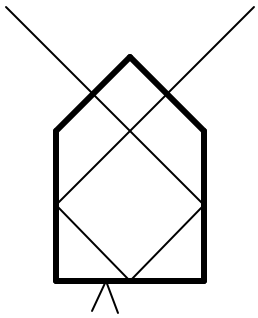
October 16, 2001 Lecture 17 Name_____

Closed book; closed notes. Use the back sides if required.
Do not use any pre-stored information or programs in your calculator.
Note any assumptions you make in solving the problems.
Show your work. Present it in a neat and logical fashion.

1) (10 points) Draw the tunnel diagram and determine the resulting image parity for this prism and the ray path shown. The bottom surface of the prism is a roof.

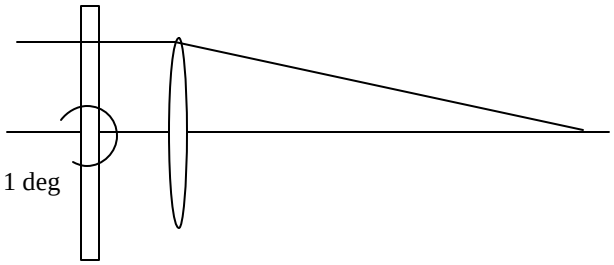


2) (15 points) A 50 mm focal length thin lens is used to image a 250 x 250 mm object onto a 10 x 10 mm detector. What is the overall object-to-image distance?

3) (15 points) A 100 mm focal length thin lens is used to image an object at infinity.

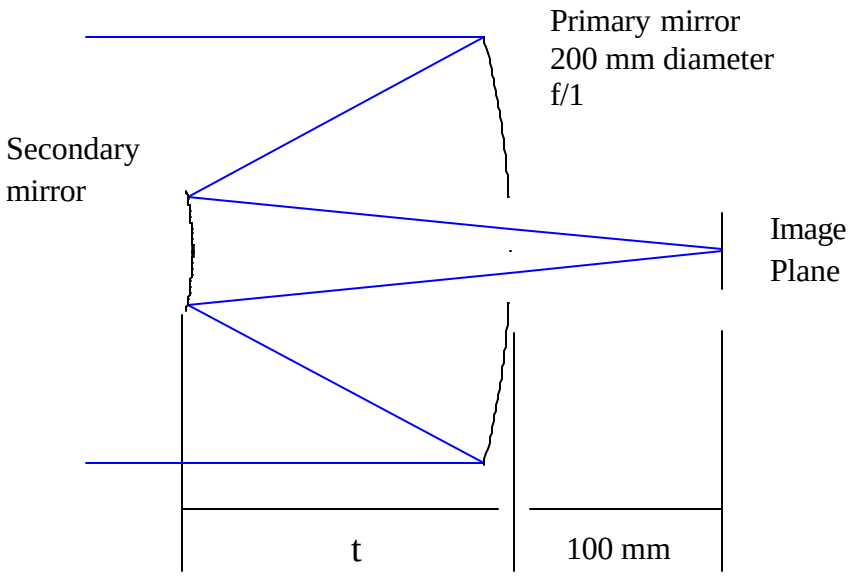
a) If the object has a total angular subtense of 10 milliradians, what is the image size?

b) The lens is looking through a 10 mm thick glass plate (n=1.5). What is the image shift if the plate is tilted by 1 degree?



4) (30 points) Design a Cassegrain telescope. The object is at infinity.

Use a 200 mm diameter primary mirror with an f-number of f/1
Put the aperture stop at the primary mirror
Set the working distance (from the primary to the image plane) to 100 mm
Set the system f-number to f/5



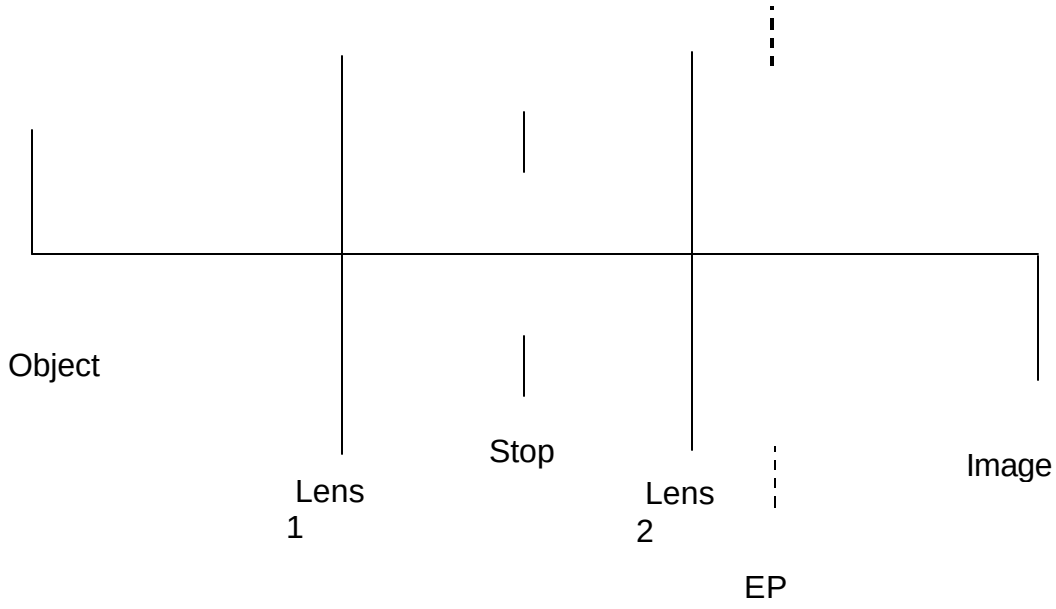
a) Find the size and location of the entrance pupil and determine the effective focal length of the telescope.
b) Determine the radius of curvature of the primary mirror, the spacing t between the two mirrors and the radius of curvature of the secondary mirror.
c) Find the size and location of the exit pupil.

5) (15 points) Below is a representation of an optical system showing the locations and sizes of the object, image, two lenses, stop and entrance pupil.

Draw the marginal and chief rays for this system.

Show the location and size of the exit pupil.

This is a graphical problem; no calculations are required.



6) (15 points) Design a Petzval lens (two positive thin lenses) with a system focal length of 100 mm and a back focal distance of 75 mm. The spacing between the two lens elements is 50 mm. Sketch the system noting the position of P' and F'.

Extra Credit (10 points) The figure shows a ray path through a thin lens. Draw a single line on the figure to locate the rear focal point of the lens. Explain your result.