

GEOMETRIC OPTICS DAY 11: REVIEW AND TBR FRQ WORKSHOP

CED 13.1-13.4 · Skill 1.A · FRQ: TBR · synthesis

MIXED RETRIEVAL

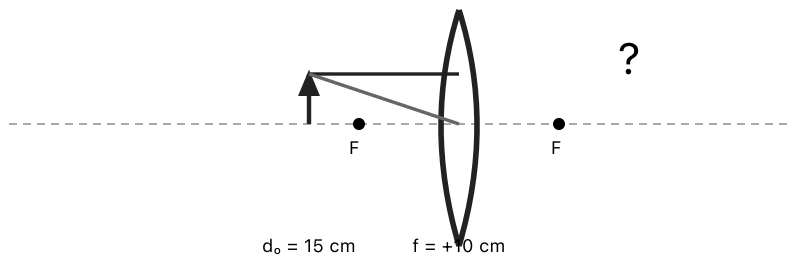
1. A plane mirror object is 44 cm away. State signed d_i .
2. A concave mirror has $f = 20$ cm and $d_o = 60$ cm. Predict reduced / same / enlarged.
3. A ray enters $n = 1.33$ from air. Does it bend toward or away from the normal?
4. What does $m < 0$ state about image orientation?

ONE EQUATION, NAMED SIGNS

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i} \quad m = -\frac{d_i}{d_o}$$

The equation form is shared by spherical mirrors and thin lenses. The optic type determines the focal-length sign and the ray rule used to check the answer.

NOTES / REASONING

TBR FRQ: DIAGRAM TO EQUATION**GIVEN SCALE AND INCIDENT RAYS; COMPLETE THE MODEL****A.** Use the labeled scale to calculate d_i and m .**B.** Complete both refracted ray segments and draw the image. Then describe the image as real/virtual, upright/inverted, and enlarged/reduced; cite both a ray feature and a sign.**C.** If the object moves toward f while remaining outside it, predict the change in d_i . Justify with the equation or ray geometry.

MIRROR-LENS COMPARISON

Feature	Concave mirror	Converging lens
converging focal sign	$f > 0$	$f > 0$
real image side	object side / in front	opposite side
parallel principal ray	reflects through F	refracts through far F
center/vertex ray	reflects by equal angles	center ray undeviated

Snell check: Air-to-water has $n_1 = 1.00$, $n_2 = 1.33$, and $\theta_1 = 50.0^\circ$. Find θ_2 and state the bend direction.

MIXED PRACTICE AND SELF-SCORE

1. Find d_i and m for the concave mirror $f = 20\text{ cm}$, $d_o = 60\text{ cm}$.

2. A plane mirror object moves 6.0 cm toward the mirror. By how much does the object-image separation change?

3. For a converging lens $f = 10\text{ cm}$, $d_o = 15\text{ cm}$, find d_i , m , and the image description.

Self-score: check physics, equation signs, units, and agreement among the diagram, calculation, and written description.