# Exercises for Experimental Physics 3 – IPSP

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# Exercise Sheet 9 (WS 2012/13)

Date of Issue to Students:     Dec. $7^{th}$ 2012

**Date of Submission:   Dec. $14^{th}$ 2012**

**Submission Place:** Marked mailbox next to room 302 (Linnestr. 5)
**Submission Time:** 11:00 a.m. at the submission day noted above

Please note: Write your name and matriculation number on EACH sheet of paper.
Only submit the calculations and results for exercise 1-3, exercise 4 will be discussed during the instruction classes.

**Exercises:**

1. A concave mirror has a radius of curvature equal to 24 cm. Use ray diagrams to locate the image, if it exists, for an object near the axis at distances of (a) 55 cm, (b) 24 cm, (c) 12 cm, and (d) 8.0 cm from the mirror. For each case, state whether the image is real or virtual; upright or inverted; and enlarged, reduced, or the same size as the object. (6 Points)

2. A very long 1.75-cm-diameter glass rod has one end ground and polished to a convex spherical surface that has a 7.20-cm radius. The glass material has an index of refraction of 1.68. (a) A point object in air is on the axis of the rod and 30.0 cm from the spherical surface. Find the location of the image and state whether the image is real or virtual. (b) Repeat Part (a) for a point object in air, on the axis, and 5.00 cm from the spherical surface. Draw a ray diagram for each case. (6 Points)

3. An object is 17.5 cm to the left of a lens that has a focal length of +8.50 cm. A second lens, which has a focal length of -30.0 cm, is 5.00 cm to the right of the first lens. (a) Find the distance between the object and the final image formed by the second lens. (b) What is the overall magnification? (c) Is the final image real or virtual? Is the final image upright or inverted? (Points 8)

4. The following four thin lenses are made of glass that has an index of refraction of 1.5. The radii given are magnitudes. Make a sketch of each lens and find each focal length in air: (a) double-convex that has radii of curvature equal to 15 cm and 26 cm, (b) plano-convex that has a radius of curvature equal to 15 cm, (c) double concave that has radii of curvature equal to 15 cm, and (d) planoconcave that has a radius of curvature equal to 26 cm.