Exercise: Angular resolution

Car headlights in the distance:

What is the maximum distance L you can be from an oncoming car at night, and still distinguish its two headlights, which are separated by a distance d = 1.5 m? Assume that your pupils have a diameter D = 2 mm at night, and that the wavelength of light is λ = 550 nm.

Use Rayleigh's criterion: $\alpha_c = 1.22\frac{\lambda}{D} = 3.4\times10^{-4}$ (radians)

Then, $L \approx d/\alpha_c$ = 4500 m = 2.8 miles (assuming perfect eyes).

The small angle approximation is valid.