1.5 Moving Shadows

The Cosine as a Functions of Angular Rotations

Despite his nervousness, Carlos enjoys his first ride on the amusement park Ferris wheel.

He does, however, spend much of his time with his eyes fixed on the ground below him.

After a while, he becomes fascinated with the fact that since the sun is directly overhead, his shadow moves back and forth across the ground beneath him as he rides around on the Ferris wheel.

Recall the following facts for the Ferris wheel Carlos is riding:

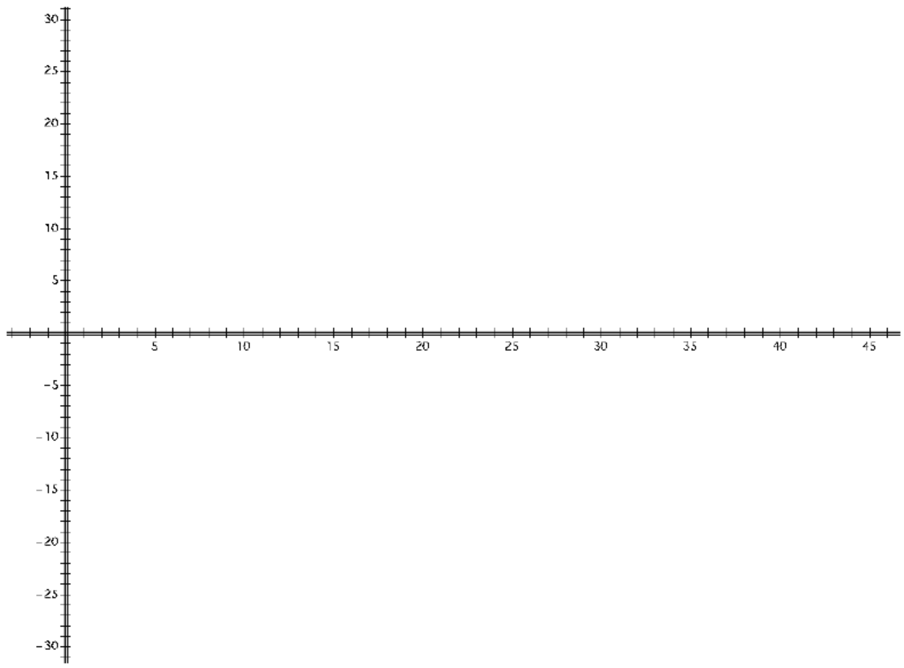
- The Ferris wheel has a radius of 25 feet
- The center of the Ferris wheel is 30 feet above the ground
- The Ferris wheel makes one complete rotation counterclockwise every 20 seconds

To describe the location of Carlos' shadow as it moves back and forth on the ground beneath him, you could measure the shadow's horizontal distance (in feet) to the right or left of the point directly beneath the center of the Ferris wheel, with locations to the right of the center having positive value and locations to the left of the center having negative values.

For instance, in this system Carlos' shadow's location will have a value of 25 when he is at the position farthest to the right on the Ferris wheel, and a value of
-25 when he is at a position farthest to the left.

1. What would Carlos' position be on the Ferris wheel when his shadow is located at 0 in this new measurement system?

2. Sketch a graph of the horizontal location of Carlos' shadow as a function of time *t*, where *t* represents the elapsed time after Carlos passes position *A*, the farthest right position on the Ferris wheel.



3. Calculate the location of Carlos' shadow at the times *t* given in the following table, where *t* represents the number of seconds since Carlos passed the position farthest to the right on the Ferris wheel. Keep track of any regularities you notice in the ways you calculate the location of the shadow. As you calculate each location, plot Carlos' position on the diagram.

Elapsed time since passing position A	Calculations	Location of shadow
1 sec		
1.5 sec		
2 sec		
2.5 sec		
3 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		

4. Write a general formula for finding the location of the shadow at any instant in time.