru focus will become ll to principal axis.

(3).



Any ray thru C will retrace its path.

(4).



Any ray striking @ pole will pass symmetrically.

Ray diagrams for Concave Mirror :-

(i) obj @ -∞
↳ along Principal axis.

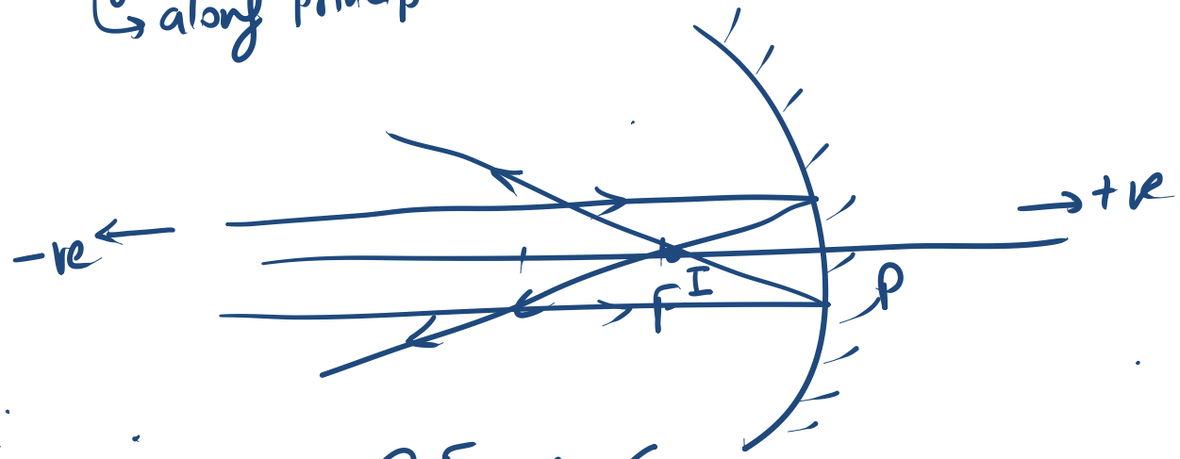
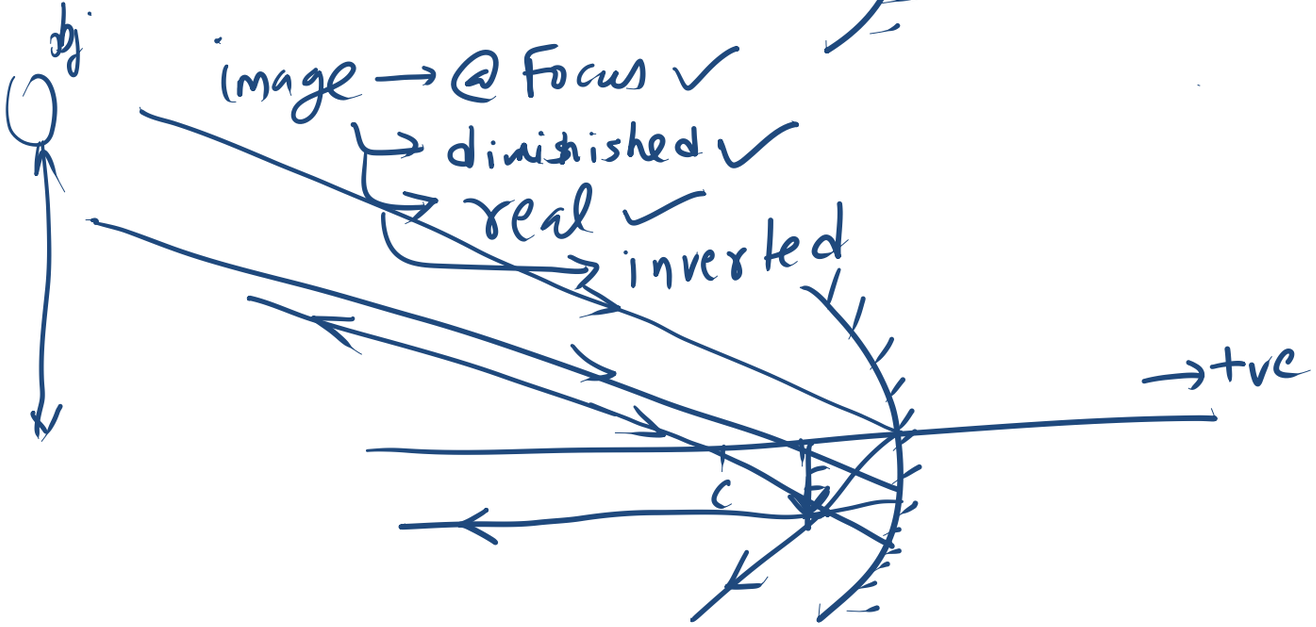
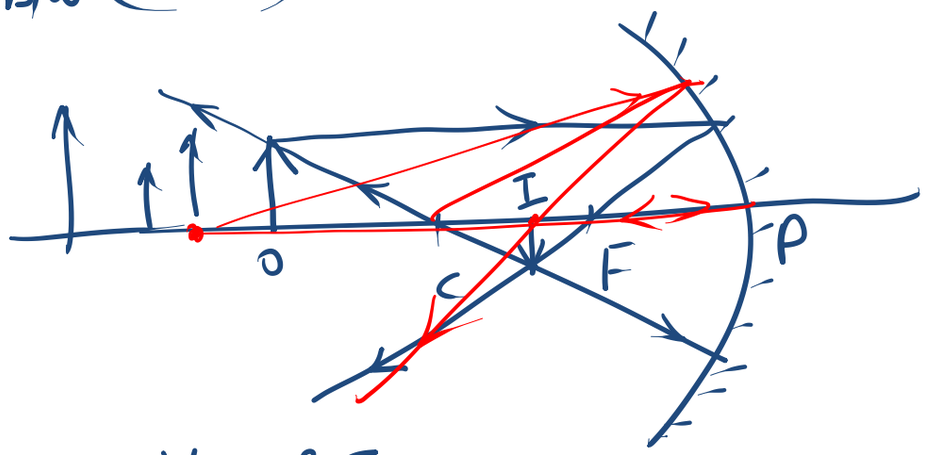


image → @ Focus ✓
↳ diminished ✓
↳ real ✓
↳ inverted

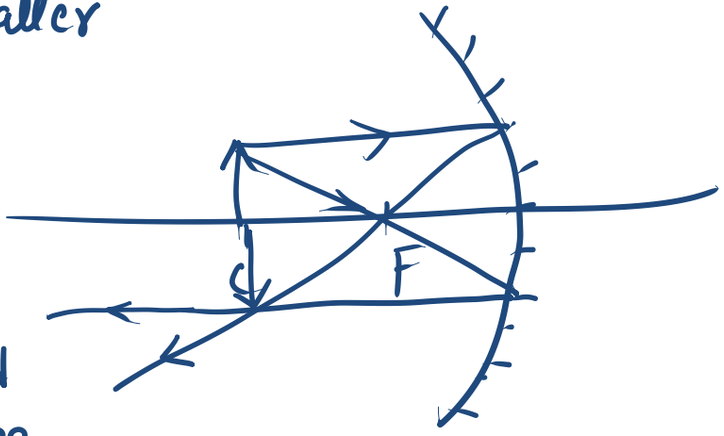


(ii) obj b/w (-∞ & C).



img → b/w C & F
↳ real
↳ inverted
↳ smaller

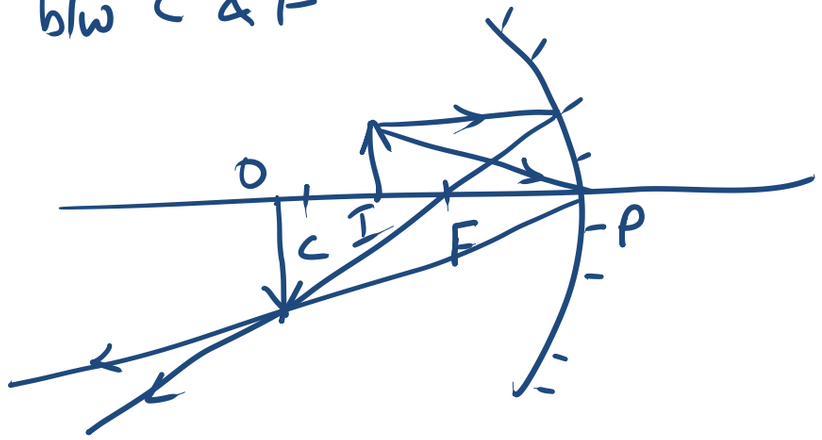
(iii) obj @ C



img → @ C
↳ real
↳ inverted
↳ same size.

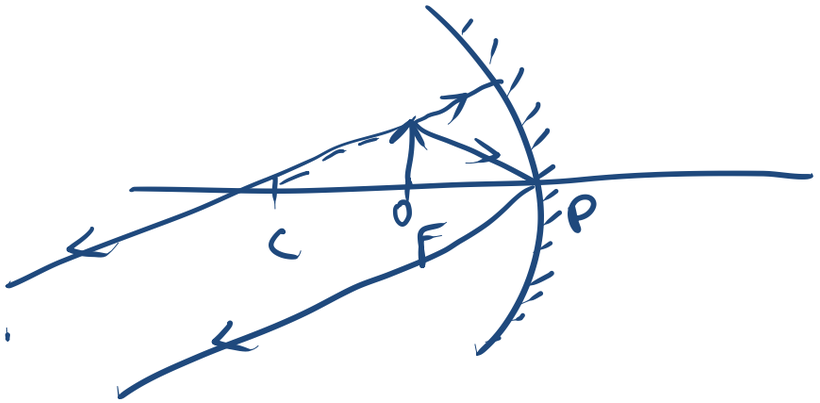
Ray diagrams – Concave Mirror – Cont.

(iv) obj b/w C & F



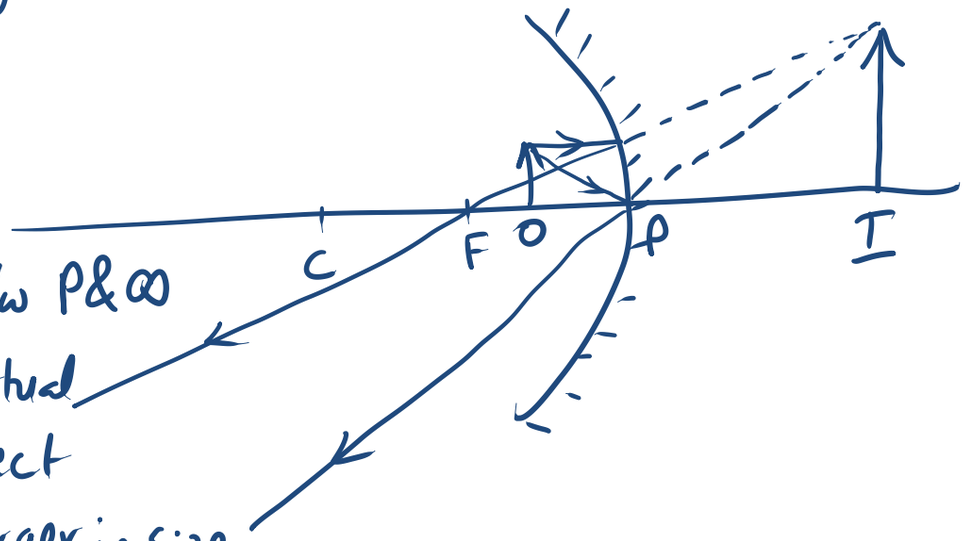
img → b/w (F & C).
- ↳ real
- ↳ inv
- ↳ enlarged.

(v) obj @ F



img → @ ∞
- ↳ real
- ↳ inv
- ↳ v. large.

(vi) obj b/w F & P

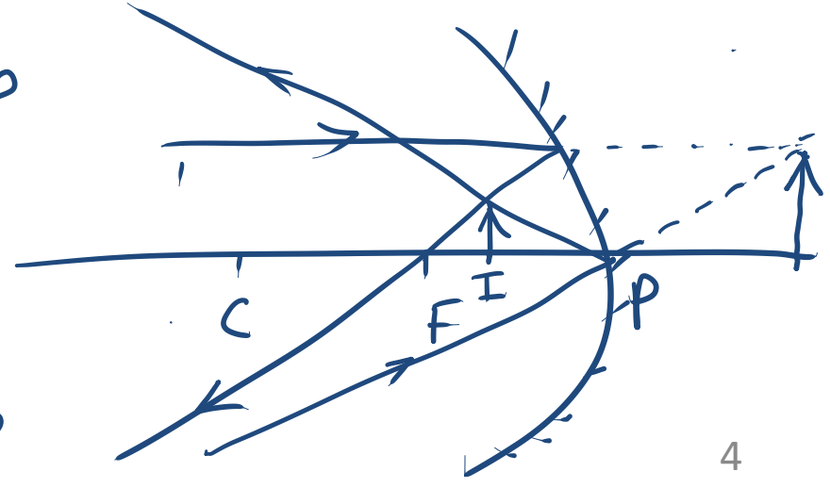


img → b/w P & ∞
- ↳ virtual
- ↳ erect
- ↳ larger in size.

(vii) obj @ P ⇒ img @ pole

(viii) obj beyond P
- ↳ virtual

img → smaller
- ↳ real
- ↳ erect
- ↳ b/w F & P



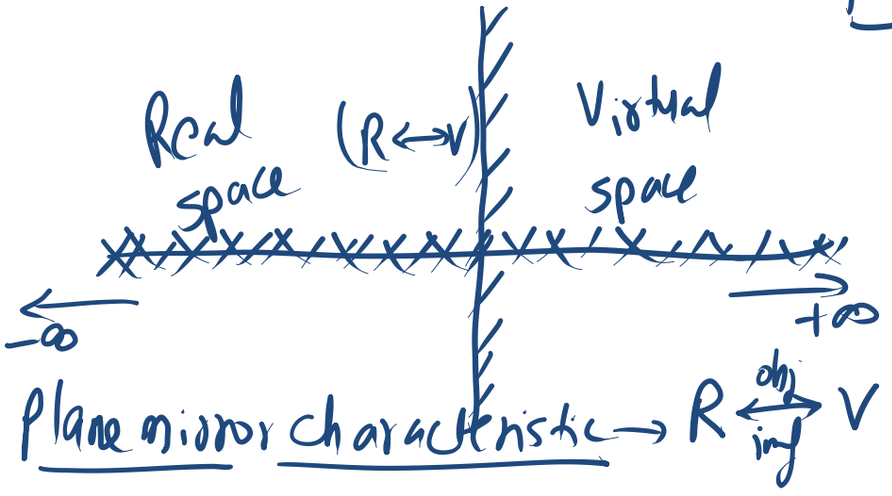
Comparison of Mirrors

ABLES KOTA

Plane Mirror

real obj → virtual img

virtual obj → real img.

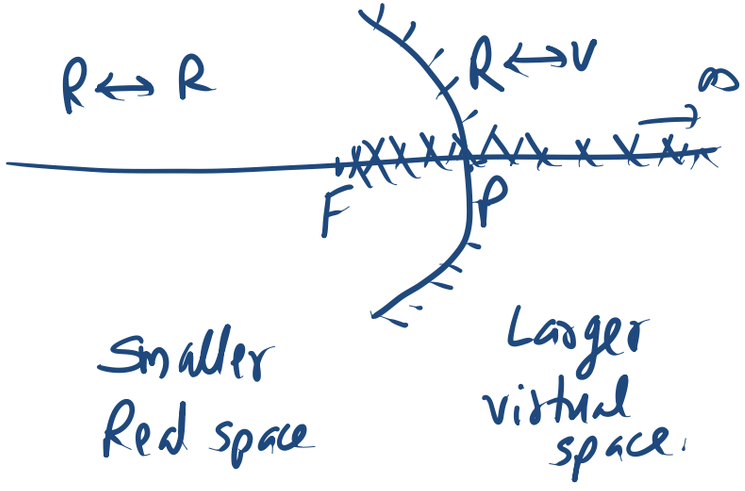


Concave Mirror

real obj → virtual img

virtual obj → real img.

real obj → real img.

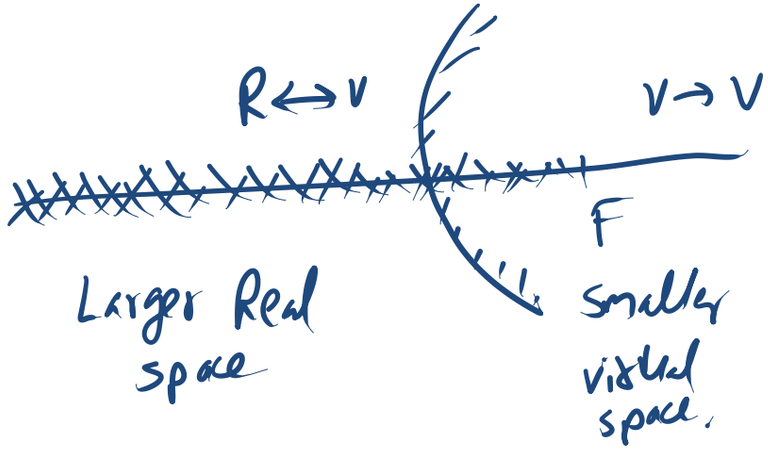


Convex Mirror

real obj → virtual img

virtual obj → real img

virtual obj → virtual img



Geometrical optics

1). Spherical Mirrors & lenses

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

f is more prevalent in lenses.

$$v = \frac{uf}{u-f}$$

$$u = \frac{vf}{v-f}$$

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

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

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

$$u = \frac{fv}{f-v}$$

$$m = v/u = \frac{f}{f+u} = \frac{f-v}{f}$$

Spherical surface

$$\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$$