Custom Problem #7:

A double slit of slit separation 0.5 mm is illuminated by a parallel beam from a helium-neon laser that emits monochromatic light of wavelength 6328 Å. Five meters beyond the slits is a screen. What is the separation of interference fringes on the screen?

Custom Problem #8:

A diffraction-limited laser beam of diameter 1 cm is pointed at the moon. What is the diameter of the area illuminated on the moon? (The moon is 240,000 miles away.) Take the light wavelength to be 6328 Å. Neglect scattering from the earth's atmosphere.

Custom Problem #9:

A plane slab of glass of thickness T and index of refraction n is inserted between an observer's eye and a point source. Show that the point source appears to be displaced to a point closer to the observer by approximately [(n-1)/n]T. Use small-angle approximations.

Custom Problem #10:

We have often said that the traveling wave from a distant point source is "like" a plane wave over a "limited region" transverse to the line of sight from the point source to the field point. How limited is the region? Suppose the source is at distance L and we wish to consider a circular plane region of radius R transverse to the line of sight from the source. How large can R be so that the phase at the center of the circle and that at the edge of the circle differ by less than π radians?

ANSWER: The phase at the center of the circle is ahead of that at the edge (the center is closer to the source) by an amount $\Delta\phi = kR^2/L$. Thus the phase is "the same" over the entire plane of the circle to the extent that the area of the circle is small compared to $L\lambda$.