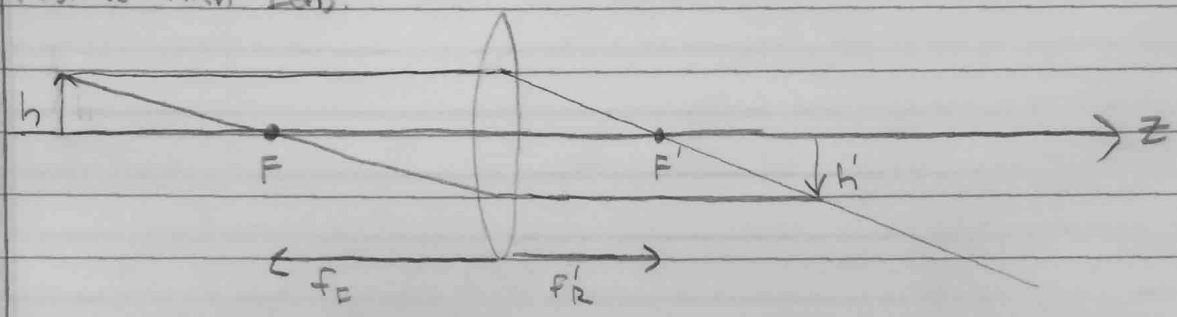
4-3. A variety of imaging configurations are given, each showing an object. Determine the image location and size by using a ray construction. Make use of the properties of the principal planes and focal points. Both real and virtual objects are shown. Indicate if the image is real or virtual.

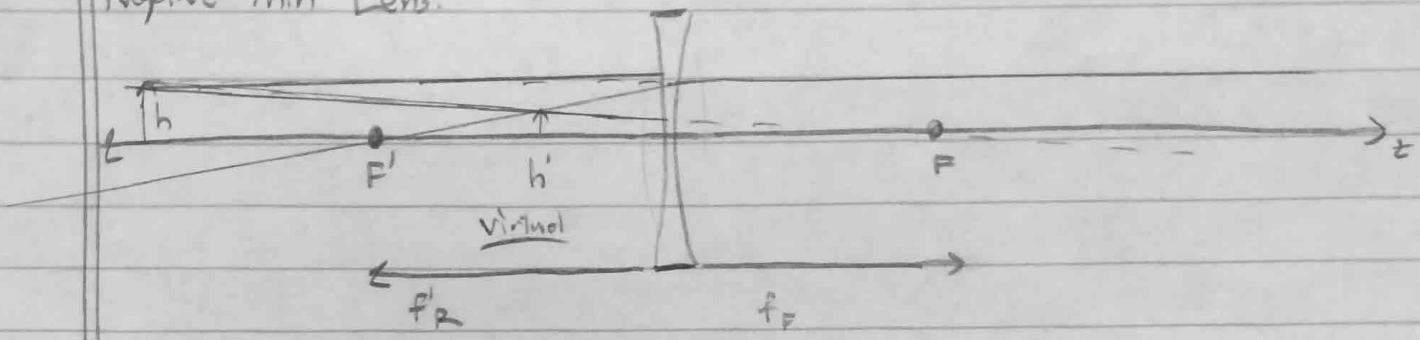
Positive Thin Lens:



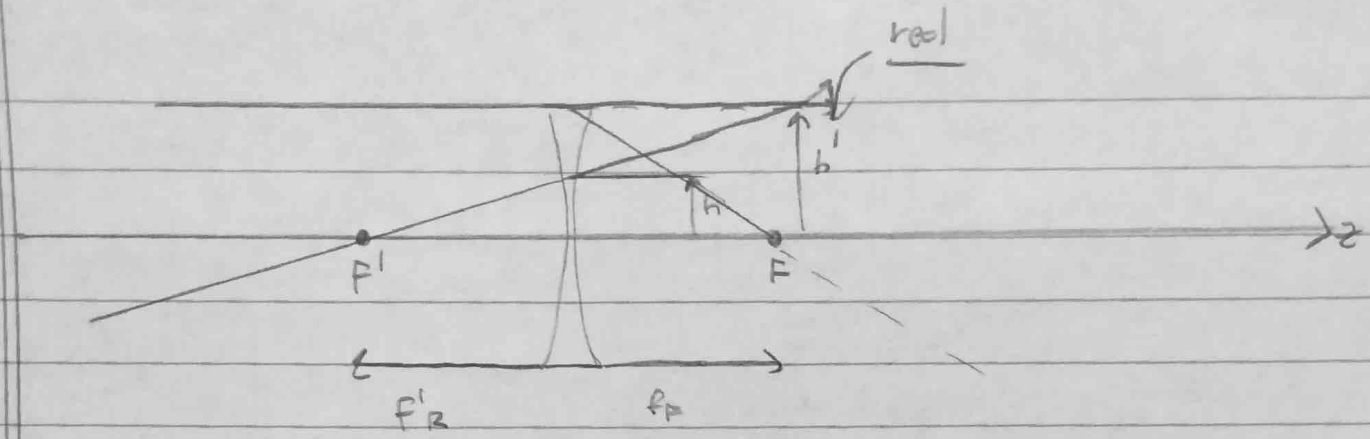
First draw a line from the object ∥ to the focal plane, through the lens, then through the rear focal point.
Next draw a line from the object through the focal point to the lens, then ∥ to the focal plane.
The location & size of the object are found where these two lines cross.

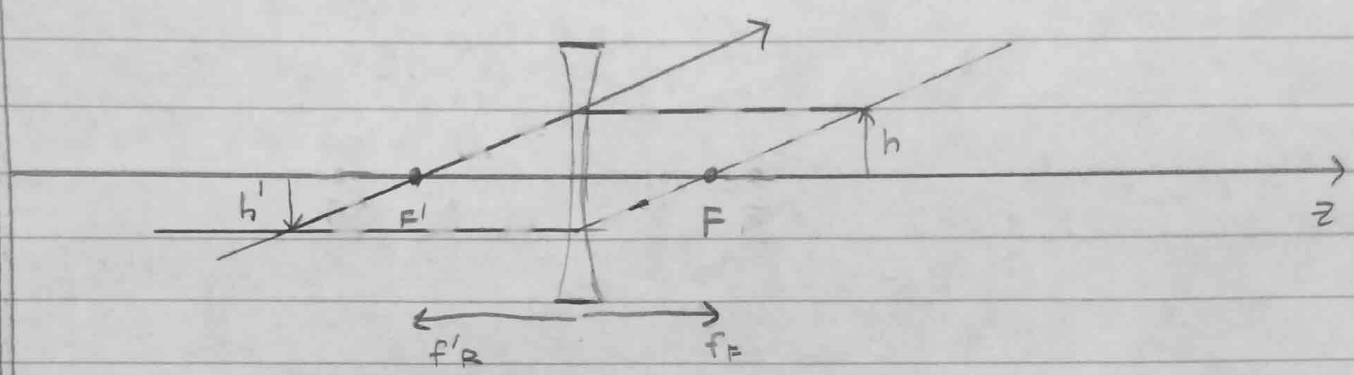
The image is real since it is to the right of the lens

Negative Thin Lens.

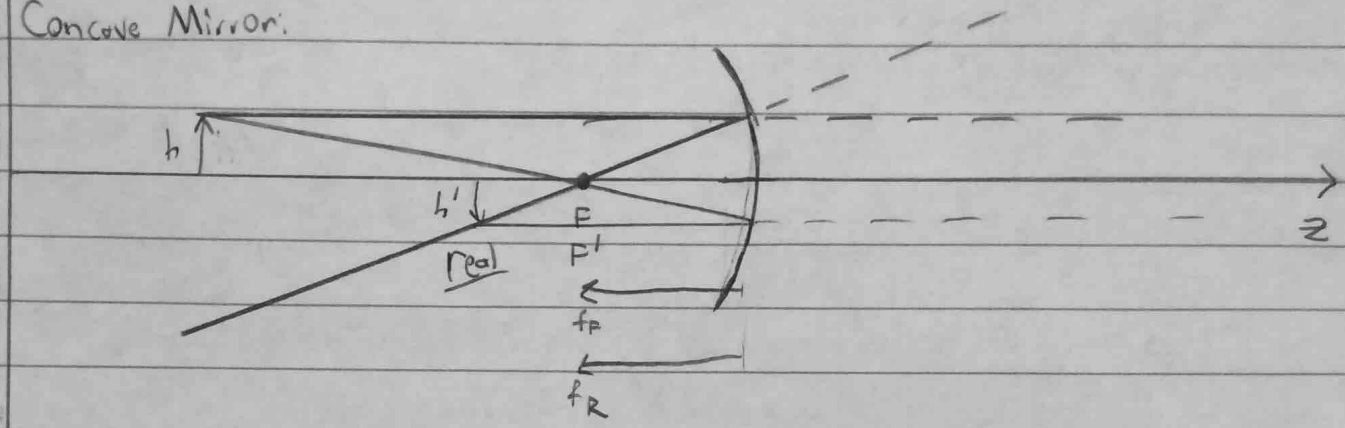


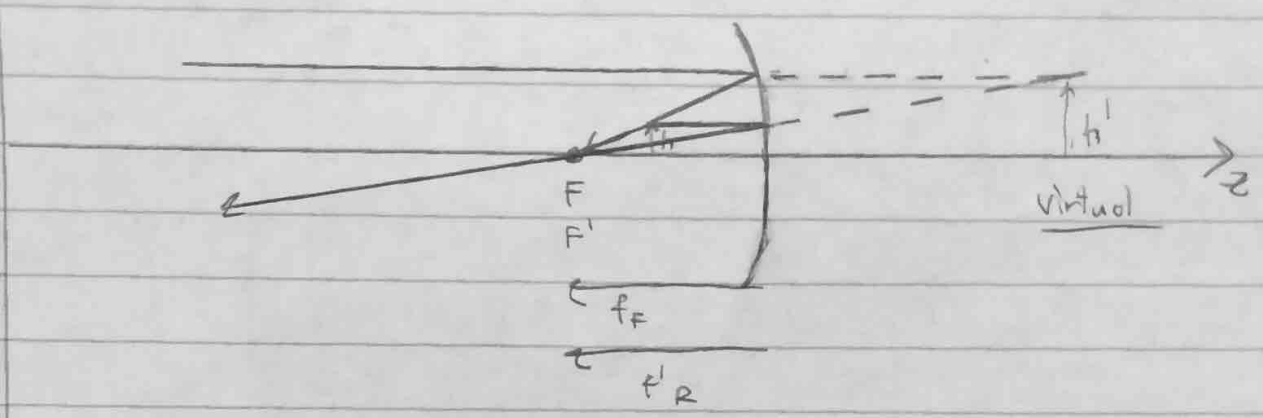
Same rules as positive, just F and F' have switched their orientation around the lens

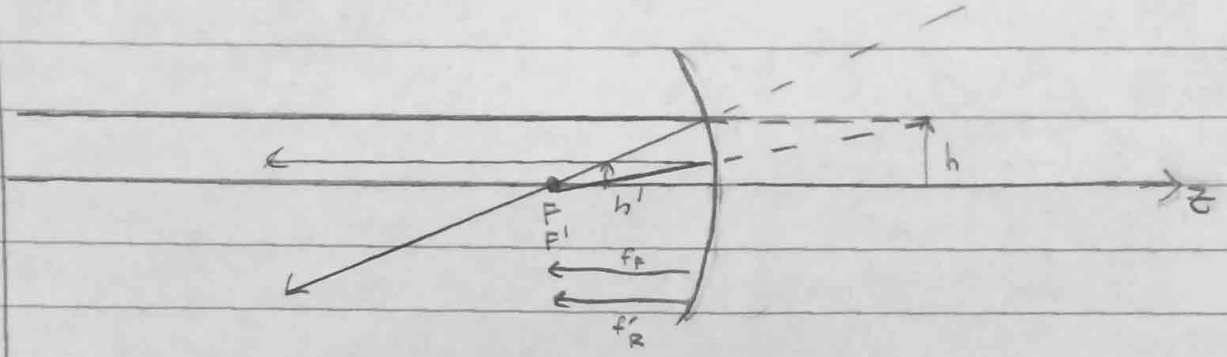

real
h'
h
z
F'
F
F'R
fP


h
h'
F'
F
z
f'R
fF

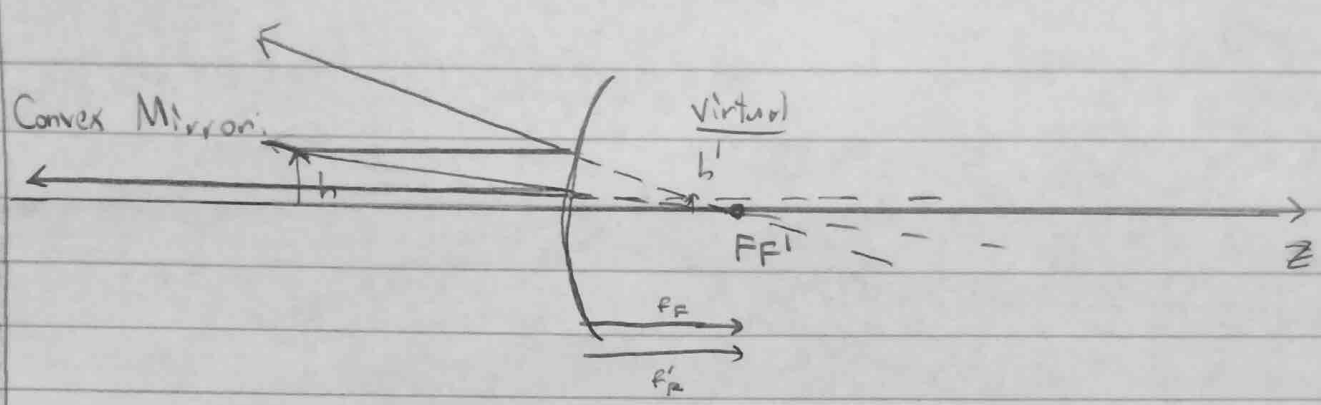
Concave Mirror.

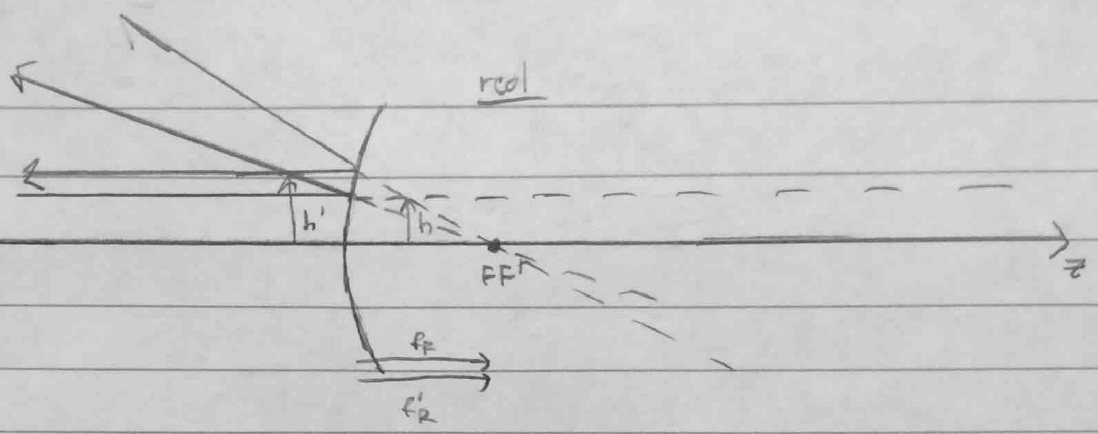


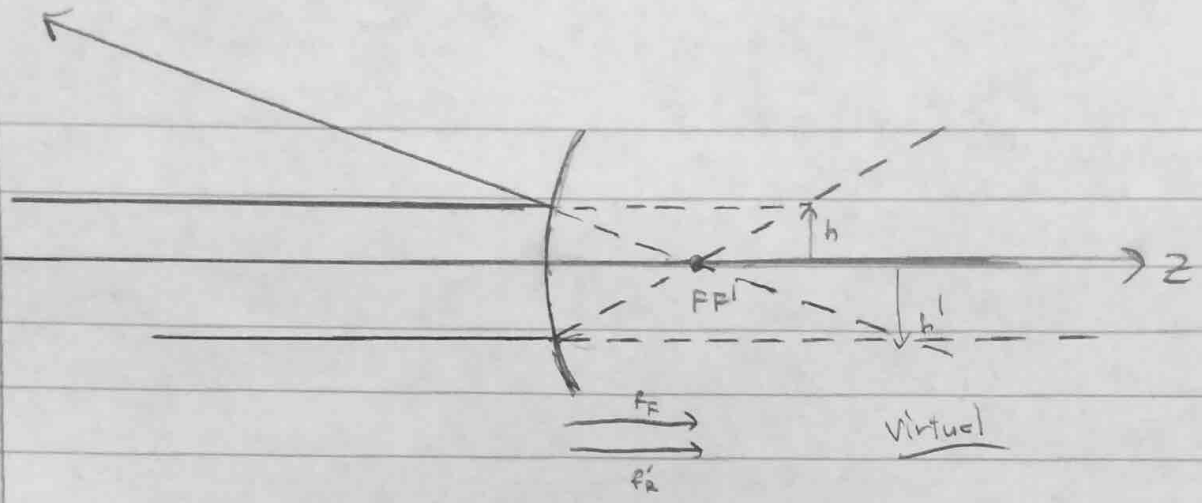

h
h'
F
F'
z
virtual
f_F
f'_R



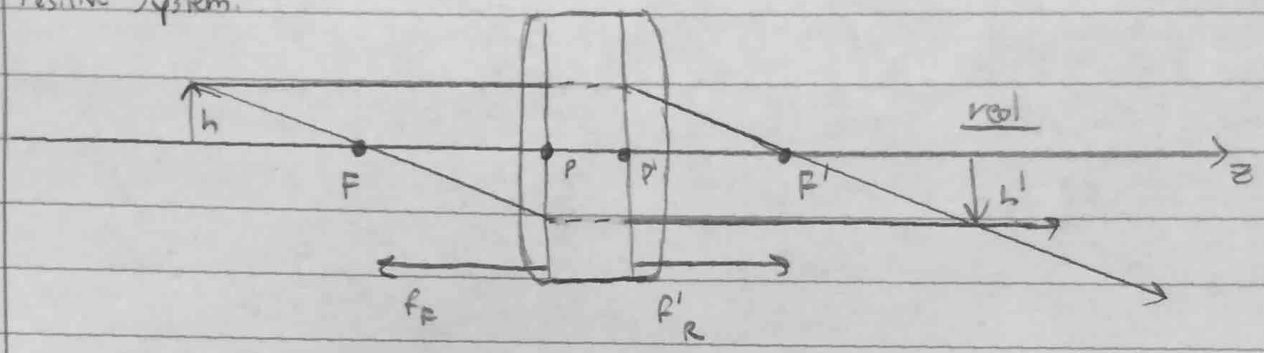
real

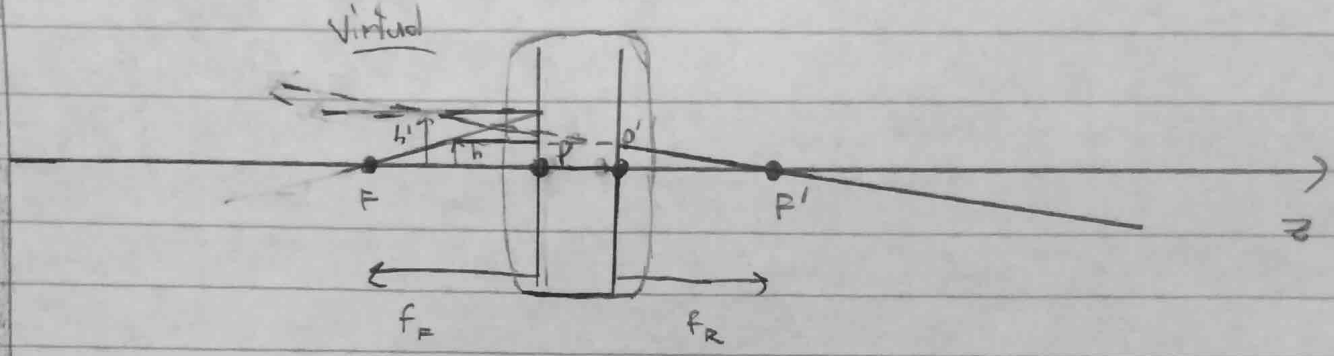

Convex Mirror
h
virtual
b'
FF'
z
f_F
$f'_{F'}$

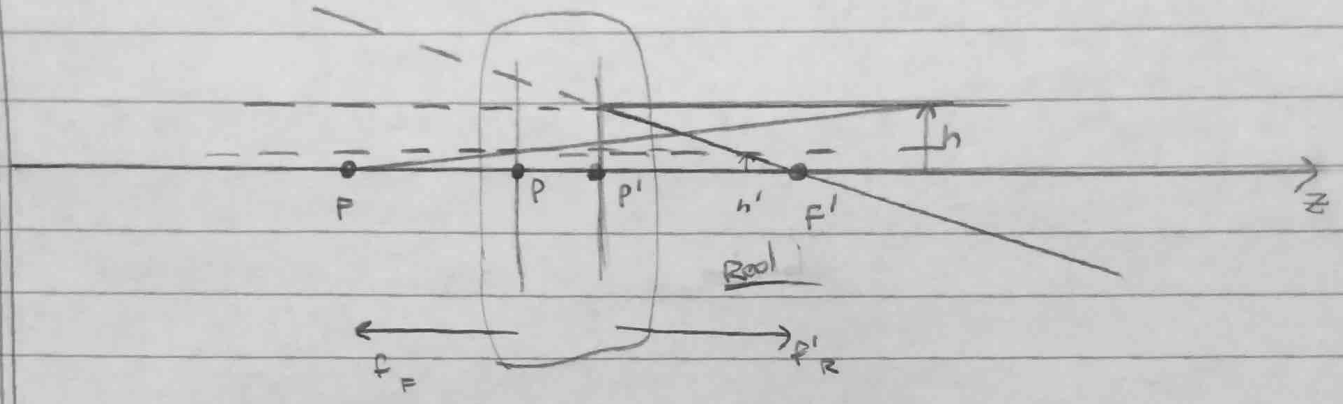

real
h'
h''
FF
z
f_F
f'_R


h
z
FP'
h'
f_F
f'_2
Virtuel

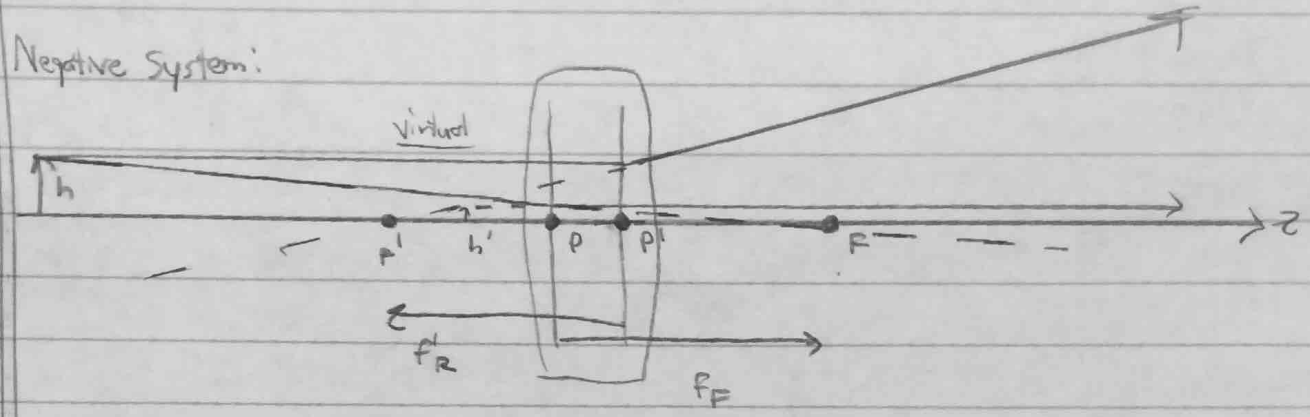
Positive System:

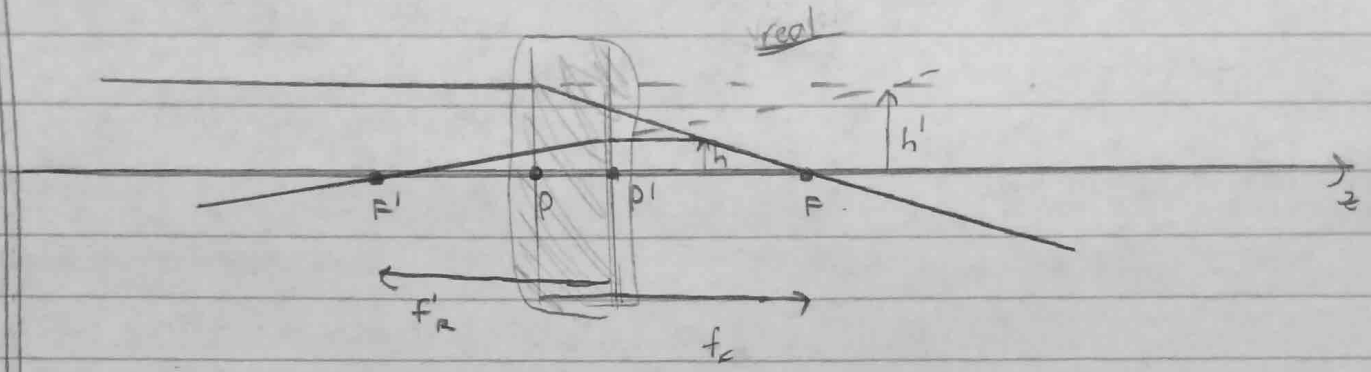


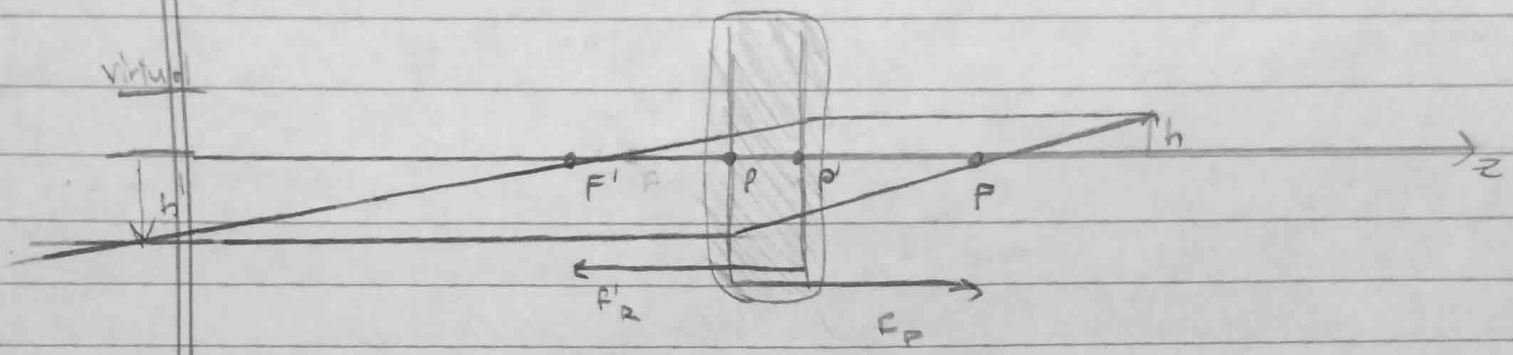

Virtual
h'
h
P
P'
F
P'
z
f_F
f_R


h
P
P
P'
h'
F'
z
Rool
f_F
f'_R

Negative System:




real
h'
h
F'
P
P'
F
z
f'R
fc


virtual
h'
F'
P
P'
F
h
z
F'R
FP