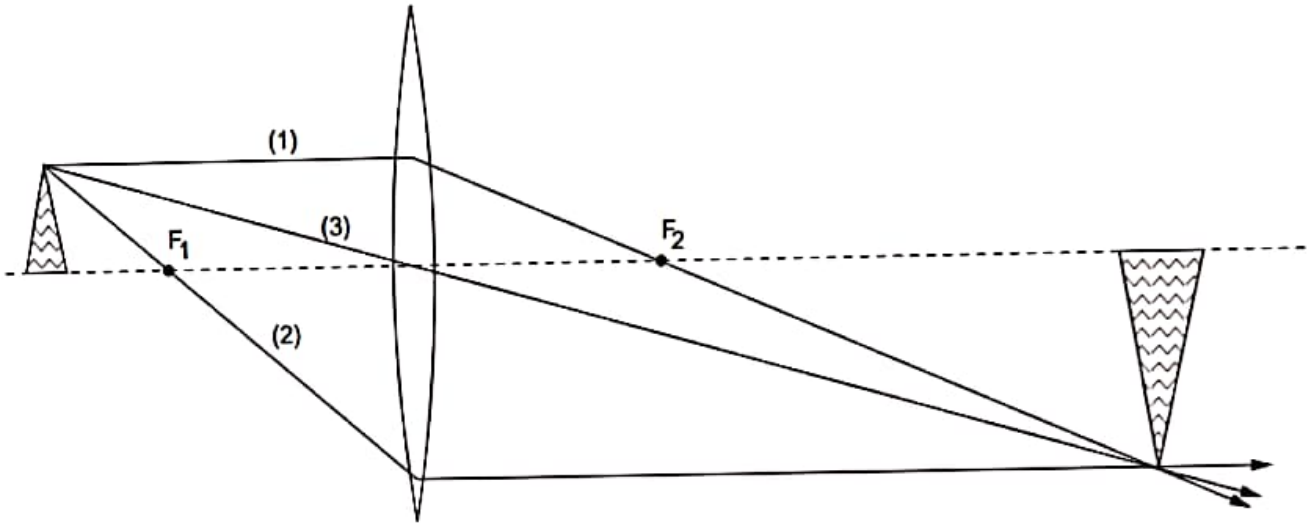

Figure 4.3: Ray tracing with a converging lens.

Exercise 4.3.1 *Use the lensmaker's equation to show that a converging lens is thicker in the middle, and a diverging lens is thinner in the middle.*

4.3.5 Ray tracing with lenses

For the purposes of ray tracing, every lens is said to have two focal points, a **primary focal point** and a **secondary focal point**. A *converging* lens has its primary focal point on the side from where the light is coming (usually drawn on the left), and the secondary focal point is symmetrically on the other side of the lens. The opposite is true of a *diverging lens.*

As with mirrors, we can locate an image formed by a lens graphically, with the help of three auxiliary rays (see Figures 4.3 and 4.4):

- A ray parallel to the axis passes through (or appears to pass through) the secondary focal point F_2. (Ray 1 in the figures).
- A ray passing through (or when extended, appearing to pass through) the primary focal point F_1 emerges from the lens parallel to the axis. (Ray 2 in the figures).
- A ray falling on the lens at its centre passes through undeflected. (Ray 3 in the figures).