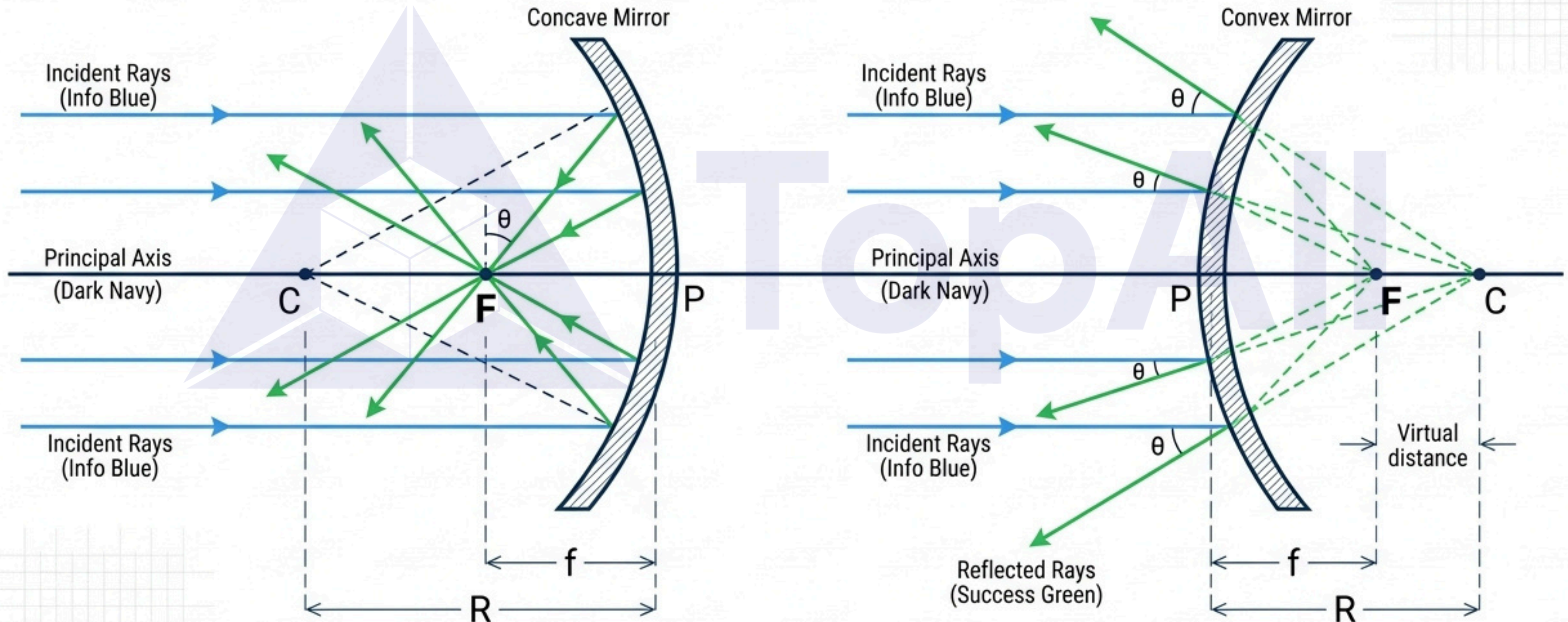
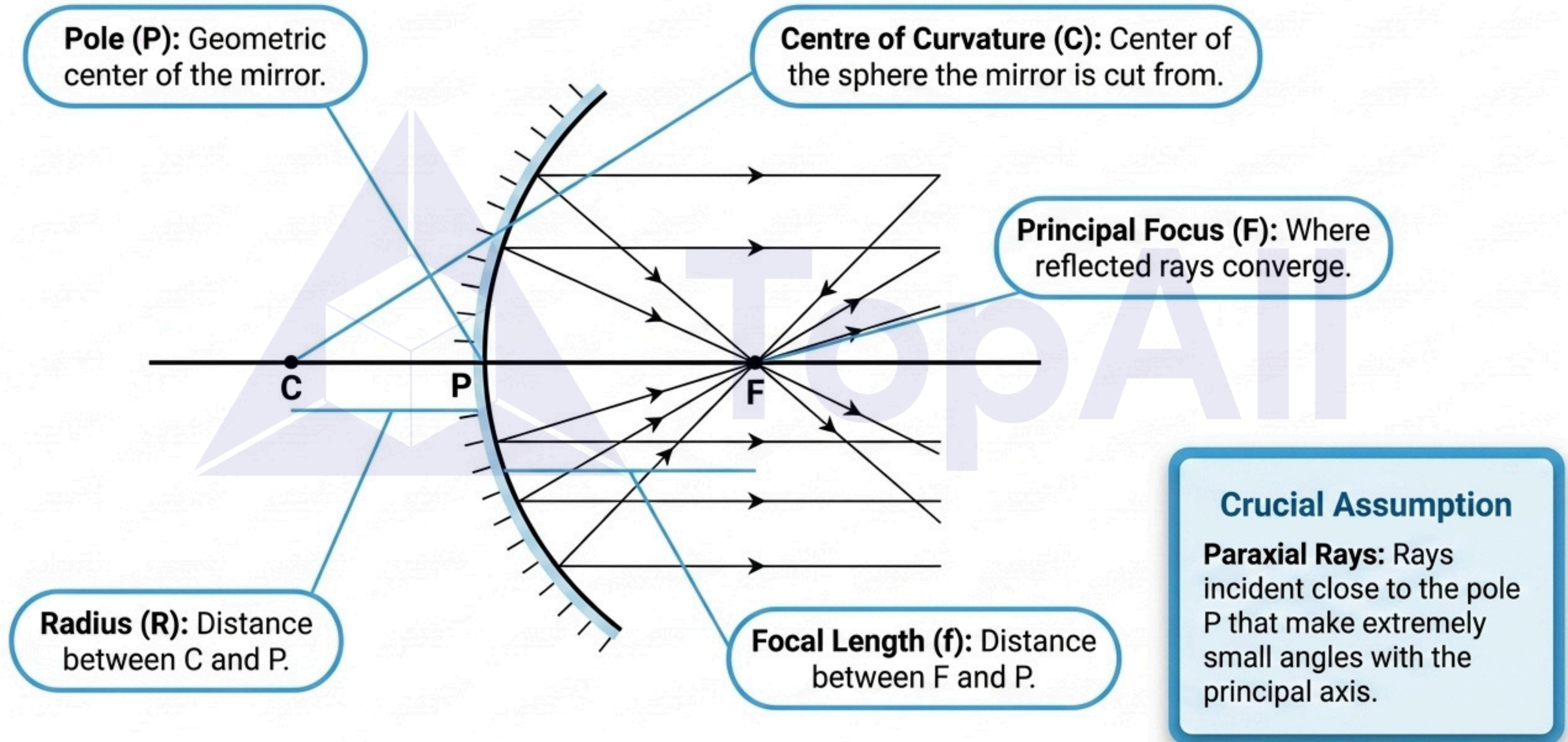


Why $f = R/2$ for Spherical Mirrors

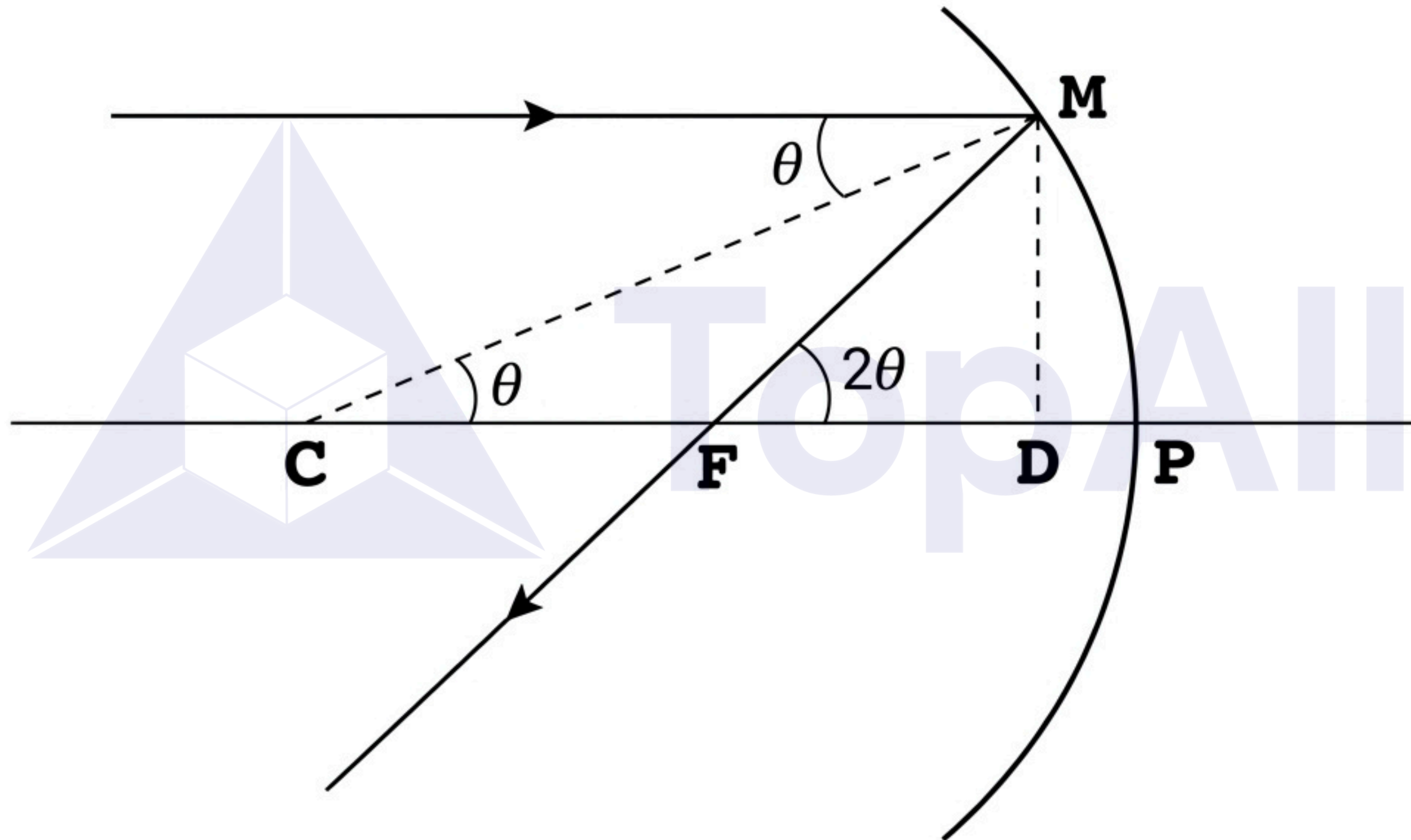
Geometric Derivation & Paraxial Approximations for JEE Physics



The Anatomy of a Spherical Mirror



Setting Up the Geometry





**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



Turn theory into marks with **unlimited MCQs, smart analysis, and focused revision.**

Practice Now



At prep.topall.app

Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
- » Climb the Leaderboard Among Fellow Aspirants
- » Practice Unlimited MCQs for NEET & JEE
- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



The Derivation Flow

1. Tangent Ratios

$$\tan \theta = \frac{MD}{CD} \quad \tan 2\theta = \frac{MD}{FD}$$



2. Paraxial Assumption

For small θ , the tangent function approximates the angle.

$$\tan \theta \approx \theta \quad | \quad \tan 2\theta \approx 2\theta$$



3. Substitution & Resolution

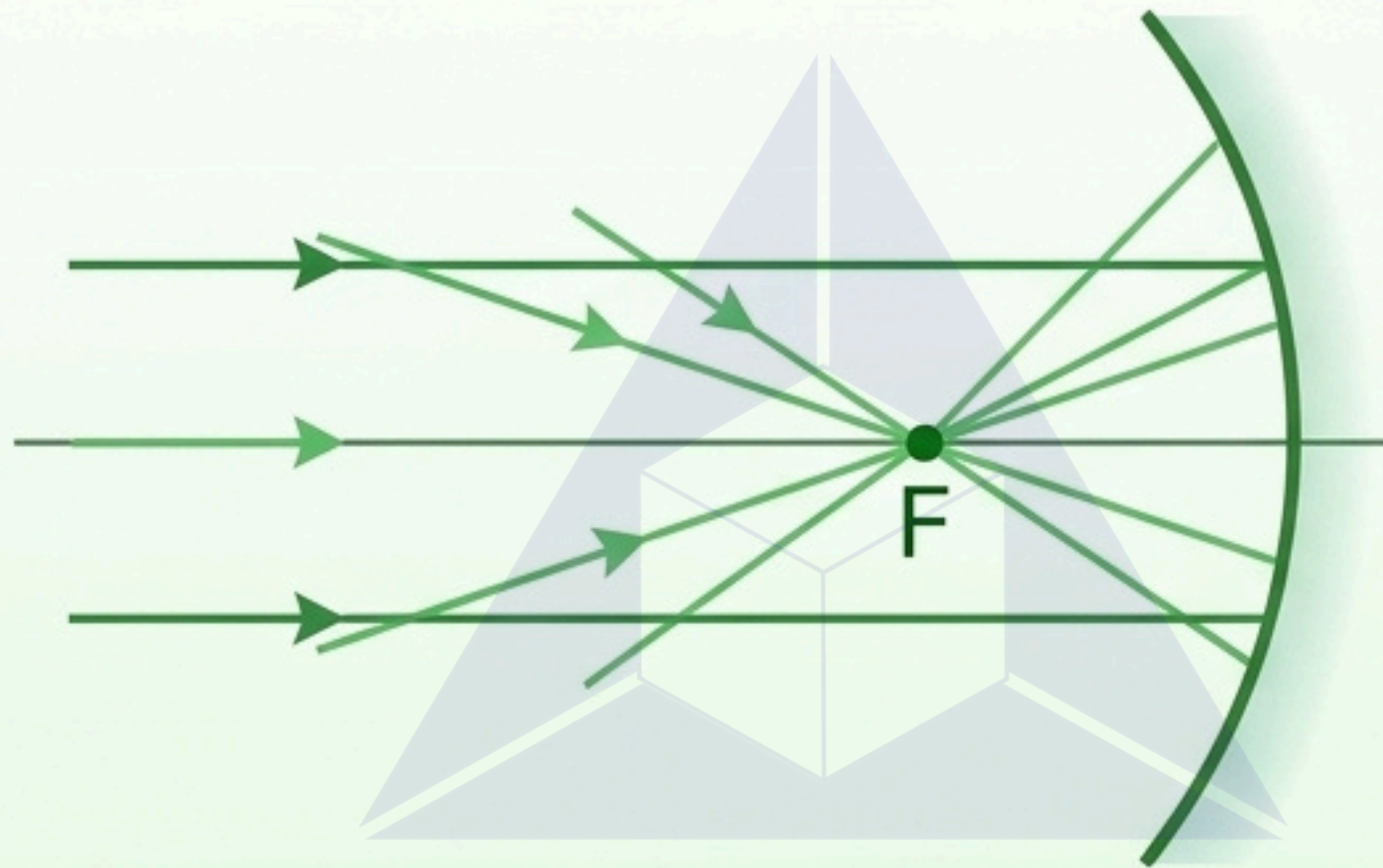
$$\frac{MD}{FD} = 2 \left(\frac{MD}{CD} \right) \rightarrow FD = \frac{CD}{2}$$

Since D is extremely close to P (paraxial limit), $FD \approx f$ and $CD \approx R$.

$$f = R / 2$$

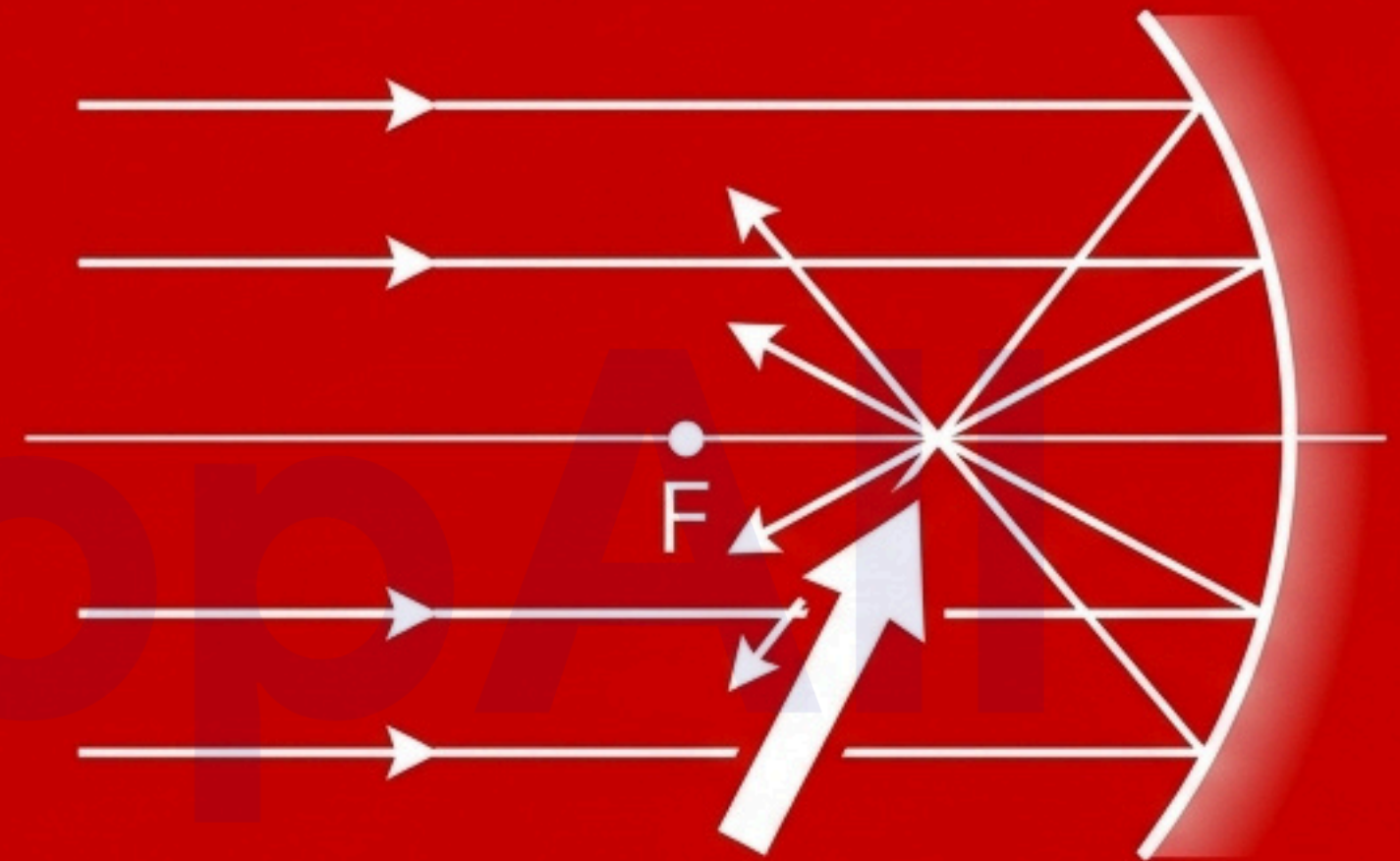
JEE Trap Alert: The Paraxial Limitation

Paraxial Rays (Valid)



$$\tan \theta \approx \theta \rightarrow f = R/2 \text{ holds}$$

Marginal Rays (TRAP!)



Spherical Aberration

In JEE Advanced multi-correct questions, $f = R/2$ is FALSE for marginal rays (large aperture mirrors).

Mini Application & Sign Convention

The Application

*Find the focal length of a concave mirror with a **radius of curvature***

$$R = 30 \text{ cm.}$$

Solution Block

Step 1: $R = -30 \text{ cm}$
(Concave mirror center is in **front** of the mirror)

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

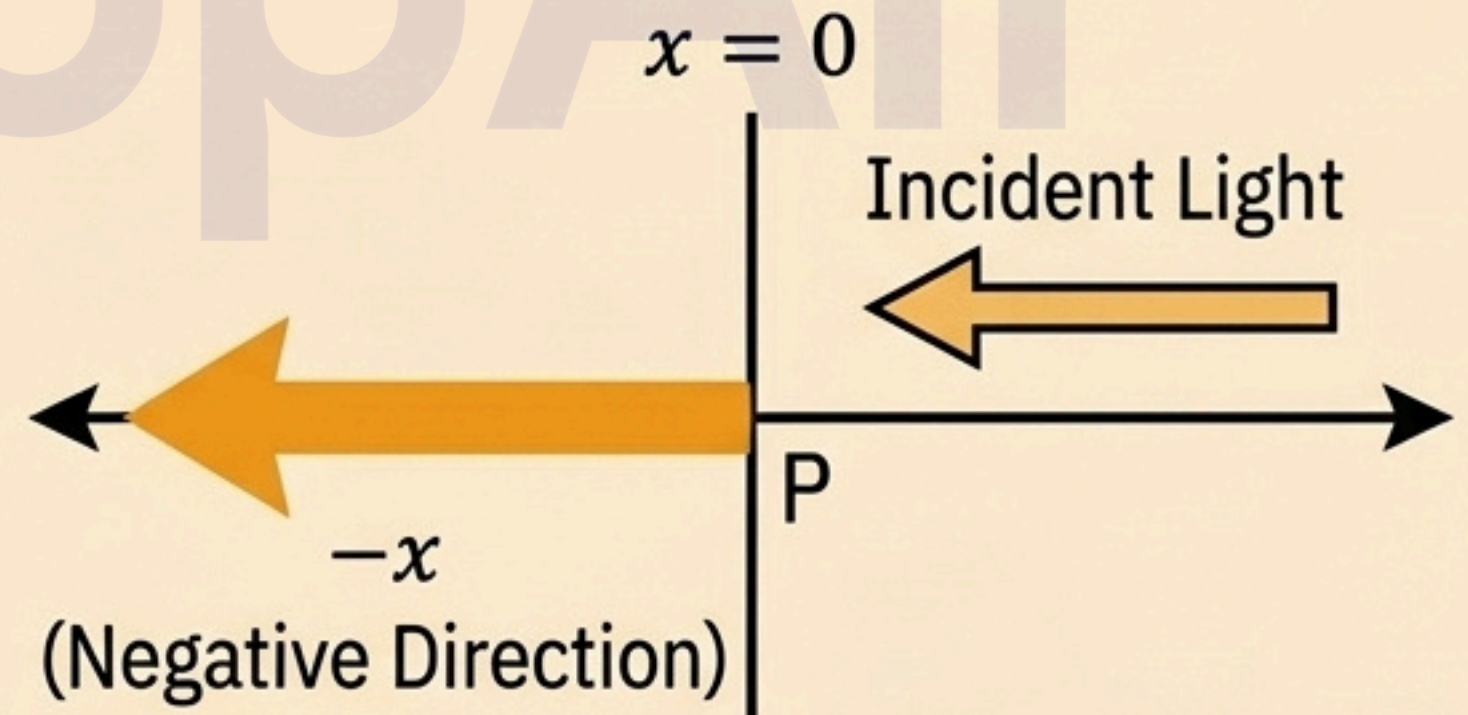
Step 3: $f = -15 \text{ cm}$

Success Green

The Convention

Cartesian Sign Convention Rule

Distances measured opposite to the direction of incident light are negative.



Final Revision Dashboard



Valid ONLY for Paraxial Rays
(Small Aperture / Small θ)

$$f = R / 2$$

Concave Rules

Center (C) and Focus (F) are in front.
Both R and f are Negative (-).

Convex Rules

Center (C) and Focus (F) are behind.
Both R and f are Positive (+).

Save this card for rapid JEE mechanics recall.



You've Learned the Theory.

Now Let's Test It.

Reading notes gets you knowledge.

Practicing MCQs gets you marks.

That's exactly what TopAll Pro is built for.

Try TopAll Pro Now

What TopAll Pro Does Differently

-  **Stuck? Snap it. Solve it. — Doubts AI**
Photo → step-by-step solution in seconds, 24/7
-  **Your AI Coach finds your blind spots**
Concept-level weakness detection — not just chapter-level
-  **4.5 Lakh+ questions. Never run out.**
13× more content than any other prep app in India
-  **Build your own test in 60 seconds**
Pick a chapter, set difficulty — AI does the rest instantly.
-  **AI Recommendation that helps you improve**
AI Recommendation Analysis your Tests and tell you where you need to improve.



Practice the moment you finish studying
Jump in while the concept is still fresh in your head

4.5L+
MCQs

1.5L+
Students

AI Powered
In-Depth Analysis