1. (40%) Specify if the following statements are true, false, or inappropriately stated. Give a brief justification of your opinion for each statement.

1.a) A telescope must have large magnifying power.
1.b) A microscope is the cascade of two magnifying lenses.
1.c) Consider an optical instrument producing a virtual image. The human eye can convert the virtual image to a real image on the retina, independent of where the virtual image is located.
1.d) A hyperopic person’s unaided eye can focus on her retina objects that are far away (at infinity).

PLEASE TURN OVER!
2. (60%) Consider the telephoto lens system shown below. Lens L1 has known focal length $f$, and lens L2 has unknown focal length $f_0$. The distance $d$ between the two lenses is also unknown. Specify the telephoto system according to the following requirements:

i) An object at infinity, placed off-axis at angular deviation $\alpha = 10^{-2}$ radians, produces a real image of size $h = 5 \times 10^{-2} f$ (cm).

ii) The real image specified in part (i) is located at a distance $3f$ from L1.

![Telephoto lens system diagram](image)

2.a) Specify the two unknowns $f_0$, $d$ in terms of $f$.

2.b) Locate the principal planes.

2.c) What is the effective focal length (EFL)?

2.d) If a object is $24f$ away from lens L1, where is the image plane and what is the magnification? Is the image real or virtual, erect or inverted?

GOOD LUCK!