

**Mathematics 309 — Spring 2004 — Second homework**

Due Wednesday, January 21.

You will need to use a computer for this assignment.

1. Place a hemi-spherical crown glass lens ( $n = 1.5$ ) facing left, centred at  $(0, 0)$ , radius 1. Trace horizontal red rays leaving from  $x = -2$  at  $y = 0, \pm 0.1, \pm 0.2, \pm 0.3, \pm 0.4, \pm 0.5$  up until they cross the  $x$ -axis on the other side of the lens.
2. Same for red rays leaving  $(-10, 0)$  with angles  $0, \pm 0.01, \pm 0.02, \pm 0.03, \pm 0.04, \pm 0.05$  (in radians).
3. Same for red rays leaving  $(-10, 0.1)$  with angles  $0, \pm 0.01, \pm 0.02, \pm 0.03, \pm 0.04, \pm 0.05$  (in radians), but now up until  $x = 3$ .
4. Trace horizontal red rainbow rays entering a water drop of radius 1 centred at  $(0, 0)$  starting at  $(-2, y)$  with  $y = 0, y = 0.1, 0.2, \dots, 0.9$ . all the way back to  $x = -2$ .