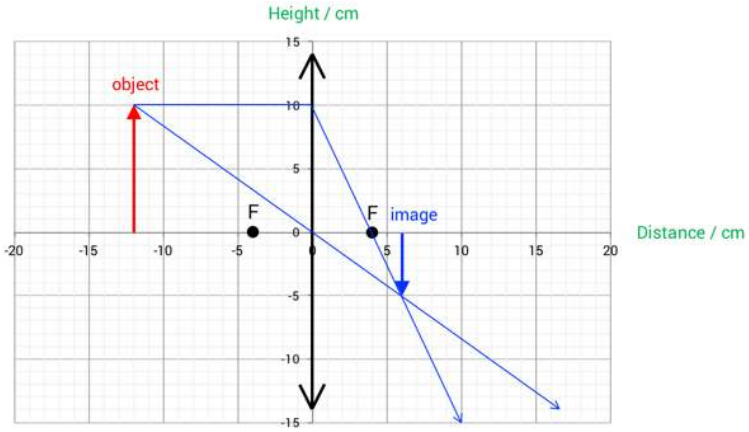
0 1

A student is experimenting with a lens in an optics lab. The setup she is using at one point in her investigation is as shown below.



0 1 . 1

State the type of lens which the student is using.

Convex / converging [1].

0 1 . 2

By drawing two (or more) appropriate rays onto the above diagram, determine the location of the image of the object produced by the lens.

One ray [1], second ray [1], image correctly located and oriented [1].

0 1 . 3

Is the image produced real or virtual? Explain your answer.

Real [1]. It has been produced by the convergence of actual light rays / could be projected onto a screen [1].

0 1 . 4

By measuring the sizes of the object and image using the above graph, show that this lens is producing a magnification of 0.5.

Image height, h_i = 5 cm, object height, h_o = 10 cm
Magnification = $h_i \div h_o$ = 5 ÷ 10 = 0.5

0 1 . 5

Theory suggest that the magnification of a lens can also be determined by using the following equation:

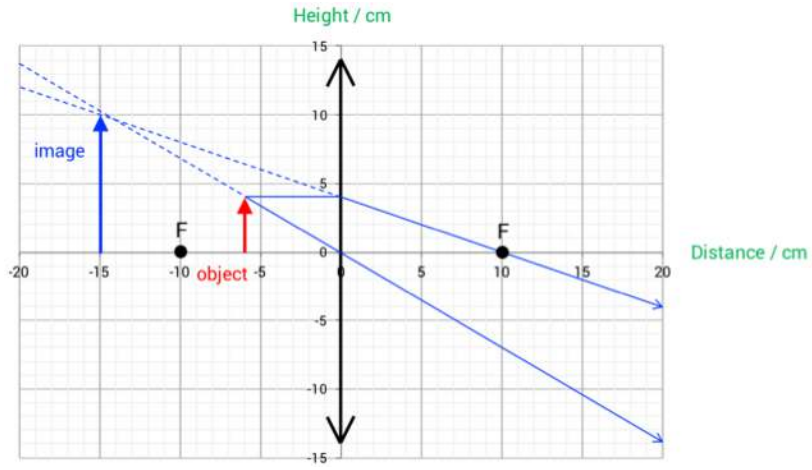
$$\text{Magnification} = \frac{\text{Distance between lens and image}}{\text{Distance between lens and object}}$$

Show that a magnification of 0.5 is also calculated using this equation.

Distance between lens and image = 6 cm
Distance between lens and object = 12 cm
Magnification = 6 ÷ 12 = 0.5

0 2

Later, the same student investigates a lens with a longer focal length.



0 2 . 1

Describe a method for measuring the focal length of a lens such as the one shown above.

Allow parallel rays of light to be incident onto / to strike convex lens [1]. (They will converge to the principal focus on the opposite side of the lens.) The distance between the lens and the principal focus is equal to the focal length [1].

0 2 . 2

By drawing two (or more) appropriate rays onto the above diagram, determine the location of the image of the object produced by this lens.

One ray [1], second ray [1], image correctly located and oriented [1].

0 2 . 3

The image formed can be described as virtual, upright and magnified. Explain the meaning of each of these terms.

Virtual: an image formed by light rays which *appear* to diverge from a point (cannot be projected onto a screen) [1]. Upright: has the same orientation (accept 'the same way up') as the object [1]. Magnified: (appears) larger than the object [1].

0 2 . 4

The student later uses a lens which looks like this:

Describe the nature of the image which would be formed by this lens.

This is a concave (diverging) lens so the image formed will always be: virtual, upright and diminished.

(All three for 2 marks; one or two for 1 mark.)