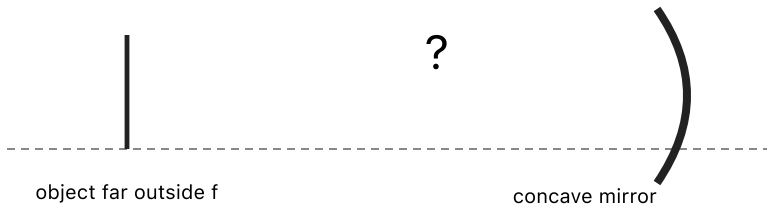
GEOMETRIC OPTICS DAY 3: CURVED MIRRORS AND RAY DIAGRAMS

CED 13.2 · Skill 1.A · FRQ: TBR

PREDICT THE ORIENTATION

Hold a concave mirror at arm's length and look at a distant object. Predict the image: **upright / inverted / no image**. Commit before the mirror or projected bench is shown.

FAR OBJECT AND CONCAVE MIRROR - IMAGE WITHHELD



LANDMARKS

- The **vertex** is the center of the mirror surface.
- The **focal point F** is halfway from the vertex to the center of curvature C.
- For a spherical mirror, $f = R/2$.
- Concave mirrors have $f > 0$; convex mirrors have $f < 0$.

NOTES / REASONING

PRINCIPAL RAYS FOR A CONCAVE MIRROR

1. A ray parallel to the axis reflects through F.
2. A ray aimed through F reflects parallel to the axis.
3. A ray aimed through C reflects back along its incoming path.

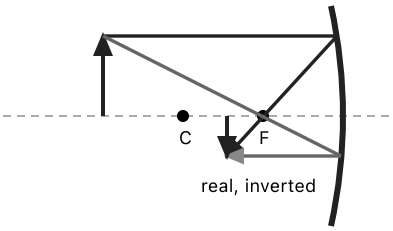
DRAW For a concave mirror with $f = 12\,\text{cm}$, place an object $36\,\text{cm}$ from the mirror. Draw any two principal rays from the arrow tip and mark the image.

A real image occurs where physical reflected rays meet. It can be projected onto a screen.

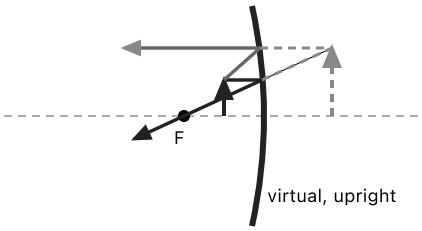
CROSSING THE FOCAL POINT

RAY CONSTRUCTION OUTSIDE AND INSIDE F

A OBJECT OUTSIDE f



B OBJECT INSIDE f



Concave object position	Image
$d_o > 2f$	real, inverted, reduced
$d_o = 2f$	real, inverted, same size
$f < d_o < 2f$	real, inverted, enlarged
$d_o = f$	rays leave parallel; image at infinity
$d_o < f$	virtual, upright, enlarged

Repeat the $f = 12\,\text{cm}$ construction for $d_o = 8\,\text{cm}$. Use dashed backward extensions.

CONVEX MIRRORS AND CLASSIFICATION

A convex mirror diverges reflected rays. Their backward extensions meet behind the mirror, producing an image that is **virtual, upright, and reduced** for every real-object position.

1. Classify the image for a concave mirror when $d_o = 3f$.

2. Classify the image when a concave mirror has $d_o = 0.70f$.

3. Explain why moving an object across F changes whether physical rays or backward extensions meet.

4. State the three image properties of a convex mirror.