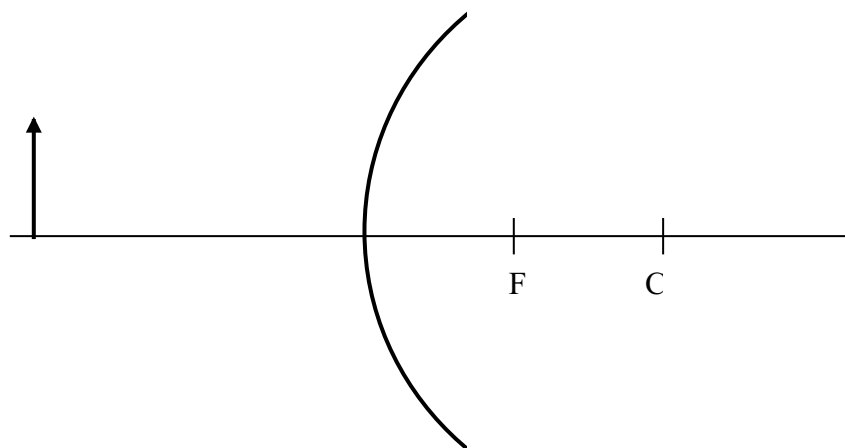
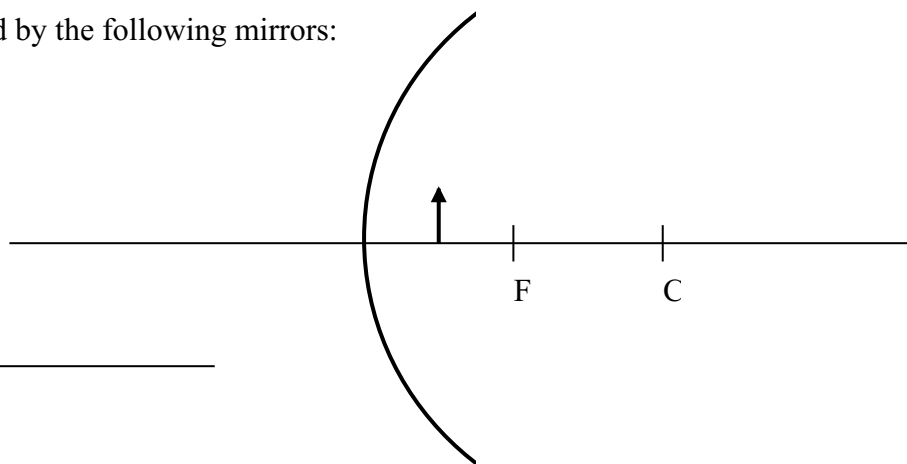
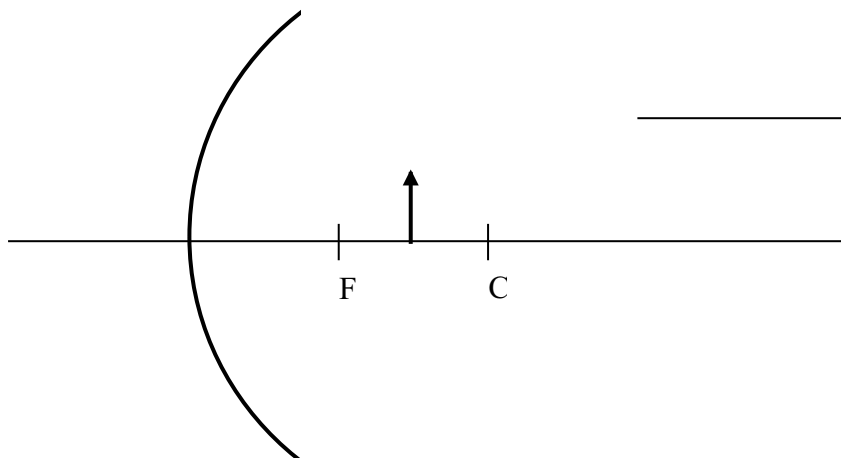


Definitions: Light, normal, law of reflection, law of refraction, refraction, total internal reflection, critical angle, focal point, magnification

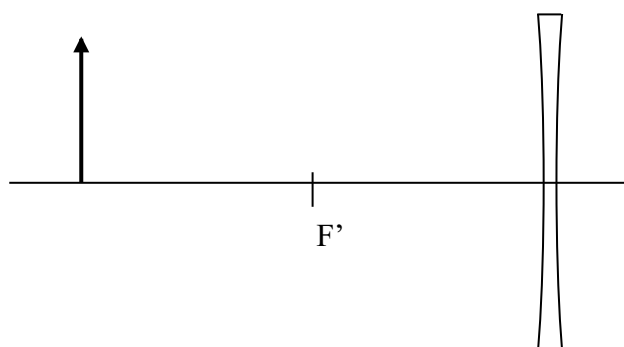
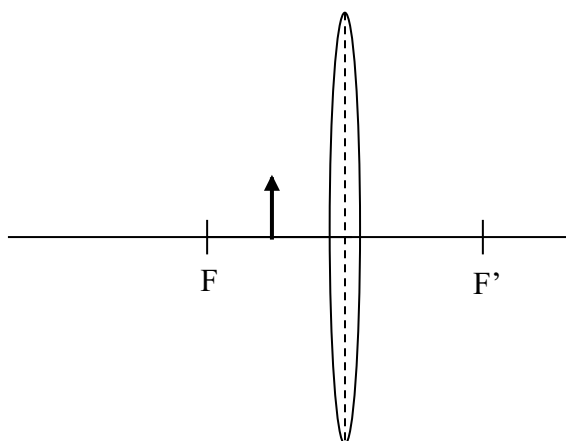
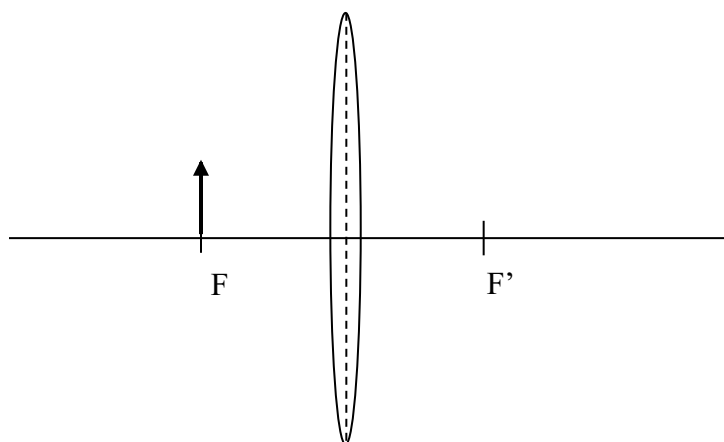
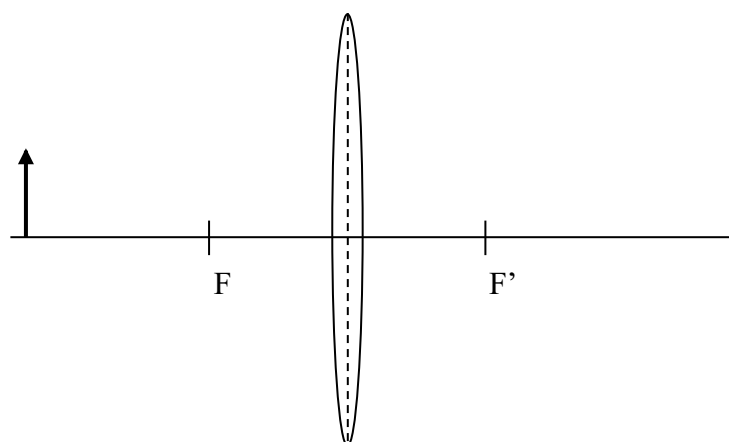
Problems: Know how to solve questions similar to the following:

1. A laser beam is shot at a comet in outer space and the beam is reflected off its shiny surface and returns to Earth. The entire process takes 22.4 seconds. How far away is the comet from Earth?
2. A ray of light is shone from water into diamond with an angle of incidence in water of 43° . Calculate the angle of refraction in diamond. ($n_{\text{diamond}} = 2.42$)
3. A scuba diver shines a light from underwater at an angle of 33° to the vertical. What angle will it emerge from the water into the air above? ($n_{\text{water}} = 1.33$; $n_{\text{air}} = 1.0003$)
4. A certain convex lens forms an image which is 86.0 cm from the lens, when a candle is placed 6.50 cm from the lens. What is the focal length of the lens, and what will be the magnification of the image?
5. A converging mirror of focal length 5.5 cm has an 11 cm candle placed 16 cm in front of it. By calculations only, locate and describe the image.
6. What is the critical angle for a laser beam which is in a glass fiber ($n = 1.52$) that is surrounded by water ($n=1.33$)?

7. Locate and describe the images created by the following mirrors:



8. Locate and describe the images created by the following lenses:



Use the diagrams in your textbook to help you with the following two problems.

9. Using a concave mirror, where can you place an object (relative to the center and focal point) so that the image is:
 - a. Real, and larger than the object?
 - b. Real, and the same size as the object?
 - c. Real, and smaller than the object?
 - d. Non-existent?
 - e. Virtual, and larger than the object?

10. Using a convex lens, where can you place an object (relative to the focal point) so that the image is:
 - a. Real, and larger than the object?
 - b. Real, and the same size as the object?
 - c. Real, and smaller than the object?
 - d. Non-existent?
 - e. Virtual, and larger than the object?

Short Answer Questions: Answer on separate page in complete sentences, so a reader can tell, from your answer, what was asked.

1. Explain how the human eyeball uses a lens to form images. What type of lens is it? Knowing what you know about object placement versus focal length, is there anywhere you can place an object in front of your eye and not be able to see an image?
2. What causes dispersion from a prism or a raindrop?
3. Side-view mirrors on a car are convex. What type of image will these types of mirrors produce?
4. Many vision problems occur when the eye's cornea and lens don't focus light onto the retina. Laser eye surgery reshapes the cornea of the eye. Using your knowledge of refraction terminology (ie., focal length, object distance, image distance, etc.) choose one vision problem, and describe how reshaping the cornea fixes a particular vision problem.
5. Fiber optic cables allow for the transportation of information at the speed of light. Explain how fiber optic cables work, and how they can be able to bend light around objects in the ground.
6. As a gifted spear fisherperson, you have the ability to stand on the river bank and see fish under water. In order to aim your spear correctly you need to know a little bit about refraction. Explain why you can't aim directly at the fish.