



Upward Image Compound Microscope

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Science 10

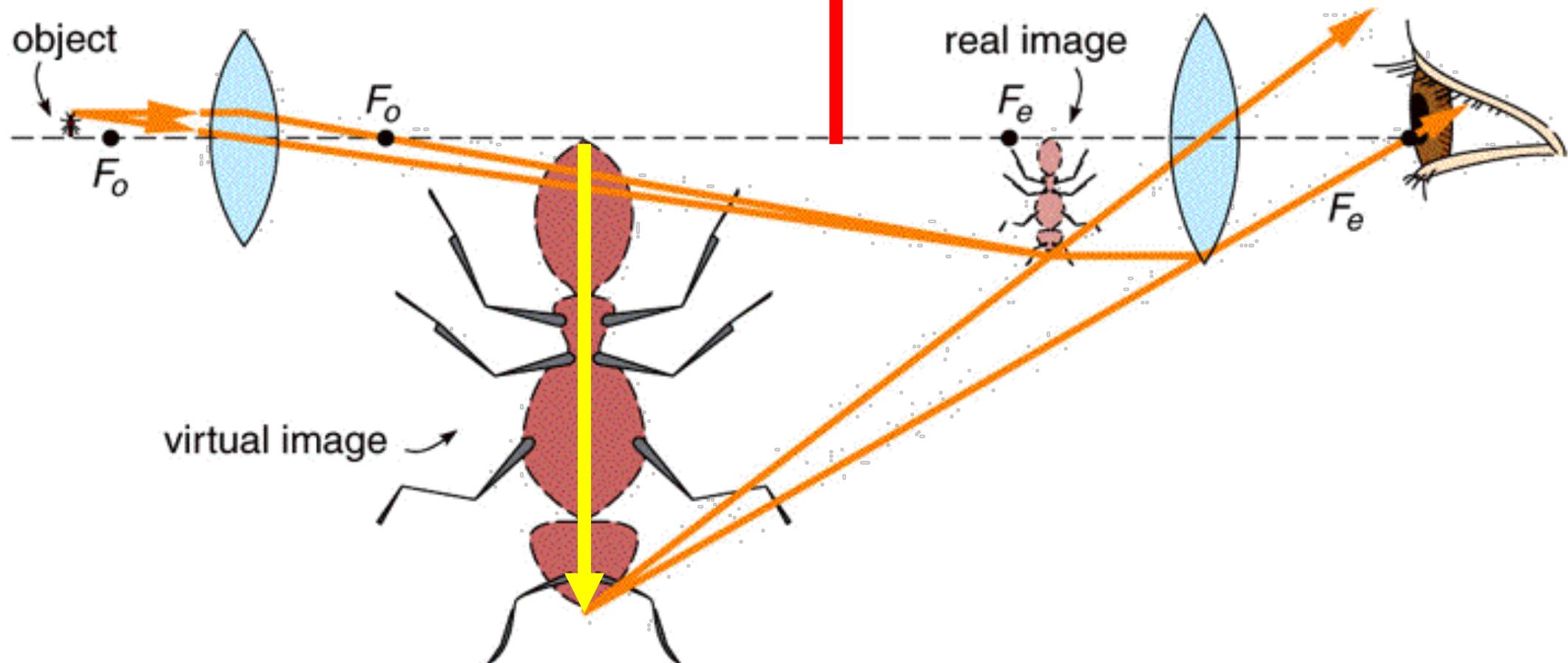
11 December 2020

The *purpose* of my project is to build the upright image microscope in order to help students learn the biological concepts faster.

How the technology of resultant upright image microscope can be applied

- Flattening the learning curve
- Displaying the upright image of the object during the real time interaction

Microscope as an optical system





Microscope with multiple lenses
and different magnifying powers

Eyepiece

Objective Lenses

Revolving nosepiece



Design goals for my optical systems

- 250x
- 500x *Length of microscope $\leq 40\text{ cm}$*
- 1000x

Lenses used

BoliOptics Standart Eyepiece



BoliOptics Objective Lenses



Things you need to know about a lens

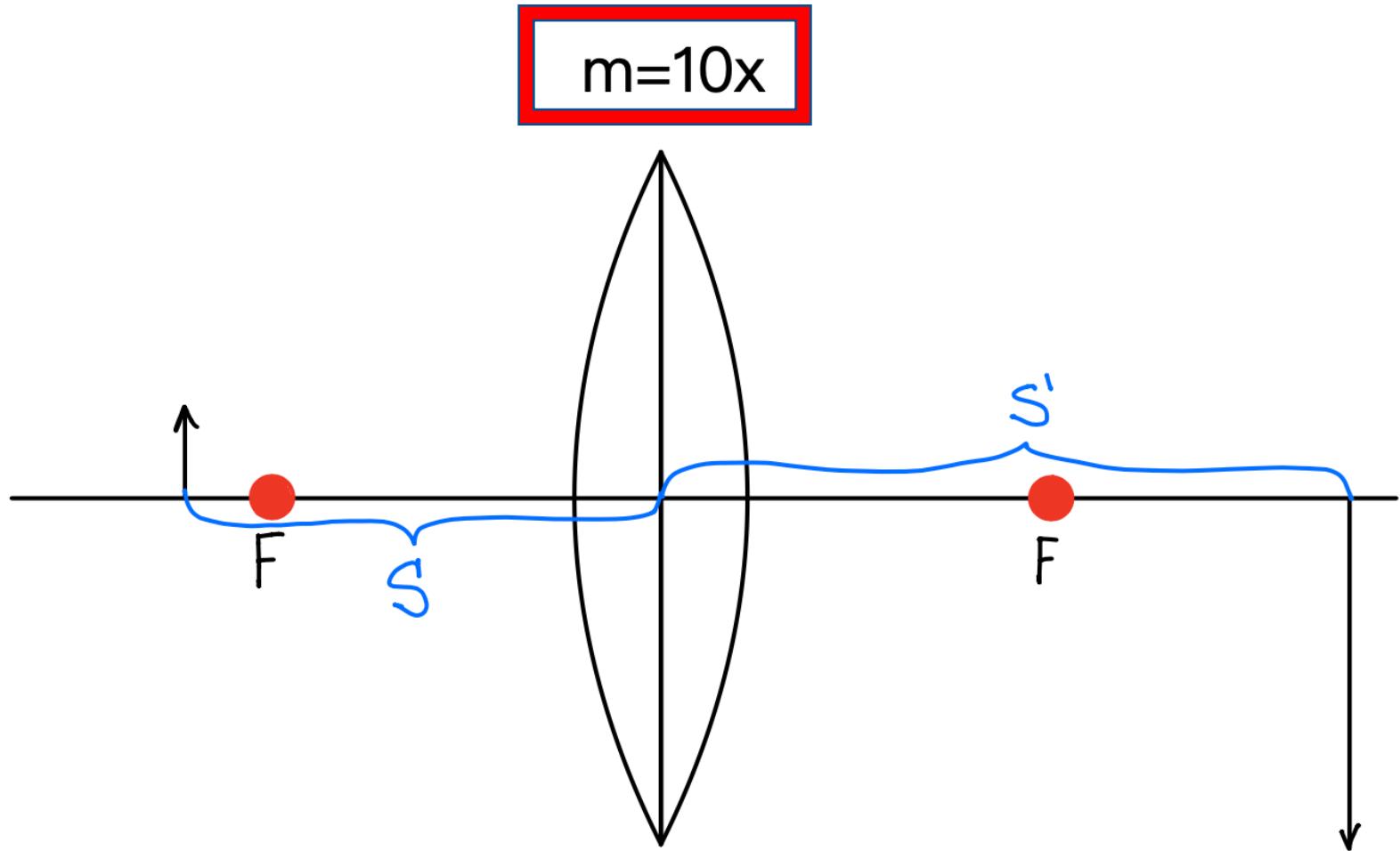
Converging lens

1. Magnification = m

2. Focal points = F

3. Distance between object and lens = S

4. Distance between lens and image = S'



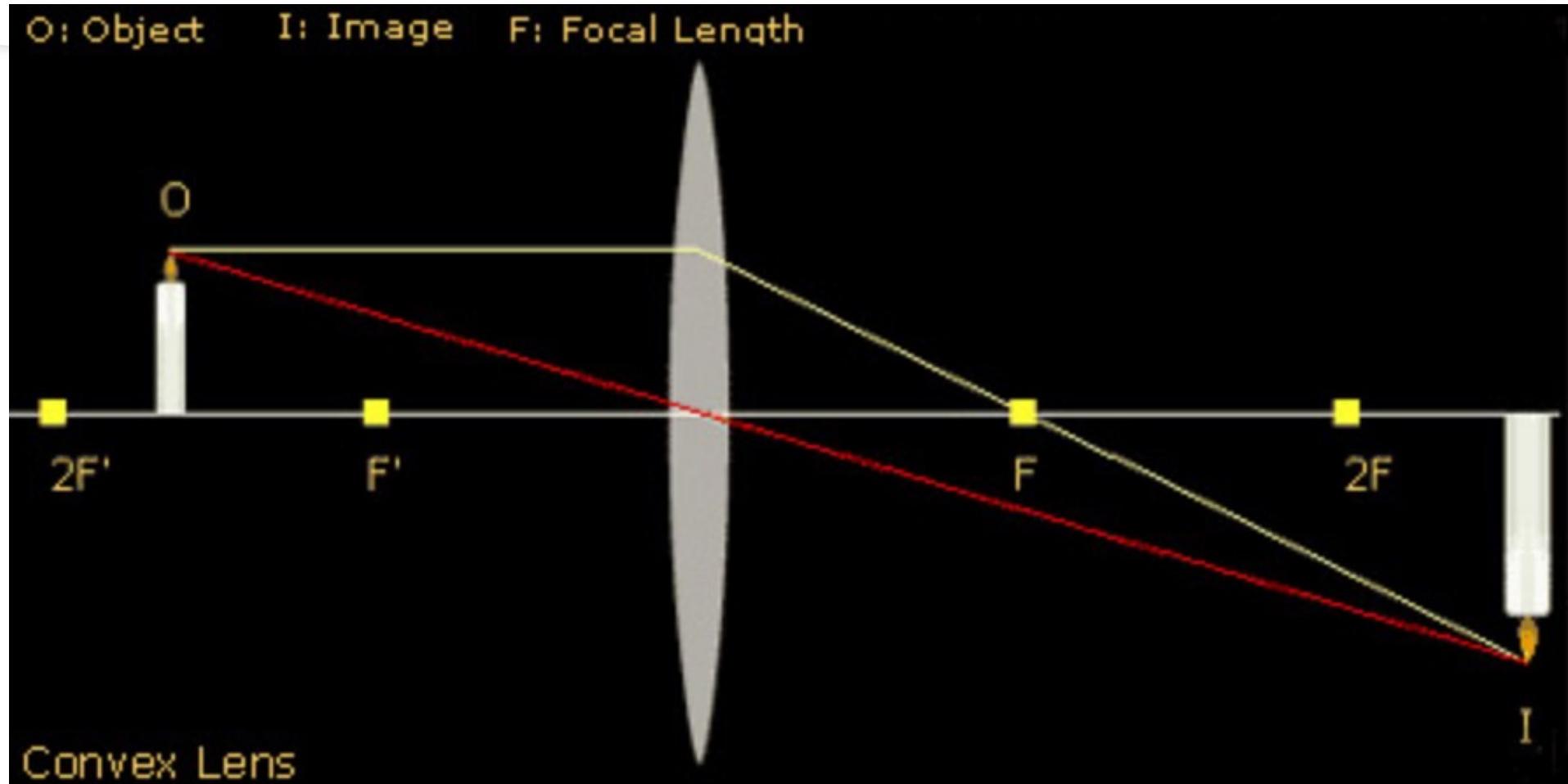
Real Image vs Virtual Image

Real Image



https://www.youtube.com/watch?v=1ziBoKT_WUc&t=413s

Real Image



Virtual Image

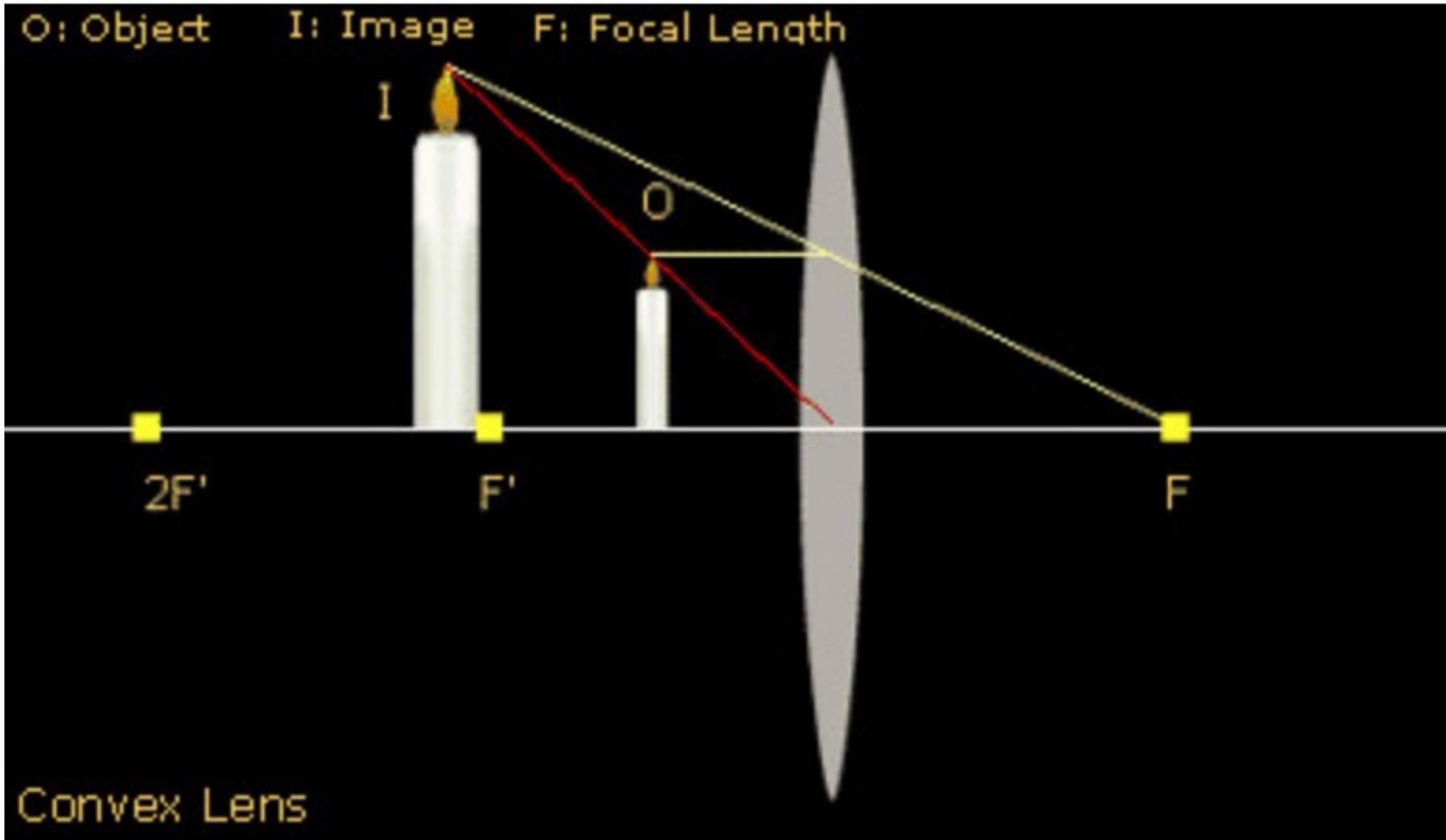


https://www.youtube.com/watch?v=1ziBoKT_WUc&t=413s

Virtual Image



Virtual Image

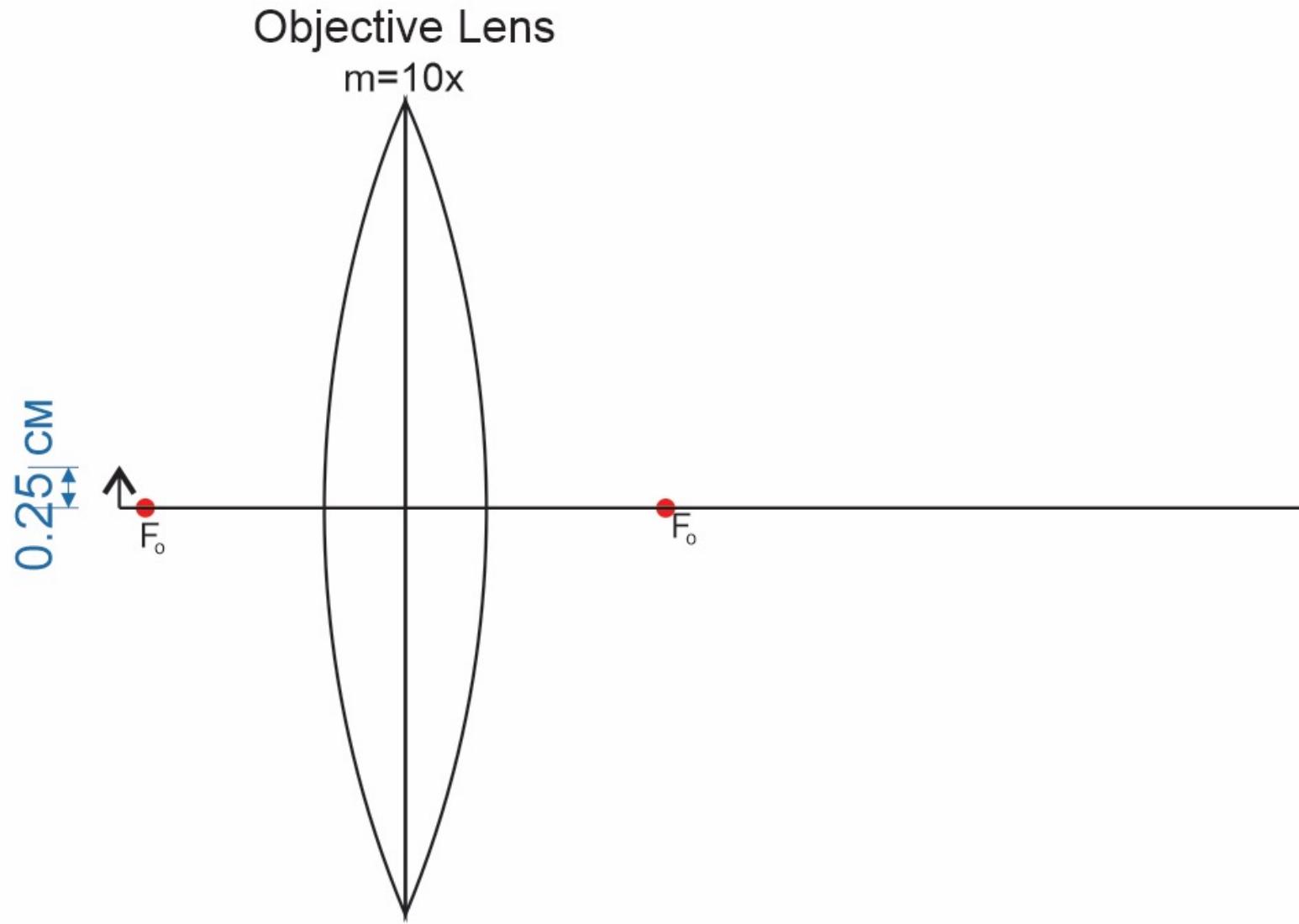


Optical system with magnifying power 250x

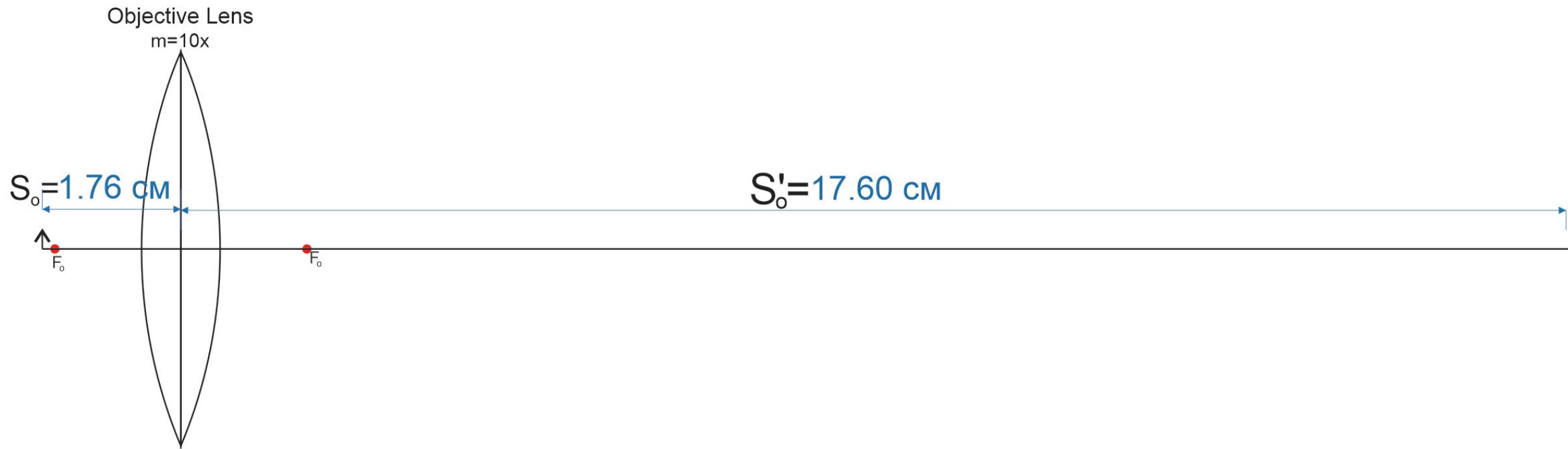
Original object



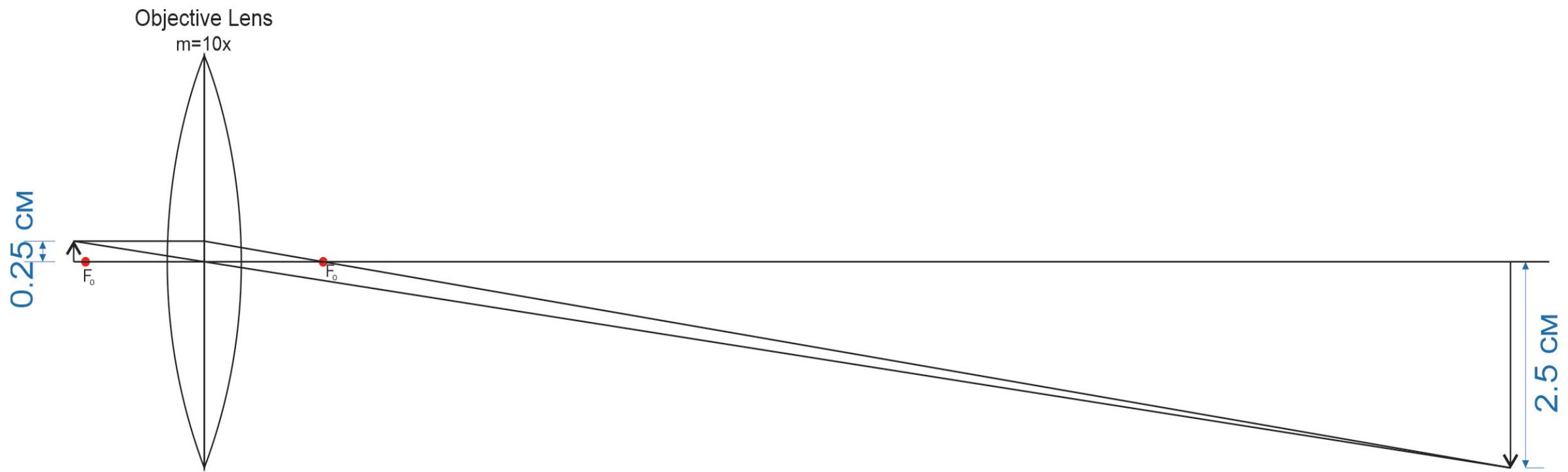
Objective lens #1



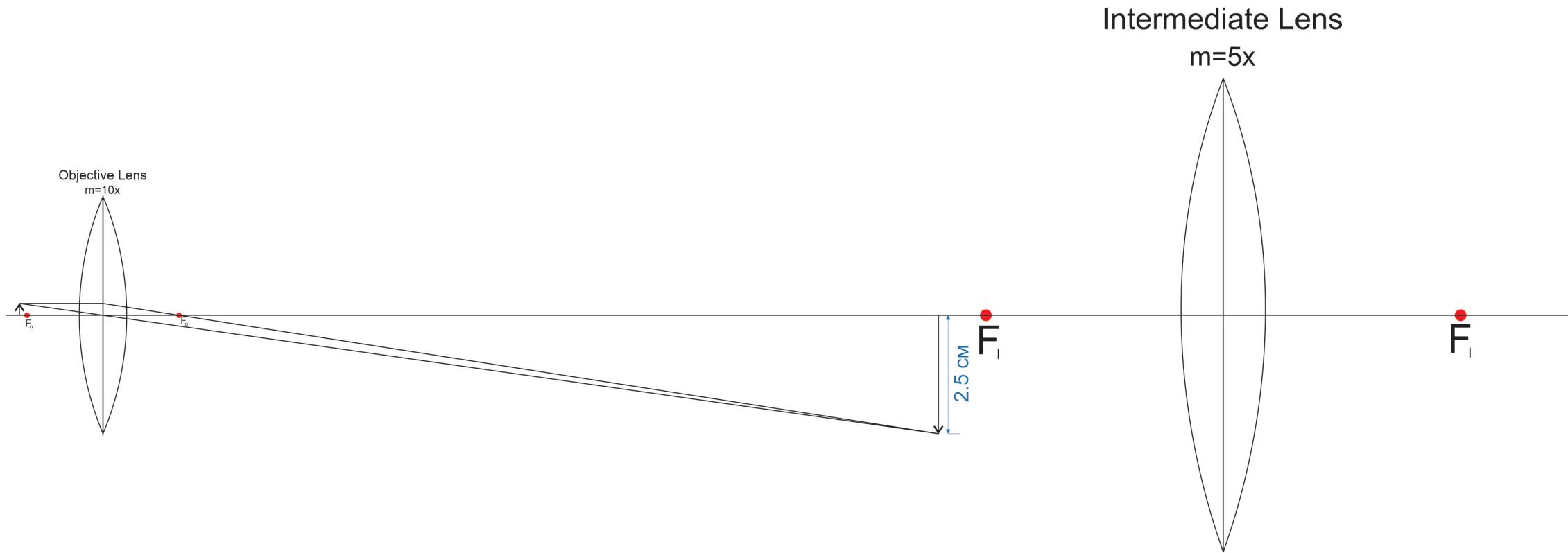
Calculating the distance between object and the image



Projection of the real image #1



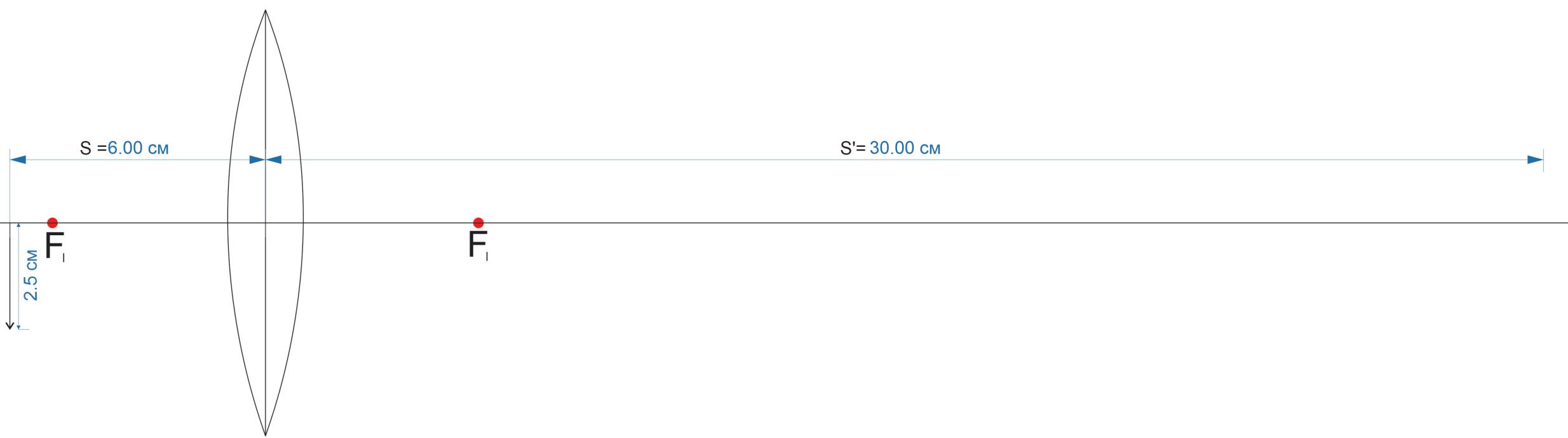
Placement of intermediate lens



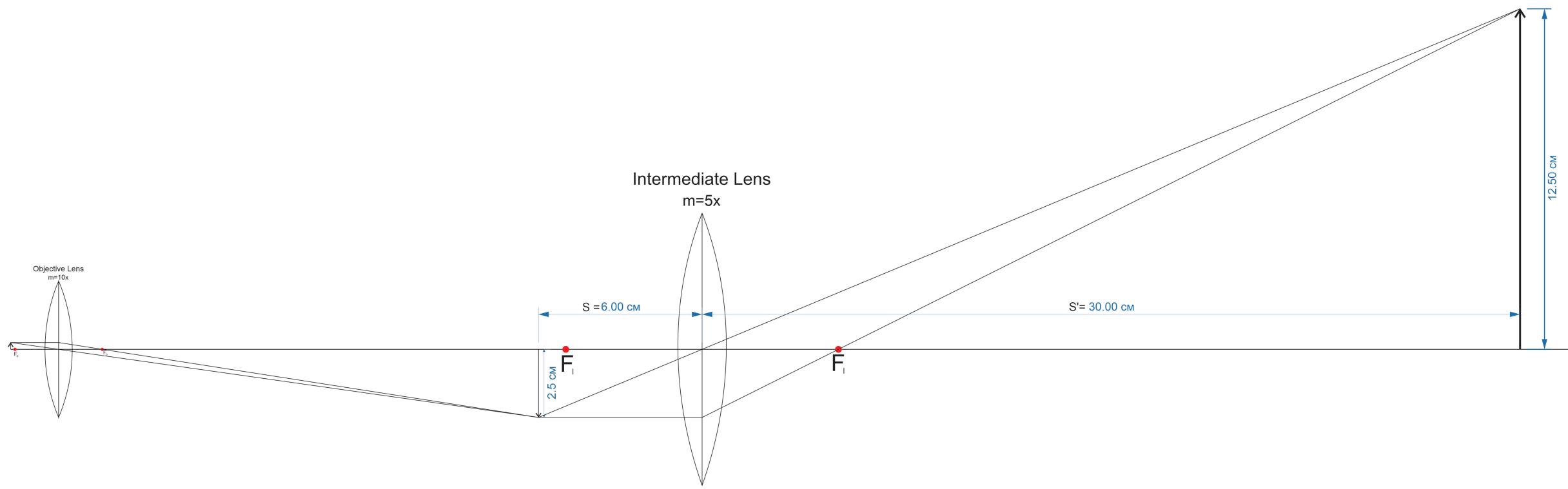
Calculating distance between object/real image #1 and image #2

Intermediate Lens

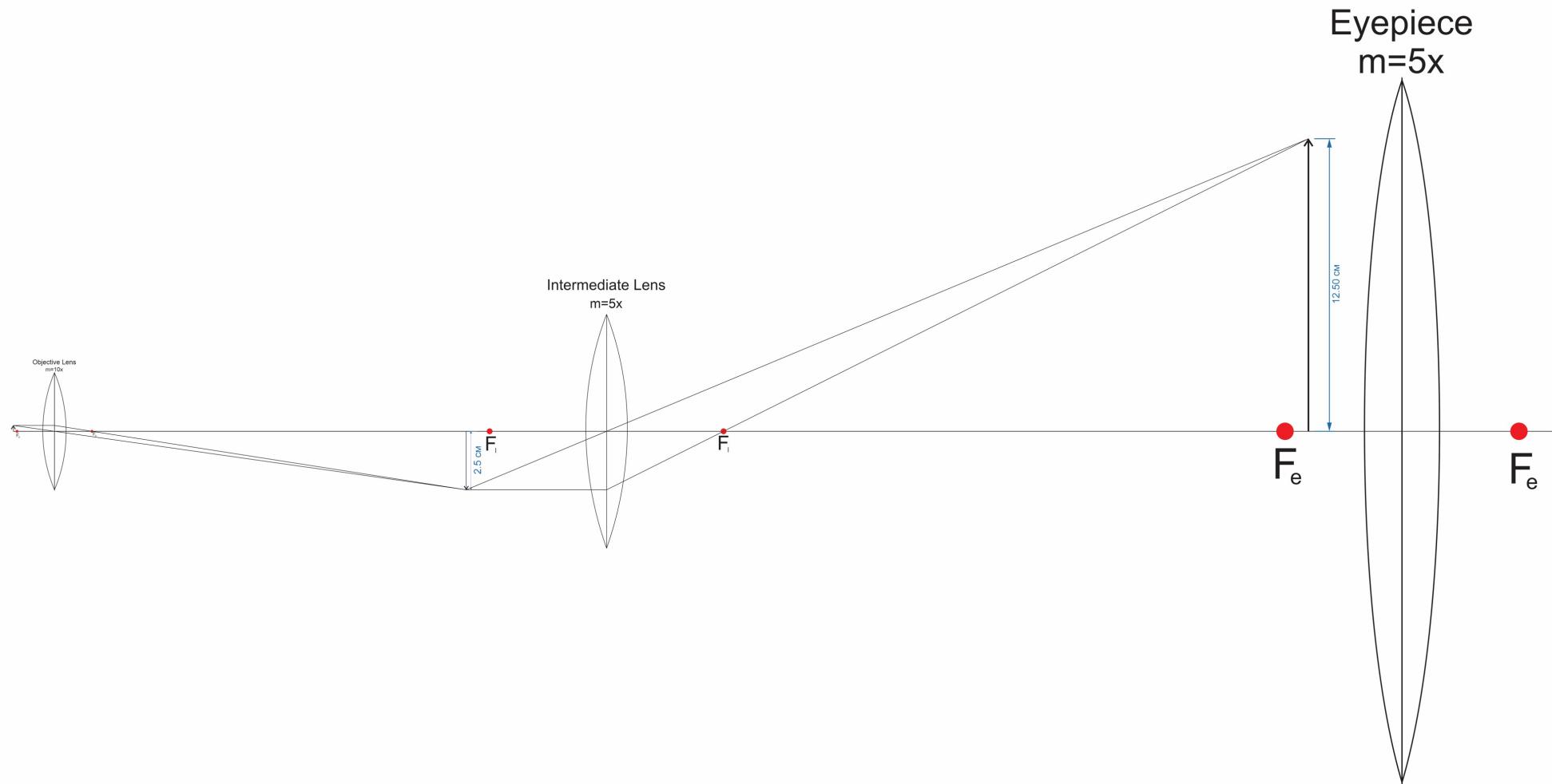
$$m=5x$$



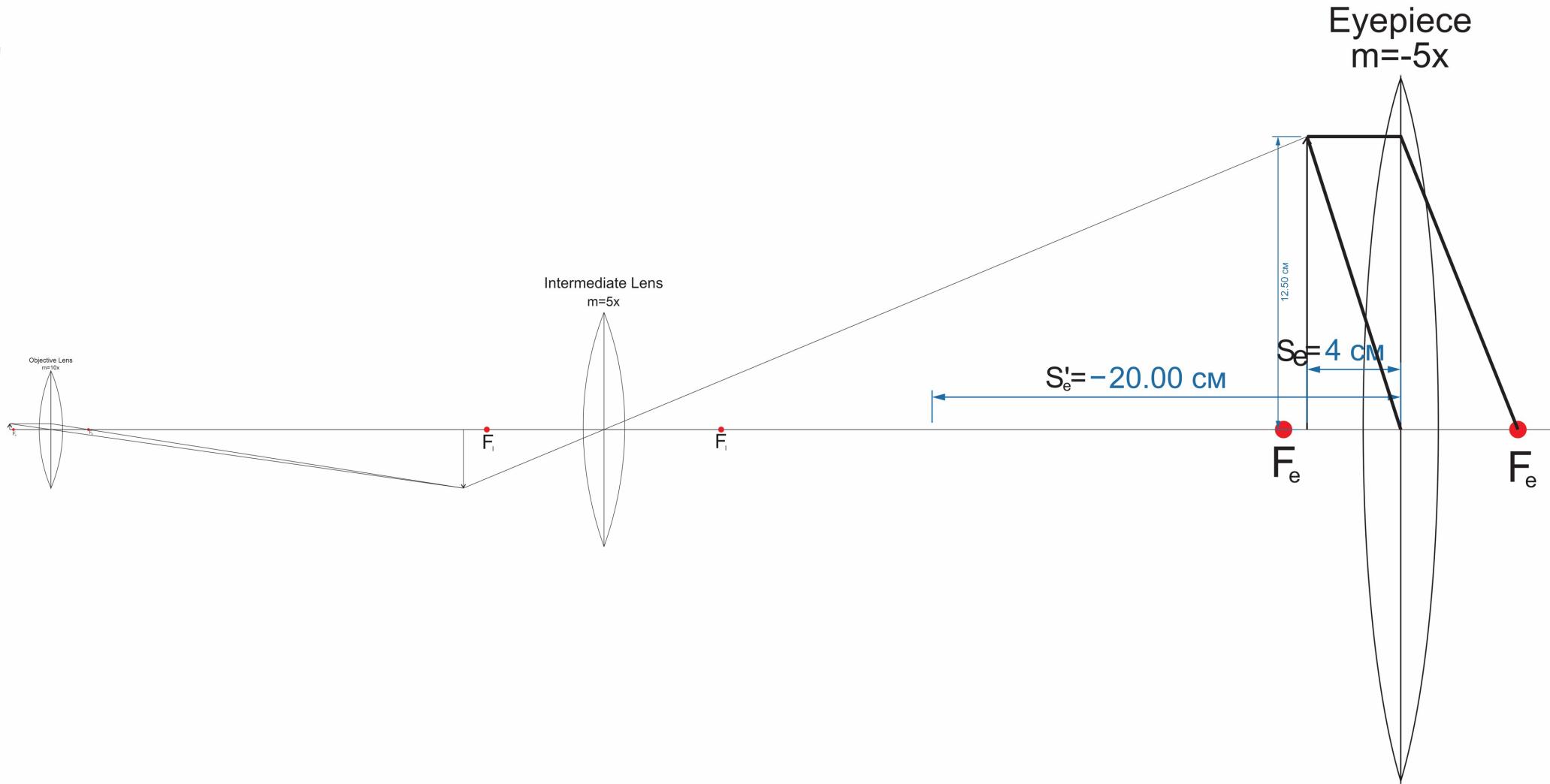
Projection of real image #2



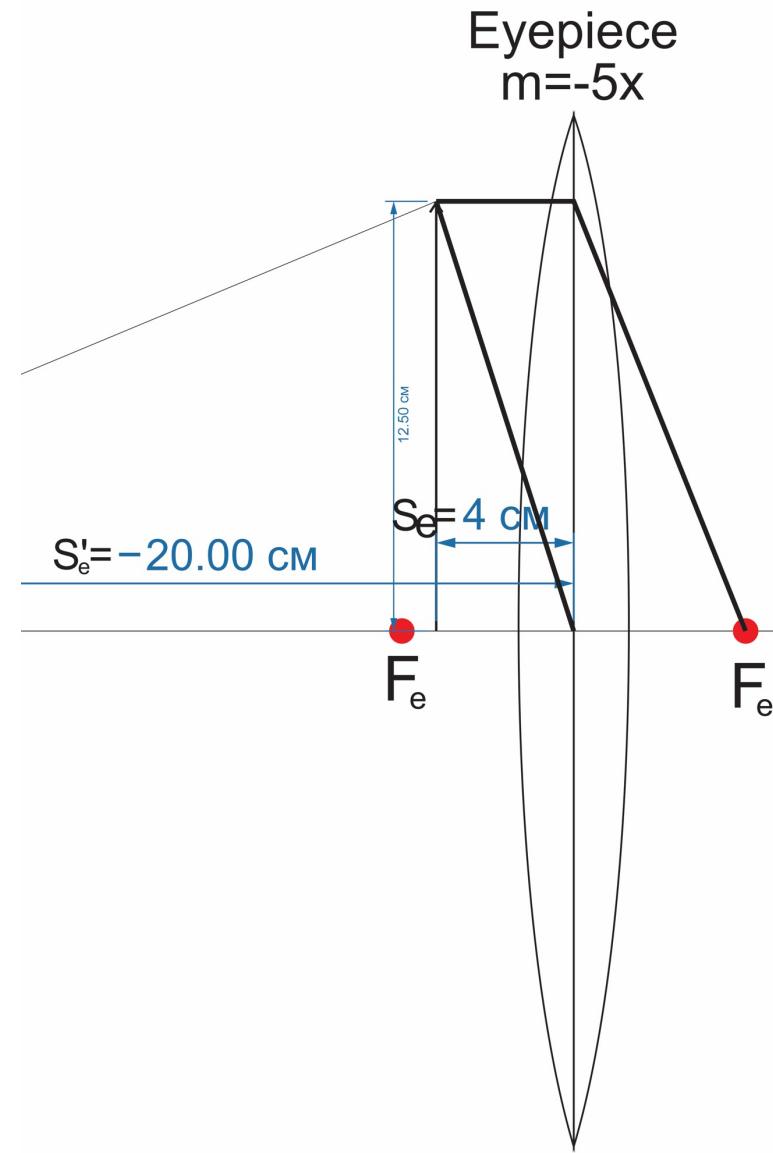
Placement of eyepiece lens

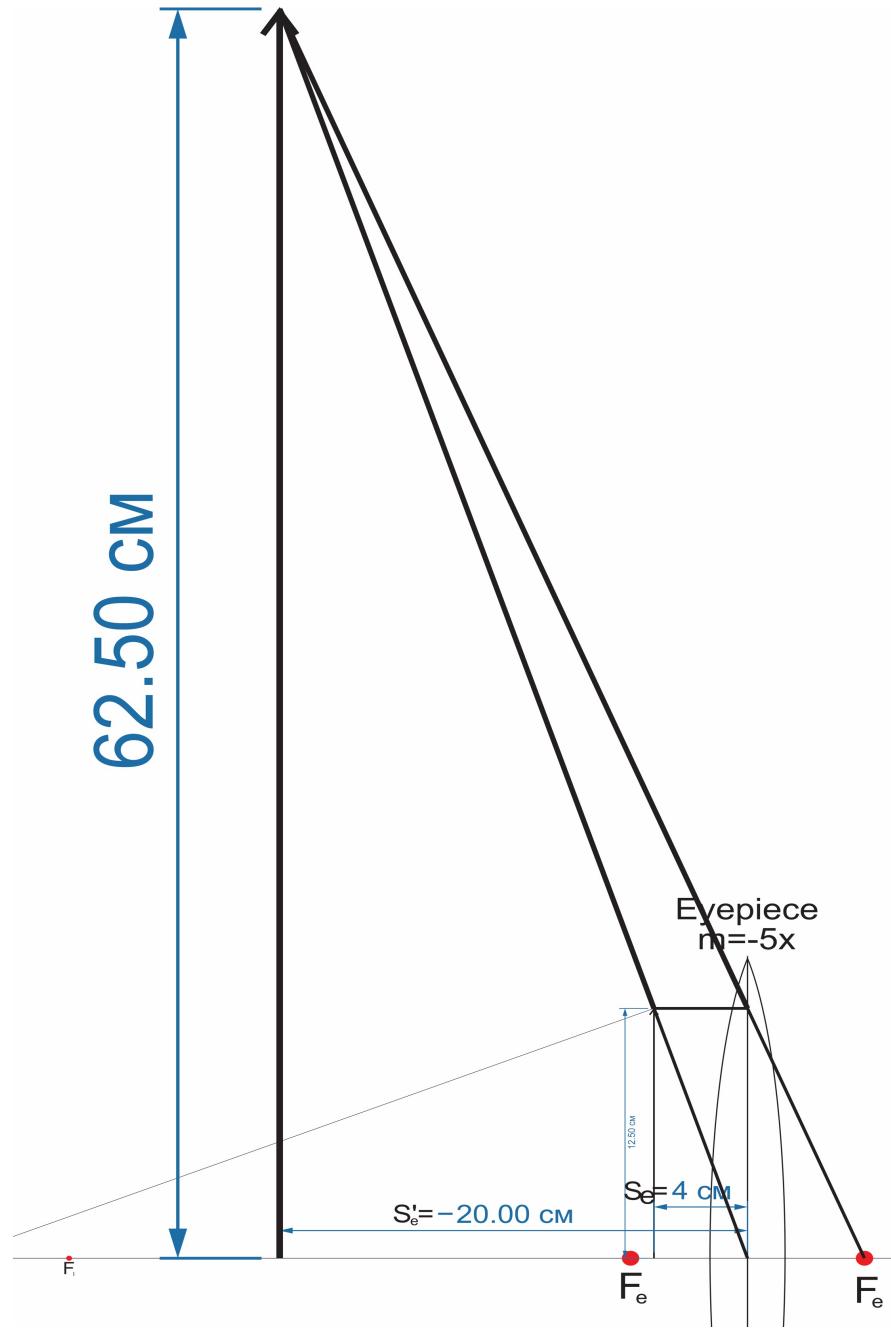


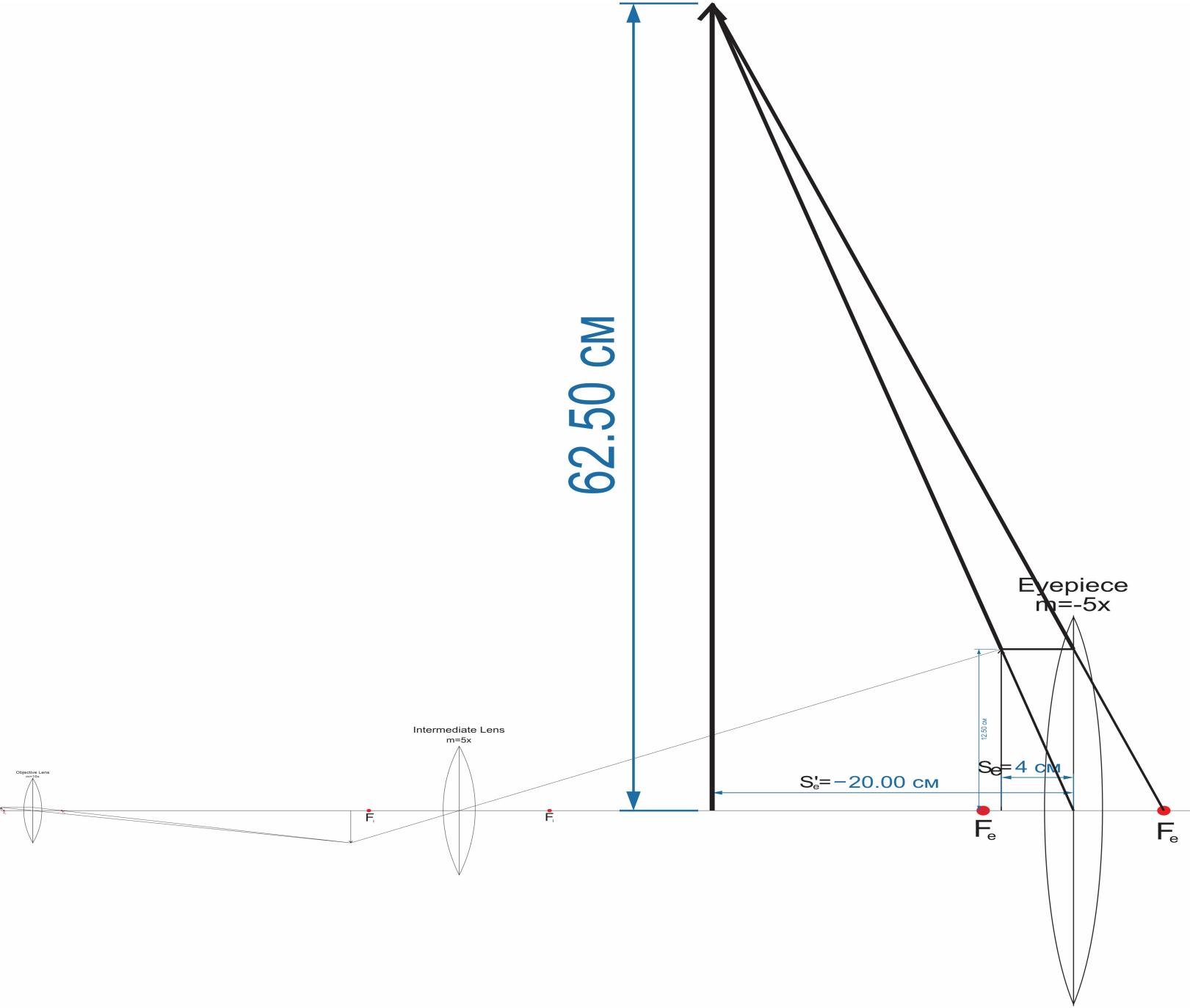
Tracing the rays coming from real image #2 through the eyepiece



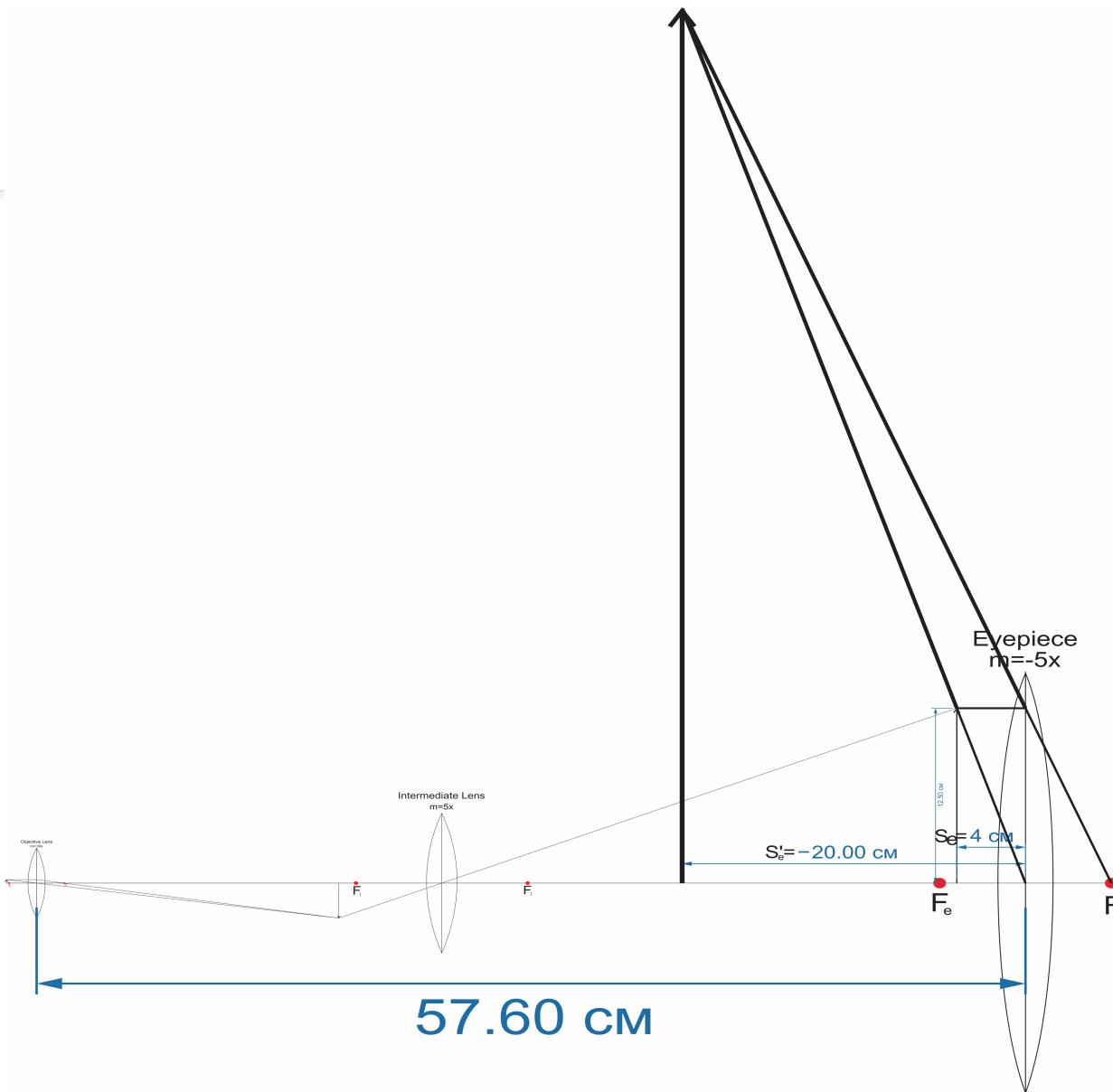
Tracing the rays backwards until the vertical image #3 appears





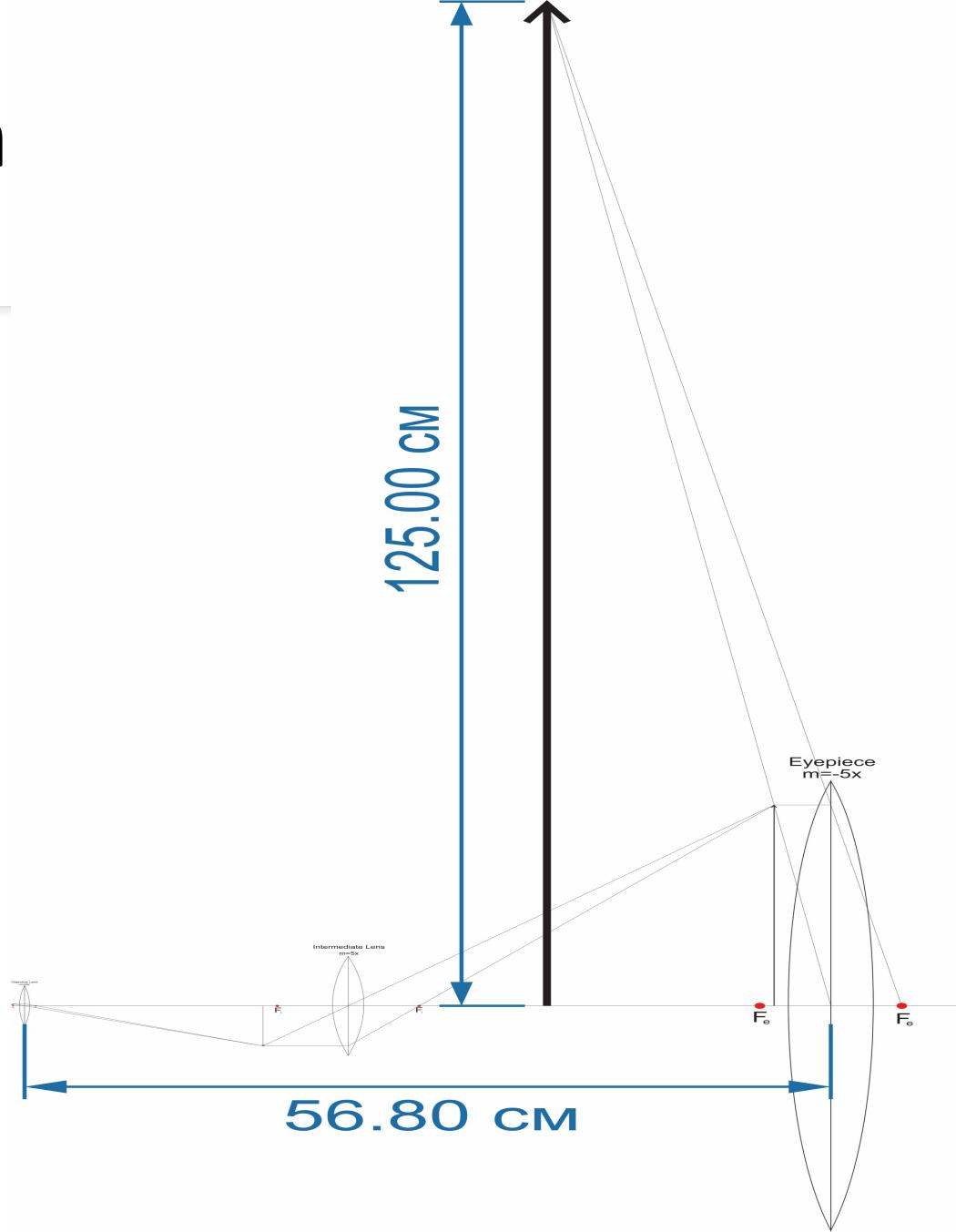
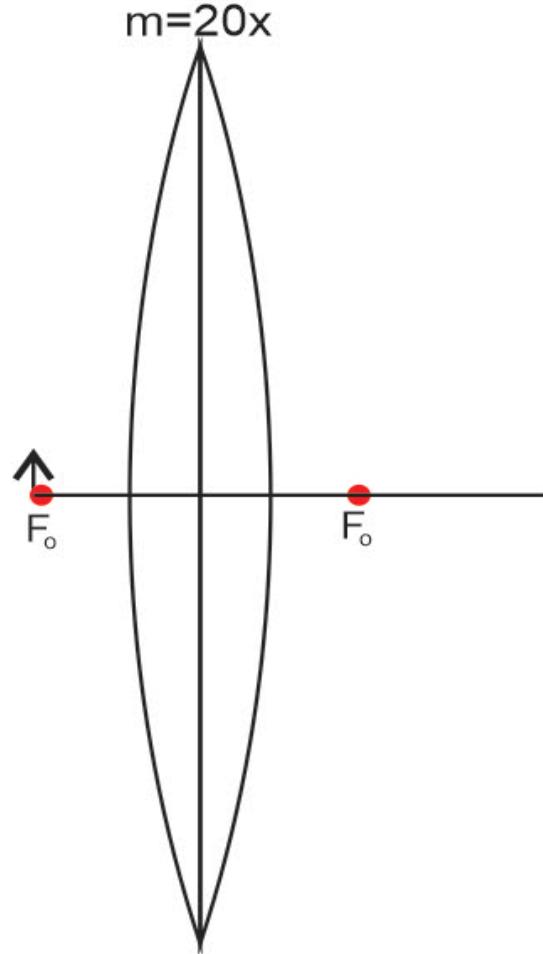


The total length of the microscope

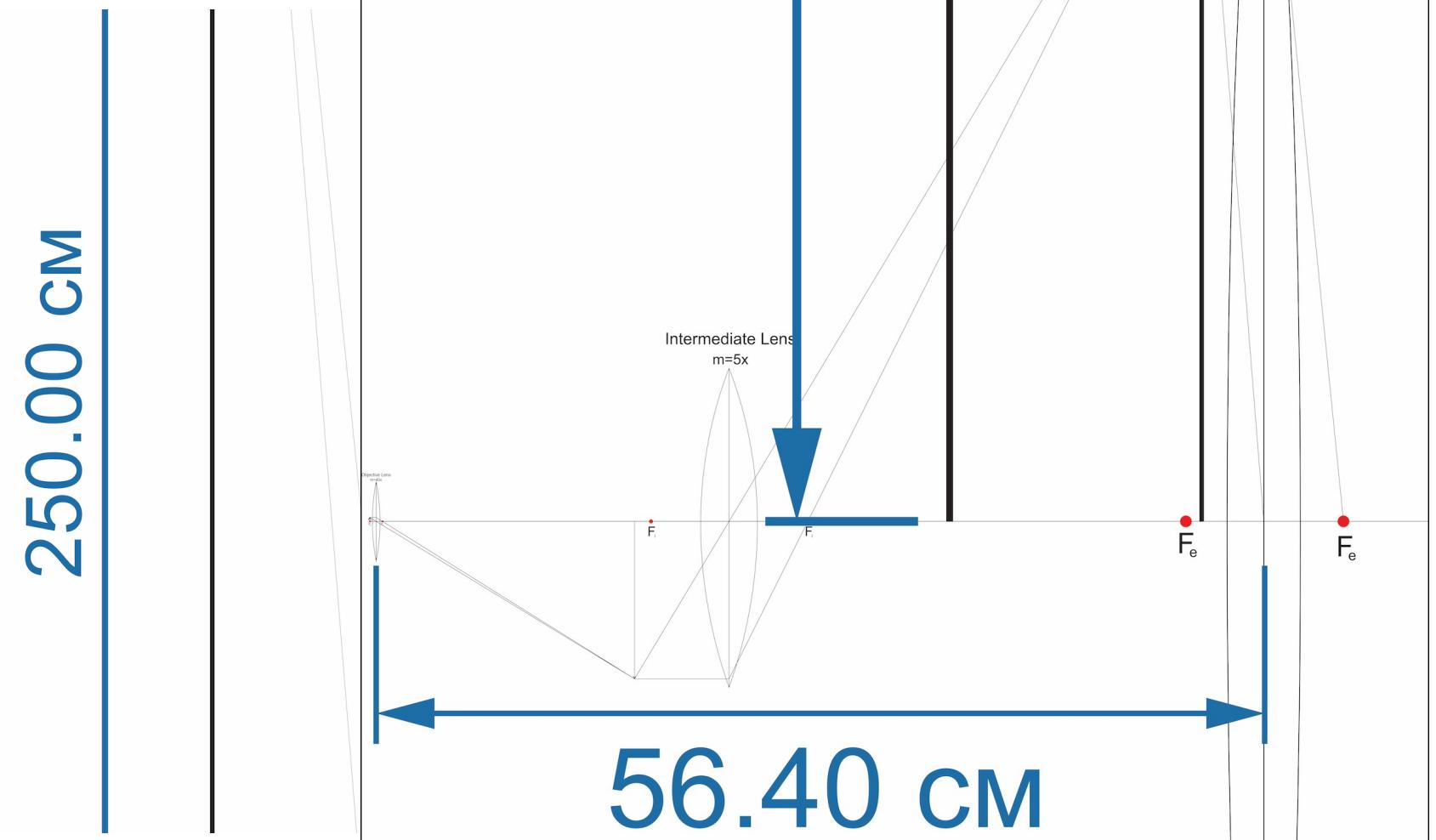
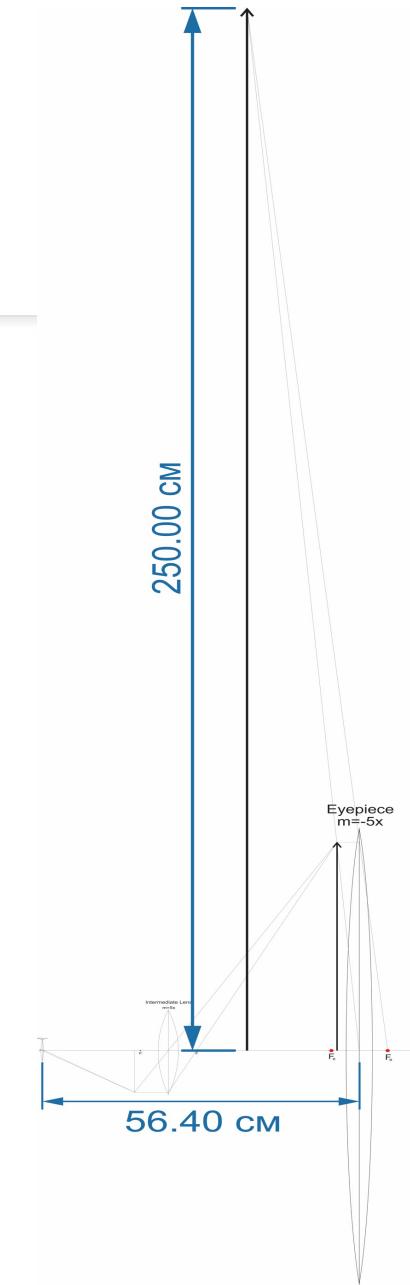


Microscope with m

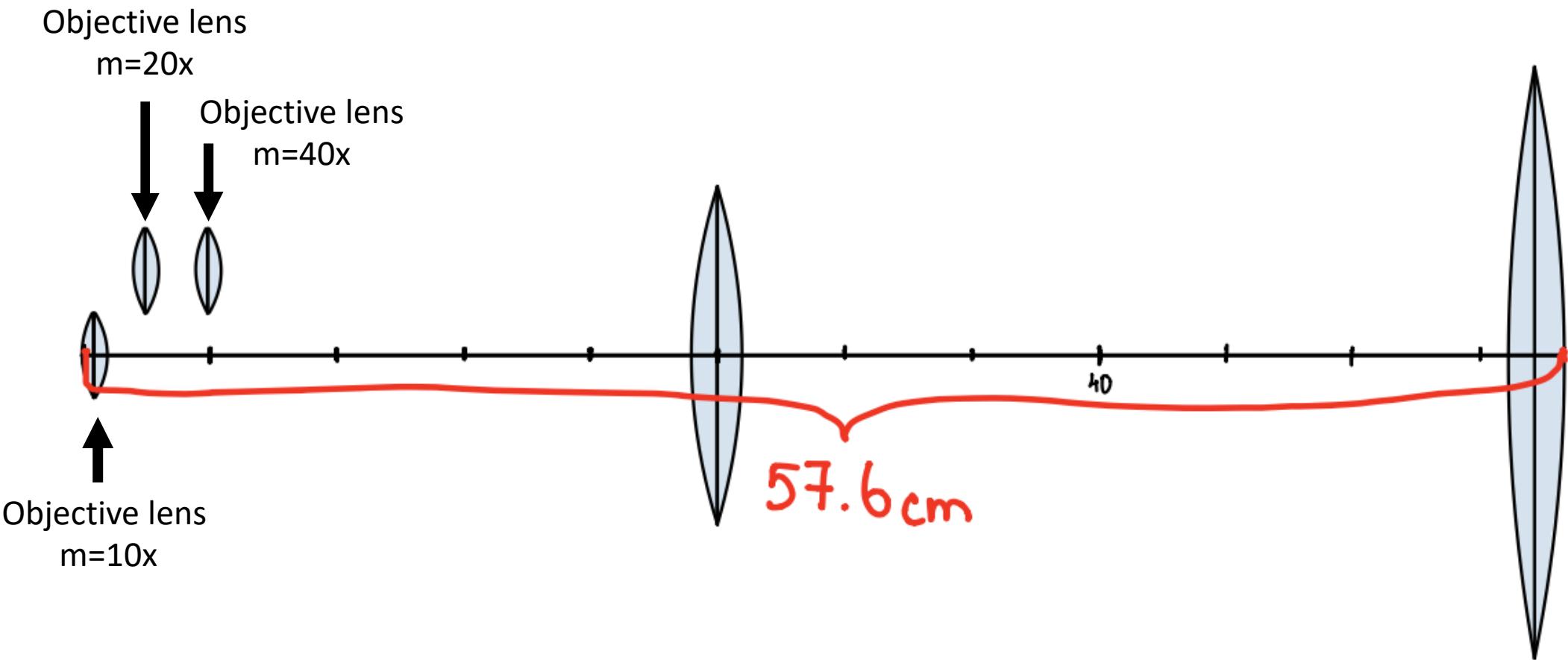
Objective Lens



Microscope with magnification 1000x



Adjustment of an earlier prototype



Summary

Magnification	250x	500x	1000x
Length	57.6 cm	56.8 cm	56.4 cm

Thank you

Dr. Jennifer Carson

Dr. Betsy Rich

Andrey Kondratyuk

Cristina Arsene



<https://www.amazon.com/AmScope-M500-Magnification-Illumination-Brightfield/dp/B004UNFSYG>