39. (a) The discussion in the textbook of the refracting telescope (a subsection of §35-7) applies to the Newtonian arrangement if we replace the objective lens of Fig. 35-18 with an objective mirror (with the light incident on it from the right). This might suggest that the incident light would be blocked by the person's head in Fig. 35-18, which is why Newton added the mirror M' in his design (to move the head and eyepiece out of the way of the incoming light). The beauty of the idea of characterizing both lenses and mirrors by focal lengths is that it is easy, in a case like this, to simply carry over the results of the objective-lens telescope to the objective-mirror telescope, so long as we replace a positive f device with another positive f device. Thus, the converging lens serving as the objective of Fig. 35-18 must be replaced (as Newton has done in Fig. 35-44) with a concave mirror. With this change of language, the discussion in the textbook leading up to Eq. 35-15 applies equally as well to the Newtonian telescope: $m_\theta = -f_{\text{ob}}/f_{\text{ey}}$.

(b) A meter stick (held perpendicular to the line of sight) at a distance of 2000 m subtends an angle of

$$\theta_{\text{stick}} \approx \frac{1\,\text{m}}{2000\,\text{m}} = 0.0005 \text{ rad} .$$

Multiplying this by the mirror focal length gives $(16.8\,\text{m})(0.0005) = 8.4$ mm for the size of the image.

(c) With $r = 10$ m, Eq. 35-3 gives $f_{\text{ob}} = 5$ m. Plugging this into (the absolute value of) Eq. 35-15 leads to $f_{\text{ey}} = 5/200 = 2.5$ cm.