3-5 Notes Graphs of Trig. Functions
Pre-Calculus

Name: _____

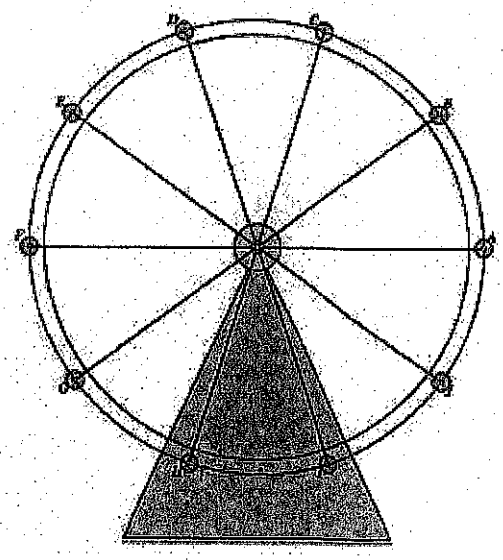
George W. Ferris' Day Off

A Develop Understanding Task

Perhaps you have enjoyed riding on a Ferris wheel at an amusement park. The Ferris wheel was invented by George Washington Ferris for the 1893 Chicago World's Fair.

Carlos, Clarita and their friends are celebrating the end of the school year at a local amusement park. Carlos has always been afraid of heights, and now his friends have talked him into taking a ride on the amusement park Ferris wheel. As Carlos waits nervously in line he has been able to gather some information about the wheel. By asking the ride operator, he found out that this wheel has a radius of 25 feet, and its center is 30 feet above the ground. With this information, Carlos is trying to figure out how high he will be at different positions on the wheel.

1. How high will Carlos be when he is at the top of the wheel? (To make things easier, think of his location as simply a point on the circumference of the wheel's circular path.)

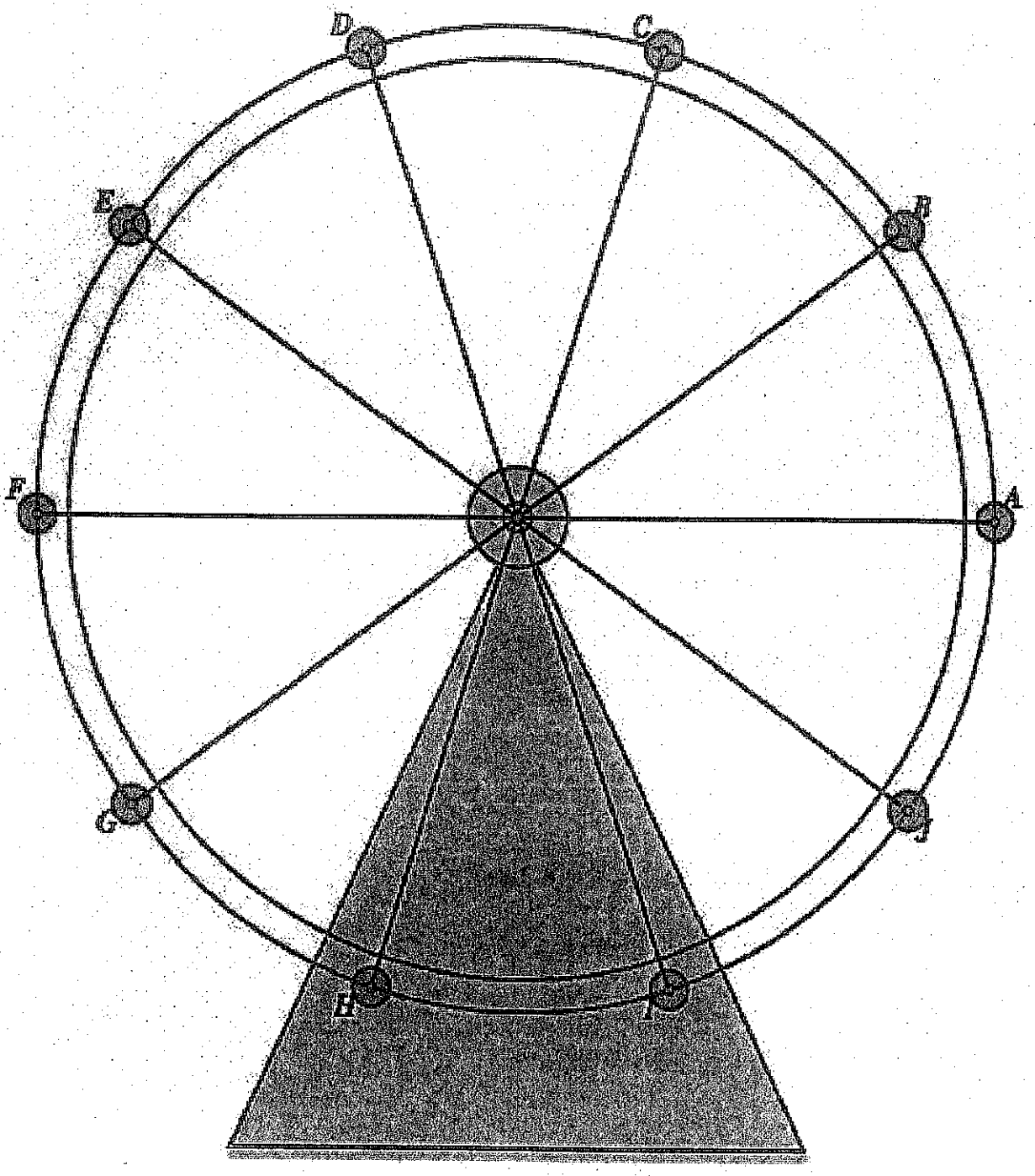


ow high will he be when he is at the bottom of the wheel?

igh will he be when h is at the positions farthest to
t or the right on the wheel?

eel has ten spokes, Carlos wonders if he can determine the height of the positions at the ends of
es as shown in the diagram. Carlos has just finished studying right triangle trig, and wonders if
can help him.

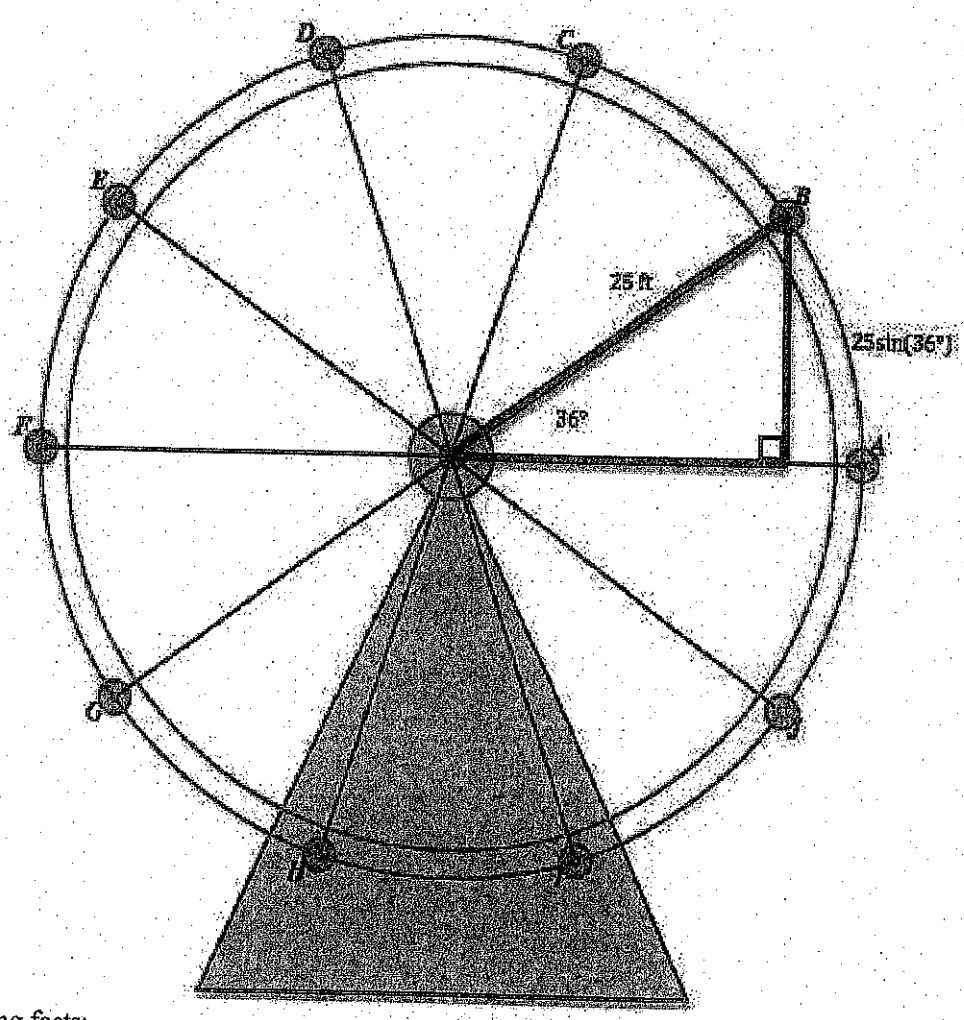
4. Find the height of each of the points labeled A – J on the Derris wheel diagram belov Represent your work on the diagram so it is apparent to others how you have calculated the height at each point.



"Sine" Language

A Solidify Understanding Task

In the previous task, you found Carlos' height at different positions on the Ferris wheel using right triangles, as illustrated in the following diagram.



Recall the following facts:

- The Ferris wheel has a radius of 25 feet.
- The center of the Ferris wheel is 30 feet above the ground.

Carlos has also been carefully timing the rotation of the wheel and has observed that the Ferris wheel makes **one complete rotation counterclockwise every 20 seconds.**

1. How high will Carlos be 2 seconds after passing position A on the diagram?

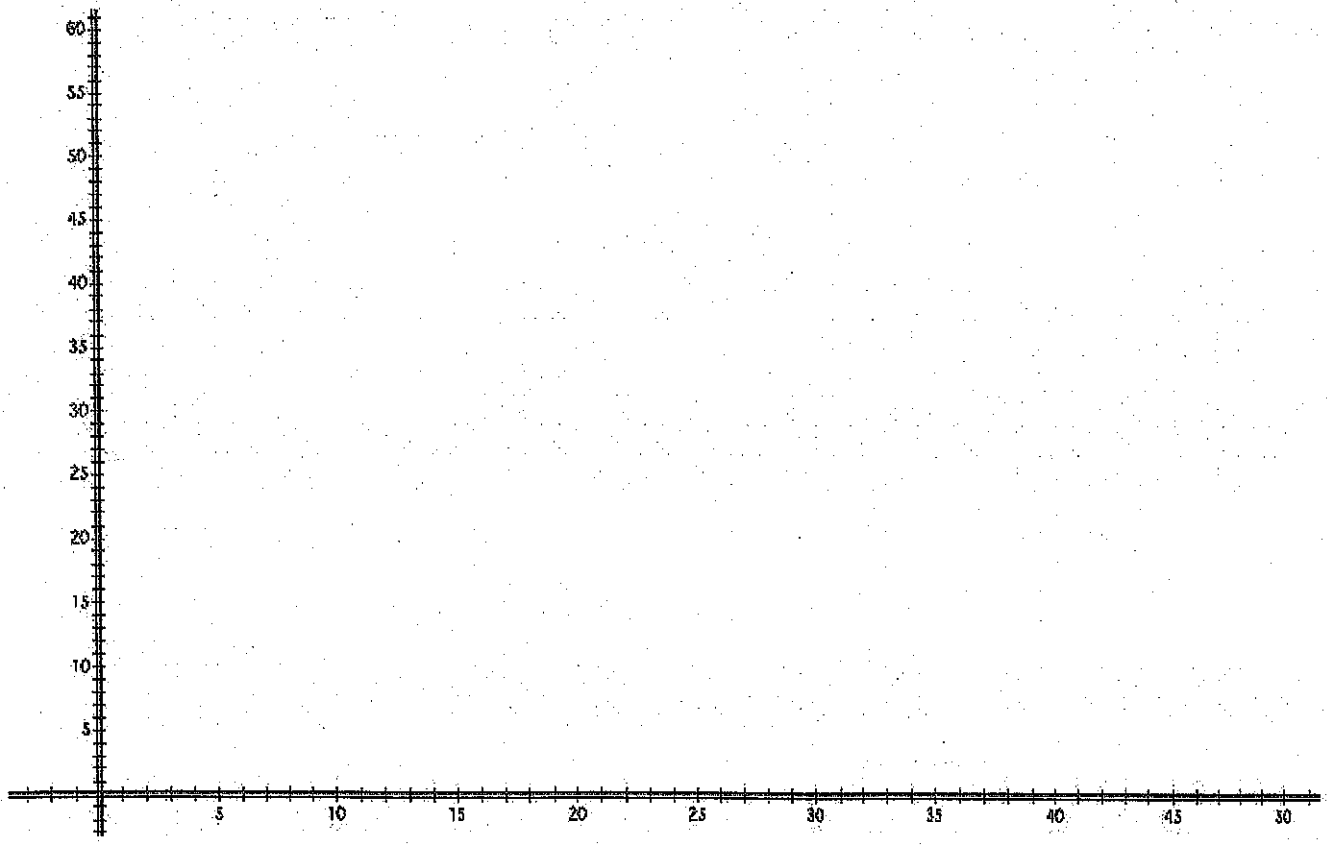
2. Calculate the height of the rider at each of the following times t, where t represents the number of seconds since the rider has passed position A on the diagram. Keep track of any patterns you notice in the ways you calculate the height. As you calculate the height, plot the position on the diagram.

Elapsed time since passing A	Calculations		Height of the rider
	Angle of Rotation	Reference Angle	
1 sec			
2 sec			
3 sec			
4 sec			
5 sec			
6 sec			
8 sec			
9 sec			
10 sec			
12 sec			
14 sec			
15 sec			
18 sec			
19 sec			
20 sec			
23 sec			
28 sec			
35 sec			
36 sec			
37 sec			
40 sec			

3. Examine your calculations for finding the height of the rider during the first 5 seconds after passing position A. During this time, the angle of rotation is somewhere between 0° and 90°. Write a general formula for finding the height of the rider during this time interval.

4. How might you find the height of the rider in other "quadrants" of the Ferris wheel, when the the angle of rotation is greater than 90°?

5. Based on the data you calculated in Day 1 & 2 Notes, sketch a graph of the height of a rider on this Ferris wheel as a function of the time elapsed since the rider passed the position farthest to the right on the Ferris wheel. (We can consider this position as the rider's starting position at time t = 0 seconds.)



6. How would your graph change if:
   a. The radius of the wheel was larger or smaller?

   b. The height of the center of the wheel was greater or smaller?

   c. The wheel rotates faster or slower?

7. How does the equation of the rider's height change if:
   a. The radius of the wheel was larger or smaller?

   b. The height of the center of the wheel was greater or smaller?

   c. The wheel rotates faster or slower?

8. Write the equation of the height of a rider on each of the following Ferris wheels t seconds after the rider passes the farthest right position.

   a. The radius of the wheel is 30 feet, the center of the wheel is 45 feet above the ground, and the angular speed of the wheel is 15 degrees per second counterclockwise.

   b. The radius of the wheel is 50 feet, the center of the wheel is at ground level (you spend half your time below ground), and the wheel makes one revolution *clockwise* every 15 seconds.