45. (a) We use Eq. 35-10, with the conventions for signs discussed in §35-5 and §35-6.

(b) For the bi-convex (or double convex) case, we have

$$f = \left[(n-1)\left(\frac{1}{r_1} - \frac{1}{r_2}\right)\right]^{-1} = \left[(1.5-1)\left(\frac{1}{40\,\text{cm}} - \frac{1}{-40\,\text{cm}}\right)\right]^{-1} = 40\ \text{cm}\ .$$

Since $f > 0$ the lens forms a real image of the Sun.

(c) For the planar convex lens, we find

$$f = \left[(1.5-1)\left(\frac{1}{\infty} - \frac{1}{-40\,\text{cm}}\right)\right]^{-1} = 80\ \text{cm}\ ,$$

and the image formed is real (since $f > 0$).

(d) Now

$$f = \left[(1.5-1)\left(\frac{1}{40\,\text{cm}} - \frac{1}{60\,\text{cm}}\right)\right]^{-1} = 240\ \text{cm}\ ,$$

and the image formed is real (since $f > 0$).

(e) For the bi-concave lens, the focal length is

$$f = \left[(1.5-1)\left(\frac{1}{-40\,\text{cm}} - \frac{1}{40\,\text{cm}}\right)\right]^{-1} = -40\ \text{cm}\ ,$$

and the image formed is virtual (since $f < 0$).

(f) In this case,

$$f = \left[(1.5-1)\left(\frac{1}{\infty} - \frac{1}{40\,\text{cm}}\right)\right]^{-1} = -80\ \text{cm}\ ,$$

and the image formed is virtual (since $f < 0$).

(g) Now

$$f = \left[(1.5-1)\left(\frac{1}{60\,\text{cm}} - \frac{1}{40\,\text{cm}}\right)\right]^{-1} = -240\ \text{cm}\ ,$$

and the image formed is virtual (since $f < 0$).