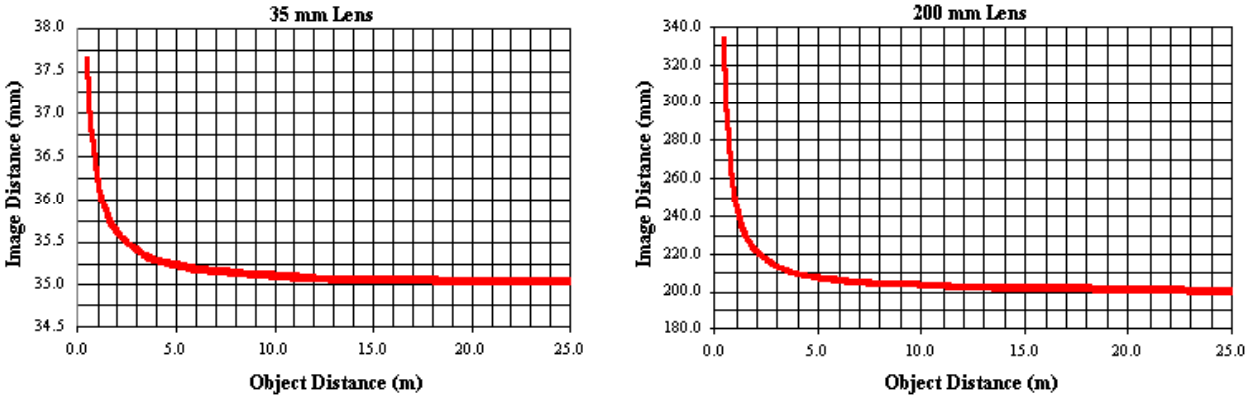
Depth of Field

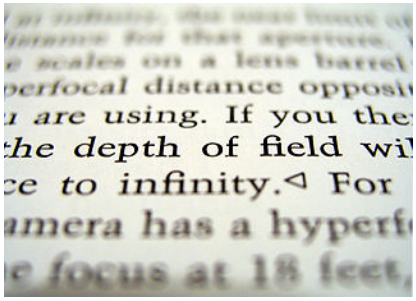
Lenses form images of objects a predictable distance away from the lens. The distance from the image to the lens is the **image distance**. Image distance depends on the **object distance** (distance from object to the lens) and the **focal length** of the lens. **Figure 1** shows how the image distance depends on object distance for lenses with focal lengths of 35 mm and 200 mm.

Figure 1: Dependence Of Image Distance Upon Object Distance



Cameras use lenses to focus the images of object upon the film or exposure medium. Objects within a photographic scene are usually a varying distance from the lens. Because a lens is capable of precisely focusing objects of a single distance, some objects will be precisely focused while others will be out of focus and even blurred. Skilled photographers strive to maximize the depth of field within their photographs. Depth of field refers to the distance between the nearest and the farthest objects within a photographic scene that are acceptably focused. **Figure 2** is an example of a photograph with a shallow depth of field.

Figure 2



One variable that affects depth of field is the f-number. The f-number is the ratio of the focal length to the diameter of the aperture. The aperture is the circular opening through which light travels before reaching the lens. **Table 1** shows the dependence of the depth of field (DOF) upon the f-number of a digital camera.

Table 1: Dependence of Depth of Field Upon f-Number and Camera Lens

	35-mm Camera Lens			200-mm Camera Lens		
f-Number	D_N (m)	D_F (m)	DOF (m)	D_N (m)	D_F (m)	DOF (m)
2.8	4.11	6.39	2.29	4.97	5.03	0.06
4.0	3.82	7.23	3.39	4.95	5.05	0.10
5.6	3.48	8.86	5.38	4.94	5.07	0.13
8.0	3.09	13.02	9.93	4.91	5.09	0.18
22.0	1.82	Infinity	Infinite	4.775	5.27	0.52

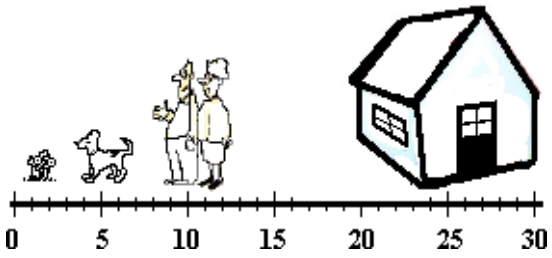
The D_N value represents the nearest object distance that is acceptably focused. The D_F values represent the farthest object distance that is acceptably focused.

Questions:

1. How does the location of an image change as an object moves further from the lens?
   a. The image moves closer to the lens.
   b. The image moves farther from the lens.
   c. The answer varies, depending upon the object distance.
   d. Nonsense! The image does not actually move.

2. Based on the information presented in **Figure 1** for 35-mm lenses, which range of object distances would present the greatest challenge for precisely focusing all images within the range?
   a. 2.5 m to 5.0 m
   b. 10.0 m to 12.5 m
   c. 15.0 m to 20.0 m
   d. 17.5 m to 25.0 m

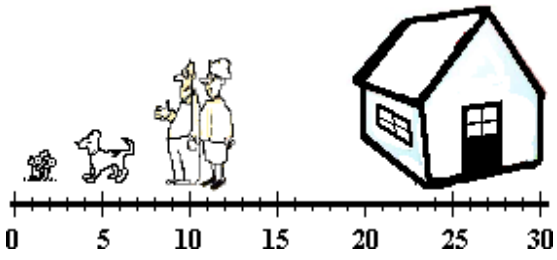
3. The diagram below includes a photographic scene with objects that are varying distances from the camera. The camera is positioned at 0 meters. What object will be acceptably focused if a 200-mm camera lens is used and the distance from lens to exposure medium is 208 mm?



   a. Flowers (at 1 m)
   b. Dog (at 5 m)
   c. People (at 10 m)
   d. House (at 25 m)

4. The lines of text in **Figure 2** are all different distances from the camera lens used to take the photograph. Which line seems to be the optimal distance from the lens such that it is acceptably focused?
   a. The line that reads "the depth of field wi…"
   b. The line that reads "…amera has a hyperf…"
   c. The line that reads "…focus at 18 feet …"
   d. All the lines seem to be acceptably focused.

5. A photographer is taking a picture of the scene at the right using a 35 mm camera lens. The scene includes flowers (at 1 meter), a dog (at 5 meters), people (at 10 meters) and a house (at 25 meters). The photographer stands at the 0-meter mark to take the photograph. Which of the subjects in the scene will be acceptably focused if the f-number is 22.0.



   a. Only the flowers.
   b. Only the dog.
   c. The flowers and the dog.
   d. The dog and the people.
   e. The dog, the people and the house.