Answers to Chapter 13 Homework:

13. 1 – Lens

#2 . A converging lens is thickest in the middle and parallel light rays will converge to a single point after going through a converging lens. Whereas a diverging lens is thickest at the ends and light rays will spread out (diverge) after going through this lens.

#3
a) Light actually refracts going into the lens (air→glass) and when leaving the lens (glass→air).
b) We are interested in what light does going into the lens and what it does leaving the lens. For relatively thin lens we can assume the light refracts just once in the centre of the lens (at axis of symmetry) and that is good enough for now.

4. A converging lens has a focal point (a focus) where the light converges. But if I run the light through the opposite way, it has another focal point. We call these f and f' . The focal point (f) is found after light goes through lens. The secondary focal point (f') is found on the incident side of light. Both f and f' are same distance from optical centre (O)

5. If I felt a converging lens, it would be thickest in the middle. It would 'bulge' in the middle.
If I felt a diverging lens, it would be thickest at the edges. It would be skinny in the middle. Yes I could tell them apart by just feeling them.

6. a) with a convergin lens, the principal focus is on the opposite side of the lens to the incident rays.
b) for a diverging lens, the principal focus is on the same side of the lens as the incident rays. (you need to trace back the diverging light to find the f.
c) a diverging lens is different from a converging lens in the way that light refracts as it exits the lens.

13.3 Images in Lens

5. A diverging lens never produces a real image because the actual light rays never converge. They always diverge. We find a virtual image by tracing them backwards to where our eye images they come from.

6. A diverging virtual image is always SMALLER than the object. A converging virtual image is always LARGER than the object (magnifying glass!).

7. For both types of lens, if the image is virtual, then it is also UPRIGHT. For converging lenses, a real image is always UPSIDE DOWN.

8. a) a traditional movie theatre projector must be a converging lens because the image is LARGER and UPRIGHT.
b) …you draw..should be light Fig. 3 c) on page 559. The objects on film must be upside down so you see the image right side up!
c) S = LARGER A = UPRIGHT L = BEHIND lens T = REAL (can catch on screen)

13.4 Magnification Formula

13.6 Human Eye