

Biomicroscopy I - Exercise 05

October 7, 2025

1 Geometrical Optics Construction

Consider the setup of Figures 1 and 2 (see the next page).

- A. Construct the focal planes of the four lenses L_1 , L_2 , L_3 and L_4 . Indicate their focal lengths in mm.
- B. Find the focal plane and the principal plane on the image side of the total system.
- C. Construct the focal plane and the principal plane on the object side of the total system.
- D. Measure the image distance (from the image side principal plane to the image) and the magnification. Verify that matrix approach with cardinal points results into the same magnification and object-image relationship.
- E. Where is the aperture? Where are the entrance and exit pupils?
- F. Where is the field stop? Where are the entrance and exit windows?
- G. What is the effect of lens L_3 ? What happens if you omit lens L_3 ?

2 Magnification with a single lens (Loupe)

A jeweler is examining a diamond whose diameter is 5.0mm using a loupe that has a focal length $f_M = 25.4\text{mm}$. Consider the relaxed eye condition.

- A. Determine the maximum angular magnification of the loupe.
- B. How big does the diamond appear through the magnifier?
- C. What is the angle subtended by the diamond at the unaided eye when held at the near point?
- D. What angle does it subtend at the aided eye?

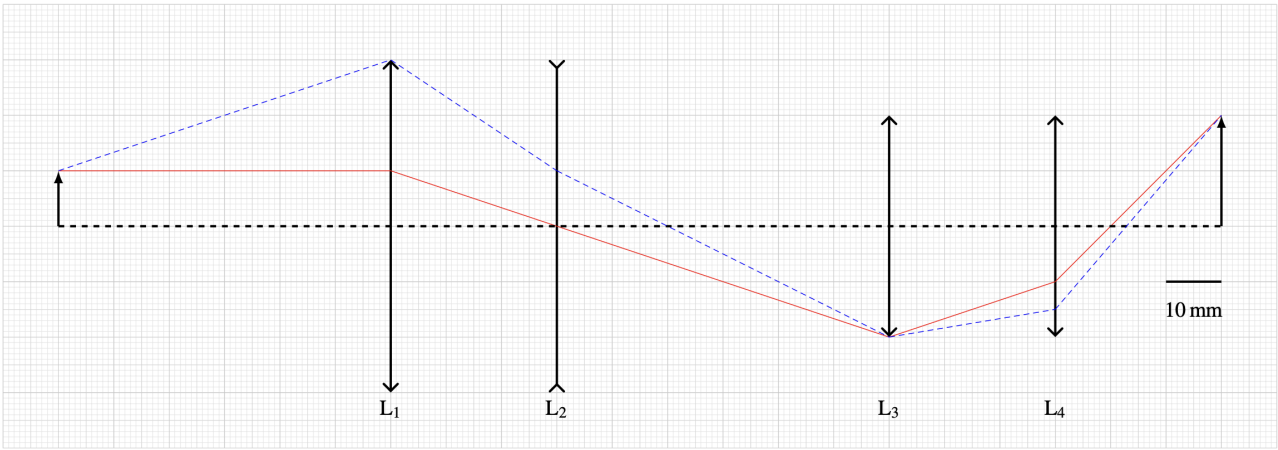


Figure 1: A four-lens setup with two rays.

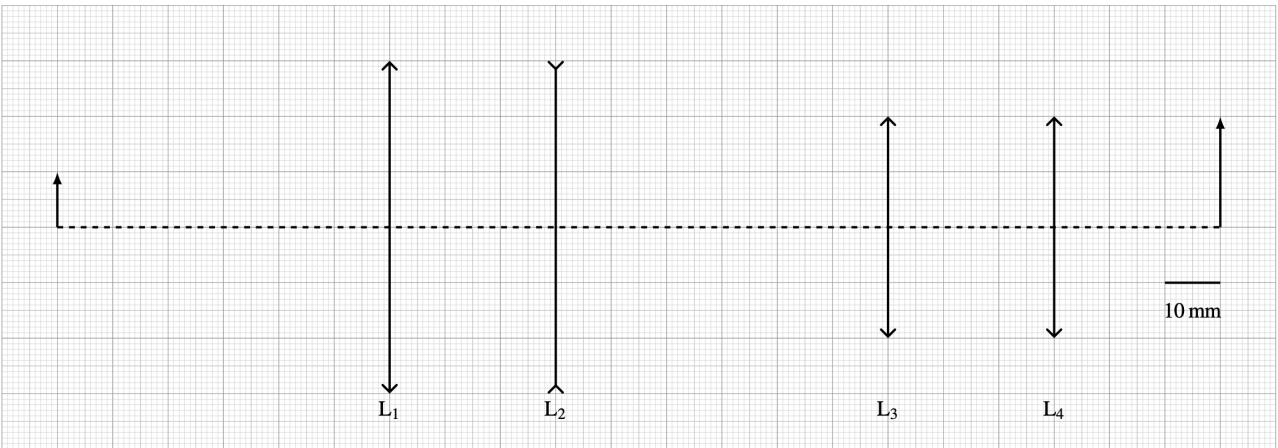


Figure 2: A four-lens setup without rays.