

Lenses and Mirrors Equations Worksheet

Level: GCSE / A-Level / AP Physics 2 | Difficulty: Intermediate | Topic: Waves & Optics

Practice with 10 problems on the thin lens equation, mirror equation, magnification, and image formation. Full worked solutions included.

Equations you will need

$1/f = 1/u + 1/v$	Thin lens / mirror equation
$M = -v/u$	Magnification (linear)
$M = h_i / h_o$	Magnification from image and object height
$P = 1/f$	Lens power

Symbol key

Symbol	Quantity	Unit
f	focal length	m
u	object distance	m
v	image distance	m
M	magnification	dimensionless
h_o	object height	m
h_i	image height	m
P	power	D (dioptries)

Practice problems

1. Object 30 cm from a converging lens with $f = 10$ cm. Find image distance.
2. Same setup: find magnification.
3. A 5 cm tall object 20 cm from a lens, $f = 15$ cm. Find image height.
4. Find focal length of a lens with power +2.5 D.
5. Object 12 cm from a concave mirror with $f = 20$ cm. Find v .
6. A converging lens ($f = 8$ cm) forms an image at 24 cm. Find the object distance.

7. A diverging lens with $f = -10$ cm: object at 15 cm. Find image position.
8. Object at f (focal point) of a converging lens. Where is image?
9. Magnifying glass: object 4 cm from $f = 8$ cm lens. Find magnification.
10. A camera lens with $f = 50$ mm photographs an object 2 m away. Find image distance.

Answer key

Full worked solutions for each problem.

1. $1/10 = 1/30 + 1/v \rightarrow v = 15 \text{ cm}$
2. $M = -15/30 = -0.5$ (inverted, reduced)
3. $1/15 = 1/20 + 1/v \rightarrow v = 60 \text{ cm}$; $M = -3$; $h_i = -15 \text{ cm}$ (inverted)
4. $f = 1/P = 0.4 \text{ m} = 40 \text{ cm}$
5. $1/20 = 1/12 + 1/v \rightarrow v = -30 \text{ cm}$ (virtual, behind mirror)
6. $1/8 = 1/u + 1/24 \rightarrow u = 12 \text{ cm}$
7. $-1/10 = 1/15 + 1/v \rightarrow v = -6 \text{ cm}$ (virtual)
8. Image at infinity (parallel rays)
9. $1/8 = 1/4 + 1/v \rightarrow v = -8 \text{ cm}$; $M = -(-8)/4 = 2$ (upright, virtual, enlarged)
10. $1/0.05 = 1/2 + 1/v \rightarrow v = 0.0513 \text{ m} = 51.3 \text{ mm}$