Part (a)

The distance between the lens of your eye and the retina is 24mm, rod cells exist in the retina and have a pixel size p = 5 um. What is the angular size corresponding to a single rod cell?

Part (b)

Your dilated pupils have a diameter of 8mm. Assuming airy-disk diffraction, is the resolution of your eyes diffraction-limited at 550nm?

Part (c)

What is the farthest distance a sun-like star could be from your eye and still be resolved? Is anything surprising about this distance? (Assume 550nm light)

Part (d)

We can see stars other than the sun, and they have (some) perceptible width. Light from a single near point-like star must be hitting several rod cells. Explain how this is possible based on the values we calculated.

Part (e)

Assume the light from a star is spread evenly over your retina in a circle with diameter equal to your diffraction limited resolution (a poor approximation), and that each rod cell needs to be struck by 6 photons per second to ‘see’ (you ate a lot of carrots as kid, the real value is closer to 6 per 0.1 second). What is the faintest apparent magnitude a star can be and still be perceived? Recall that the flux from a 0 mag star is about 10^6 visible photons /s/cm^2.