

13 Images from mirrors and lenses – Part 2

Name: _____ Class: _____ Date: _____

Vocabulary

Write each word three times.

English

Write it 3 times (English)

converging

diverging

real image

virtual image

Recall

In Part A you saw light reflect and refract. Now those effects form **images**:

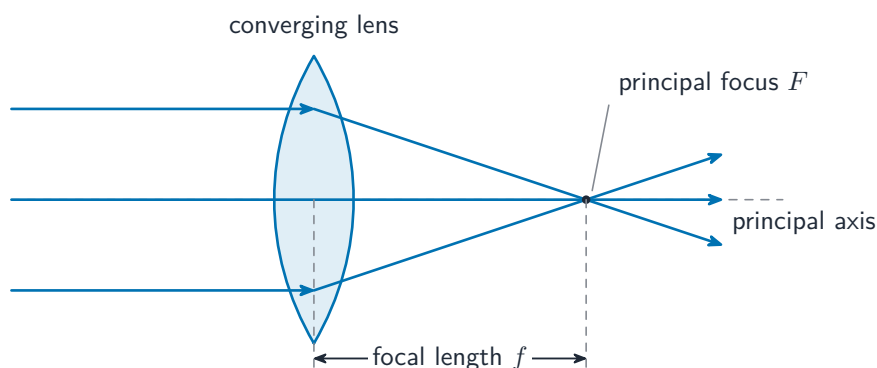
- A magnifying glass makes small print look bigger.
- A camera lens makes a small picture on its sensor.
- A curved mirror can focus light to a point.

Each idea has a worked example before the Practice.

New ideas

■ 1 A converging lens

A **converging** (convex) lens bends parallel rays to meet at its **focal point**, a distance f away.



A **diverging** (concave) lens spreads rays out instead.

■ 2 The thin-lens equation

For an object a distance d_o from a lens, the image forms at d_i where

$$\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}.$$

Worked example. An object 30 cm from a converging lens with $f = 10$ cm: $\frac{1}{d_o} + \frac{1}{d_i} = \frac{1}{f}$
 $\frac{1}{10} + \frac{1}{d_i} = \frac{1}{10}$, so $d_i = 15$ cm.

■ 3 Magnification

The **magnification** is

$$m = -\frac{d_i}{d_o},$$

where the size tells you how much bigger, and the sign tells you upright (+) or inverted (−).

Worked example. For the lens above, $m = -\frac{15}{30} = -0.5$ – the image is half-size and inverted (a camera picture).

■ 4 Real and virtual images

- A **real image** forms where rays actually meet – you can catch it on a screen (a camera, a projector).
- A **virtual image** only appears to be there – you see it by looking through the lens (a magnifying glass).

Watch out: a **positive** image distance means a real image (on a screen); a **negative** one means a virtual image (seen by looking through). Keep the signs straight.

Practice

Try these in order. The methods are all above.

2.1 State what a converging lens does to parallel rays of light. [1]

2.2 An object is 20 cm from a converging lens of focal length $f = 5.0$ cm. Find the image distance. [3]

2.3 For the lens in 2.2, find the magnification. [2]

2.4 State whether the image in 2.2 is upright or inverted, and how you can tell. [1]

2.5 Give one everyday device that uses a real image and one that uses a virtual image. [2]
