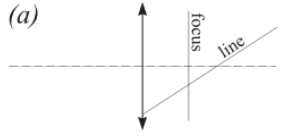
3. Tilt-shift lens (6 pts)

1) Show that an image of a straight line created by a thin lens is also a straight line. Consider two-dimensional geometry only, i.e. assume that the main optical axis and the straight line lay in the same (x, y) surface. Hint: use the coordinate system, where the origin coincides with the center of the lens and represent lines algebraically, e.g. $y = ax + b$. Make use of the formula of thin lens $f^{-1} = x^{-1} - x'^{-1}$ ($x > 0$ and x' are the x-coordinates of a point and its image, respectively) (2 pts).

2) In figure *(a)*, draw the image of the given line and indicate, which parts of the image are virtual, and which are real (2 pts).



3) Photographer wants to take a photo of a field of flowers. In order to get image where all the flowers (both the close and far ones) are sharp, he has to use a lens with tilt-shift (TS) capabilities (either an ordinary camera with TS lens, or a large-format camera, where the entire lens compartment can be freely positioned). The field of flowers (which extends effectively to infinity) and the image of its distant edge, together with the image plane are depicted in figure *(b)*. Reconstruct the position of the lens, the focal length of which is provided as a scale (2 pts).

