OPTICS

Problem Sheet 1

1. Consider three small square mirrors, one in the x-y plane, the other in the y-z plane and the third on the y-z plane, with one corner of each at the origin. Assume the sides of each mirror is a. Show that a light beam along $\vec{n}$ which hits one of the mirrors and gets reflected by the other two goes back along $-\vec{n}$.

(This was used to determine the distance to Moon by dropping several mirrors on Moon's surface and use a laser beam to get the reflection. The time lag gives the distance.)

2. The Greek astronomers obtained Earth-Moon distance using total lunar eclipse . Assume the total time of the totality is 98 minutes. Further assume the Sun and the Moon subtend an angle of 32' at Earth. Assuming the earth sun distance is very large compared to Earth's radius, Earth-Moon distance and the distance of the shadow cast by the Earth, determine the Earth Moon distance assuming the earth's radius is 6400 km

3. Experiments to be done at home.

Take a small mirror of dimension $\approx 3" \times 3"$ (It need not be a square one. All you need is a mirror which is not circular in shape. If you do not have a small mirror, you can cover a larger one by paper.) Point it to the Sun get it's reflection on a sheet of paper (or cardboard) and you will see it having the shape of the mirror with magnification. On the other hand, if you can look at the reflection on a wall which is at a distance of the order of 10 metres, you will see as bright circularly shaped spot . Explain why this happens. (Explain this even if you have not performed the experiment yourself)

Reading assignment
Not for submission
Introduction to Electrodynamic by D.J. Griffiths
Sections 2.4.3,7.2.4,8.1 and 8.2.
Try and read them in a period of two weeks.