Name_____

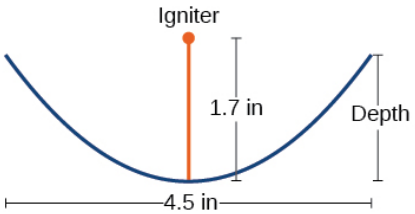
# Precalculus: Conic Section Applications

1. A satellite dish is shaped like a paraboloid of revolution. The signals that emanate from a satellite strike the surface and are reflected to a single point, where the receiver is located. If the dish is 10 feet across at its opening and is 4 feet deep at its center, at what position should the receiver be placed?

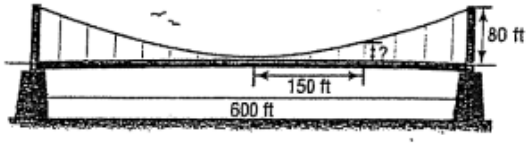
2. A cross-section of a design for a travel-sized solar fire starter is shown in the figure. The sun's rays reflect off the parabolic mirror toward an object attached to the igniter. Because the igniter is located at the focus of the parabola, the reflected rays cause the object to burn in just seconds.

   Find the equation of the parabola that models the fire starter. Assume that the vertex of the parabolic mirror is the origin of the coordinate plane.

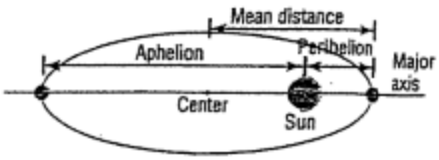
   Use the equation found above to find the depth of the fire starter.




3. The cables of a suspension bridge are in the shape of a parabola. The towers supporting the cable are 600 feet apart and 80 feet high. If the cables touch the road surface midway between the towers, what is the height of the cable at a point 150 feet from the center of the bridge?



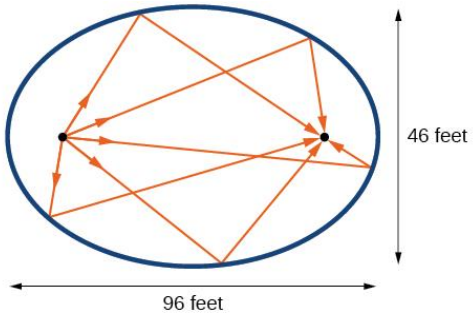

4. The aphelion of Jupiter (greatest distance) from the sun is 507 million miles. If the distance from the sun to the center of its elliptical orbit is 23.2 million miles, what is the perihelion (the shortest distance)? Write an equation for the orbit of Jupiter around the sun.



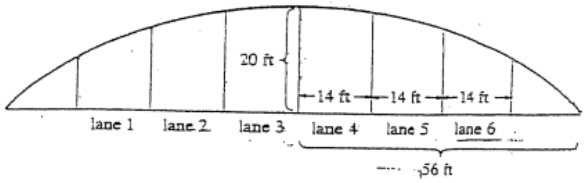

5. The Statuary Hall in the Capitol Building in Washington, D.C. is a whispering chamber. Its dimensions are 46 feet wide by 96 feet long as shown in figure.

   What is the standard form of the equation of the ellipse representing the outline of the room? Hint: assume a horizontal ellipse, and let the center of the room be the point (0,0). (0,0).

   If two senators standing at the foci of this room can hear each other whisper, how far apart are the senators? Round to the nearest foot.



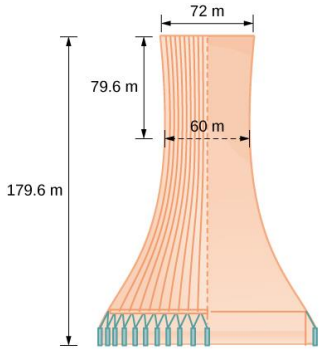
6. The roof of a highway tunnel is constructed in the form of elliptical arches (see the figure below). Each of the six lanes is 14 feet wide. Using the measurements in the figure, determine the vertical clearance in each lane; that is, determine how tall a truck can be to drive through without hitting any part of the roof.




7. The eccentricity of a hyperbola is defined by the equation *e* = distance between foci / distance between vertices. Explain why the eccentricity of any hyperbola is greater than 1. Use complete sentences.

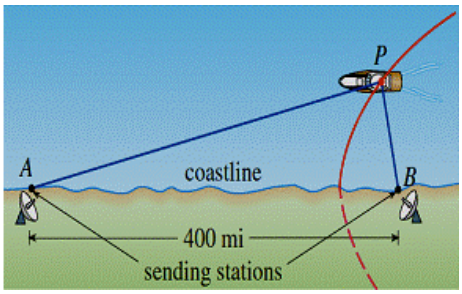
8. Some nuclear power plants utilize "natural draft" cooling towers in the shape of a hyperboloid, a solid obtained by rotating a hyperbola about its conjugate axis. Suppose such a cooling tower has a base diameter of 400 feet and the diameter at its narrowest point, 360 feet above the ground, is 200 feet. If the diameter at the top of the tower is 300 feet, how tall is the tower?

9. The design layout of a cooling tower is shown in the figure. The tower stands 179.6 meters tall. The diameter of the top is 72 meters. At their closest, the sides of the tower are 60 meters apart. Find the equation of the hyperbola that models the sides of the cooling tower. Assume that the center of the hyperbola—indicated by the intersection of dashed perpendicular lines in the figure—is the origin of the coordinate plane. Round final values to four decimal places.




10. LORAN navigational transmitters A and B are located at (-130,0) and (130,0), respectively. A receiver, P, on a fishing boat somewhere in the first quadrant listens to the pair (A,B) of transmissions and computes the difference of the distance from the boat to A and B as 240 miles. Find the equation of the hyperbola on which P is located.

11. In the LORAN (Long Range Navigation) radio navigation system, two radio stations located at A and B transmit simultaneous signals to a ship located at P. The onboard computer converts the time difference in receiving these signals into a distance difference |PA| - |PB|, and this, according to the definition of a hyperbola, locates the ship on one branch of a hyperbola (see the figure). Suppose that station B is located 400 mi due east of station A on a coastline. A ship received the signal from B 1200 microseconds (ms) before it received the signal from A.




Assuming that radio signals travel at a speed of 980 ft/ms, find an equation of the hyperbola on which the ship lies.

If the ship is due north of B, how far of the coastline is the ship?

For problems 2, 5, 9, 11: Download for free at http://cnx.org/contents/fd53eae1-fa23-47c7-bb1b-972349835c3c@10.3