7. BURNING WITH A LENS (7 points)

Sunrays are focused with a lens of diameter $d = 10\,\mathrm{cm}$ and focal length of $f = 7\,\mathrm{cm}$ to a black thin plate. Behind the plate is a mirror. Angular diameter of the Sun is $\alpha = 32'$ and its intensity on the surface of the Earth is $I = 1000\,\mathrm{W/m^2}$, Stefan-Boltzmann constant $\sigma = 5.670 \times 10^{-8}\,\mathrm{W/(m^2K^4)}$.

i) *(4 points)* Find the temperature of the heated point of the plate.

ii) *(3 points)* Using thermodynamic arguments, estimate the maximal diameter of the lens for which this model can be used.