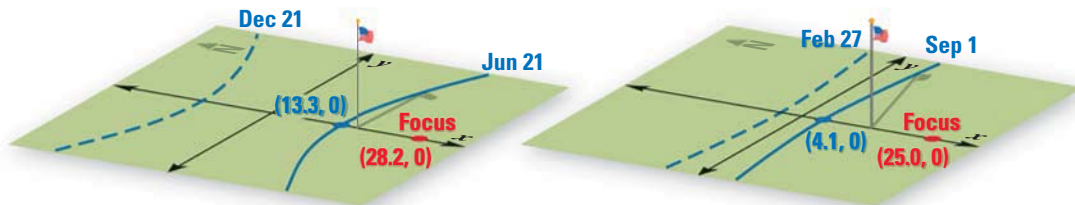
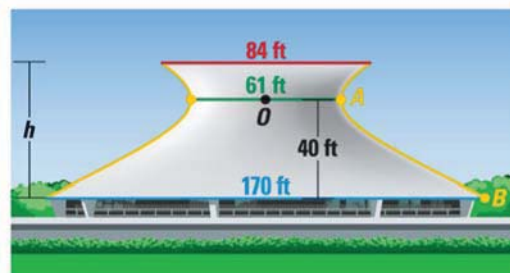


40. **SUN'S SHADOW** Each day, except at the fall and spring equinoxes, the tip of the shadow of a vertical pole traces a branch of a hyperbola across the ground. The diagram shows shadow paths for a 20 meter tall flagpole in Dallas, Texas.



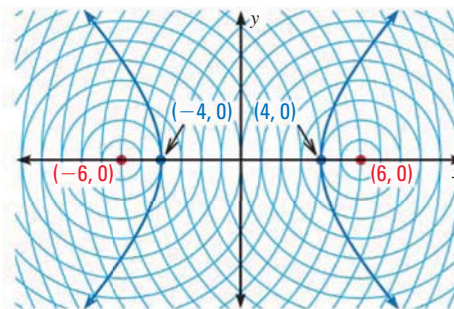
- Write an equation of the hyperbola with center at the origin that models the June 21 path, given that $a = 13.3$ meters and $c = 28.2$ meters.
- Write an equation of the hyperbola with center at the origin that models the September 1 path, given that $a = 4.1$ meters and $c = 25.0$ meters.

41. **MULTI-STEP PROBLEM** The roof of the St. Louis Science Center has a hyperbolic cross section with the dimensions shown.



- Suppose a coordinate grid is overlaid on the diagram with its origin at O , the center of the narrowest part of the roof. What are the coordinates of the points at A and B ?
 - Use your answers from part (a) to write an equation that models the cross section.
 - Find the total height h of the roof.
42. **MULTIPLE REPRESENTATIONS** A circular walkway is to be built around a statue in a park. There is enough concrete available for the walkway to have an area of 600 square feet.
- Writing an Equation** Let the inside and outside radii of the walkway be x feet and y feet, respectively. Draw a diagram of the situation. Then write an equation relating x and y .
 - Making a Table** Give four possible pairs of dimensions x and y that satisfy the equation from part (a).
 - Drawing a Graph** Graph the equation from part (a). What portion of the graph represents solutions that make sense in this situation?
 - Reasoning** How does the width of the walkway, $y - x$, change as both x and y increase? *Explain* why this makes sense.

43. **TAKS REASONING** Two stones dropped at the same time into still water produce circular ripples whose intersection points form hyperbolas with foci where the stones hit the water. The graph shows one hyperbola formed by stones dropped 12 feet apart with ripples at 1 foot intervals.



- Write an equation of this hyperbola.
- Use the definition of a hyperbola to explain why the graph shown is a hyperbola. (*Hint*: Examine the distances from each intersection point to the foci.)