HW 5 Hand-in problems due Friday 2/23.

1. Your pet hamster is 40 cm in front of a converging lens with a focal length of 20 cm.
   a) Use ray tracing (use all three principal rays) to determine the location of the image. You will be making arguments based on this figure so make it as carefully and as much to scale as possible (you must use rulers and/or graph paper—see class site for graph paper if needed).
   b) Is the image upright or inverted? Argue from your figure.
   c) Is the lateral magnification greater than, less than, or equal to 1? Argue from your figure.
   d) Is the image real or virtual? Argue from your figure.

2. You are working on the psychology of visual appearance of food on dieting. You argue that if people see images of food magnified or reduced in size, it will affect how much they actually eat. For one of your test cases, a meal is placed 30 cm in front of a diverging lens with a focal length of -30 cm.
   a) Use ray tracing (use all three principal rays) to determine the location of the image. You will be making arguments based on this figure so make it as carefully and as much to scale as possible (you must use rulers and/or graph paper—see class site for graph paper if needed).
   b) Is the image upright or inverted? Argue from your figure.
   c) Is the lateral magnification greater than, less than, or equal to 1? Argue from your figure.
   d) Is the image real or virtual? Argue from your figure.

3. You have a spherical mirror. Show that the focal length is ½ the radius of curvature for paraxial rays. Start out by drawing a picture showing the mirror and the center of curvature and consider a ray that is coming in parallel to the axis (you may refer to figure 34.45 to guide your figure). Then using only geometry, trig, and $\theta_i = \theta_r$, follow the ray through its interaction with the mirror and find where it crosses the axis.