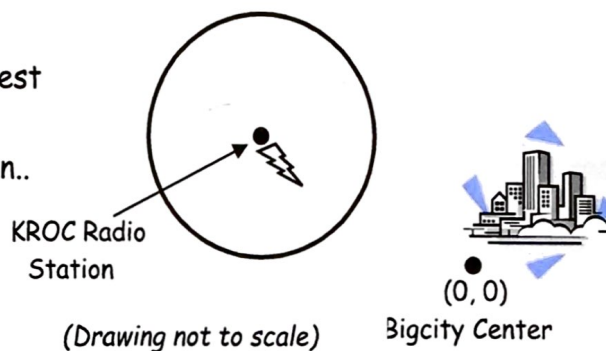


Conic Applications Worksheet

1. **Radio Waves** KROC radio station is 4 miles west and 6 miles north of the center of Bigcity. KROC can only be heard clearly 5.5 miles from the station.. Write an equation for the boundary where the radio station can be clearly heard.



2. **Sprinkler System** A sprinkler system shoots a stream of water that follows a parabolic path. The nozzle is fastened at ground level and water reaches a maximum height of 40 feet and a maximum horizontal distance of 180 feet from the nozzle. Find the equation that describes the path of the water. Use the location of the nozzle as the origin. How close to the nozzle can a $5\frac{1}{2}$ foot woman stand before completely blocking the spray?

3. **Whispering Gallery** Statuary Hall is an elliptical room in the United States Capitol in Washington D.C. This room, sometimes called the Whispering Gallery is 46 ft. wide and 96 ft. long. John Quincy Adams is said to have used the focusing properties of the room to overhear conversations.

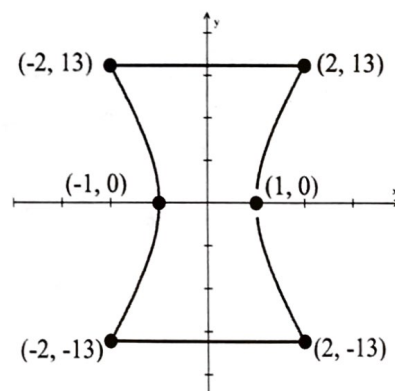
- Find an equation that models the shape of the room.
- What is the area of the floor of the room? (The area of an ellipse is $A = \pi ab$.)
- Where should the people stand to hear each other (that is - find the foci)

4. **Art.** A sculpture has a hyperbolic cross section (see figure).

- Write an equation that models the curved sides of the

sculpture. (Hint: It's NOT $\frac{x^2}{1} - \frac{y^2}{169} = 1$)

- Each unit in the coordinate plane represents 1 foot. Find the width of the sculpture at a height of 5 feet.



5. **Whispering Gallery.** Jim, standing at one focus of a whispering gallery, is 6 feet from the nearest wall. His friend is standing at the other focus, 100 feet away. What is the length of this whispering gallery? How high is its elliptical ceiling at the center?

6. **Semielliptical Arch Bridge.** The arch of a bridge is a semiellipse with a horizontal major axis. The span is 30 feet, and the top of the arch is 10 feet above the major axis. The roadway is horizontal and is 2 feet above the top of the arch. Find the vertical distance from the roadway to the arch at 5-foot intervals along the roadway.
7. **Semielliptical arch Bridge.** A bridge is to be built in the shape of a semielliptical arch and is to have a span of 100 feet. The height of the arch, at a distance of 40 feet from the center is to be 10 feet. Find the height of the arch at its center.
8. **Mars.** The mean distance of Mars from the Sun is 142 million miles. If the perihelion of Mars is 128.5 million miles, what is the aphelion? Write an equation for the orbit of Mars about the Sun. (page 659 in textbook shows Diagram)
9. **Jupiter.** The aphelion of Jupiter 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? What is the mean distance? Write an equation for the orbit of Jupiter around the Sun.
10. **Architecture** A semi-elliptical arch over a tunnel for a one-way road through a mountain has a major axis of 50 feet and a height at the center of 10 feet.
- Draw a coordinate system on a sketch of the tunnel with the center of the road entering the tunnel at the origin. Identify the coordinates of the known points.
 - Find an equation of the semi-elliptical arch over the tunnel.
 - You are driving a moving truck that has a width of 8 feet and a height of 9 feet. Will the moving truck clear the opening of the arch?
11. you and a friend live 4 miles apart on the same east-west street and you are talking on the phone to one another. You hear a clap of thunder from lightening in a storm, and 18 seconds later your friend hears the thunder. Find an equation that gives the possible places where the lightening could have occurred. Assume distances are measured in feet. $1 \text{ mile} = 5280 \text{ ft}$ and sound travels at 1100 ft/sec. (lightning problem page 669)
Example

Also complete page 702 # 77-83 all.

Conics Applications Worksheet – Answers

1. $(x+4)^2 + (y-6)^2 = 30.25$

Answers - Conic Applications WS

2. $y = -\frac{2}{405}(x-90)^2 + 40$; 6.416 ft

3. a) $\frac{x^2}{2304} + \frac{y^2}{529} = 1$; b) 3,468.318 ft c) 42.130 ft

4. a) $x^2 - \frac{3y^2}{169} = 1$; b) $x = .745$ ft

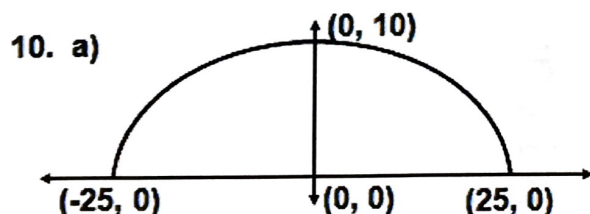
5. 112 ft long; 25.219 ft high

6.	Ft from center of bridge:	5	10	15
	Ht. of roadway above arch:	2.571	4.546	12

7. 16.666 ft high $\frac{x^2}{20,164} + \frac{y^2}{19,981.75} = 1$

8. Aphelion 155.5 million mi. $\frac{x^2}{483.8} + \frac{y^2}{233,524.2} = 1$

9. perihelion: 460.6 mill. mi.;
mean dist. 483.8 mill. mi.;



c) Yes, the truck will clear.

At 9 feet from the ground, the tunnel is 21.794 feet wide.

11. $\frac{x^2}{98,010,000} - \frac{y^2}{13,503,600} = 1$

Page 702

77) $\frac{1}{4}$ ft or 3 inches

78) 19.44 ft
17.78 ft
11.11 ft

79) 19.72 ft
18.86 ft
14.91 ft

80) The foci are located 8.78 ft in from each wall

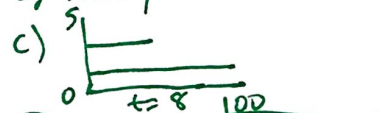
81) 450 ft.

82.

Train: $x = \frac{3}{2}t^2$
 $y = 1$ or any number

Mary: $x = 6(t-2)$
 $y =$ any number not in train. 3

b) mary won't catch train



83. a) $x = (80 \cos 35^\circ)t$
 $y = -16t^2 + (80 \sin 35^\circ)t + 6$
b) 2.9932 seconds c) 1.4339 s. 38.9 ft
d) 196.15 ft. e)

You and a friend live 4 miles apart (on the same “east-west” street) and are talking on the telephone. You hear a clap of thunder from lightning in a storm, and 18 seconds later your friend hears the thunder. Find an equation that gives the possible places where the lightning could have occurred (assume distances are measured in feet and sound travels at 1100 feet per second).

Application (2 of 3)

The difference in distances between you and the lightning and your friend and the lightning is

$$(18)(1100) = 19,800 \text{ feet.}$$

The locus of all points 19,800 feet closer to you than your friend will be one branch of the hyperbola

$$\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1.$$

Assume the center of the hyperbola is at the origin. You and your friend are at the foci located at

$$(\pm(2)(5280), 0) = (\pm 10560, 0) = (\pm c, 0).$$

Application (3 of 3)

Since the 4-mile (21,120-foot) distance between you and your friend can be thought of as

$$19,800 + 2(c - a)$$

then

$$19,800 + 2(10,560 - a) = 21,120$$

which implies $a = 9900$ and $a^2 = 98,010,000$ and thus

$$b^2 = c^2 - a^2 = (10560)^2 - (9900)^2 = 13,503,600.$$

The equation of the hyperbola is

$$\frac{x^2}{98,010,000} - \frac{y^2}{13,503,600} = 1.$$