

6.5 Moving Shadows

A Practice Understanding Task

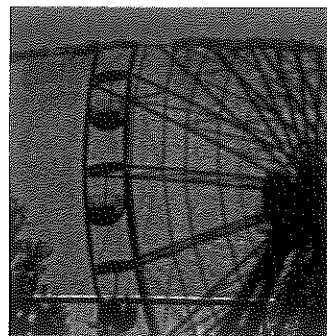
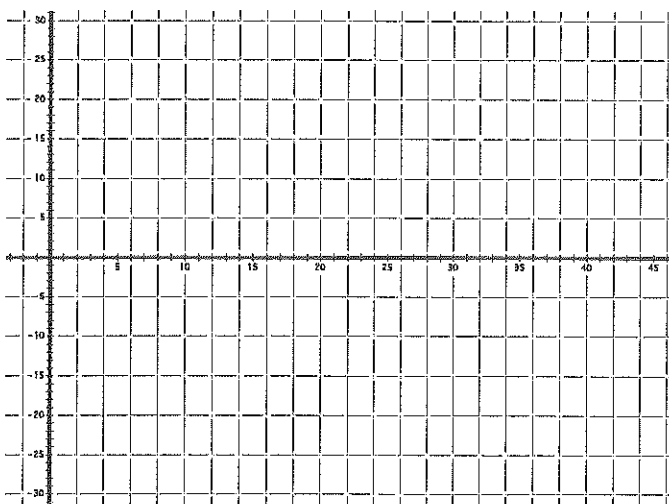
In spite of his nervousness, Carlos enjoys his first ride on the amusement park Ferris wheel. He does, however, spend much of his time with his eyes fixed on the ground below him. After a while, he becomes fascinated with the fact that since the sun is directly overhead, his shadow moves back and forth 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

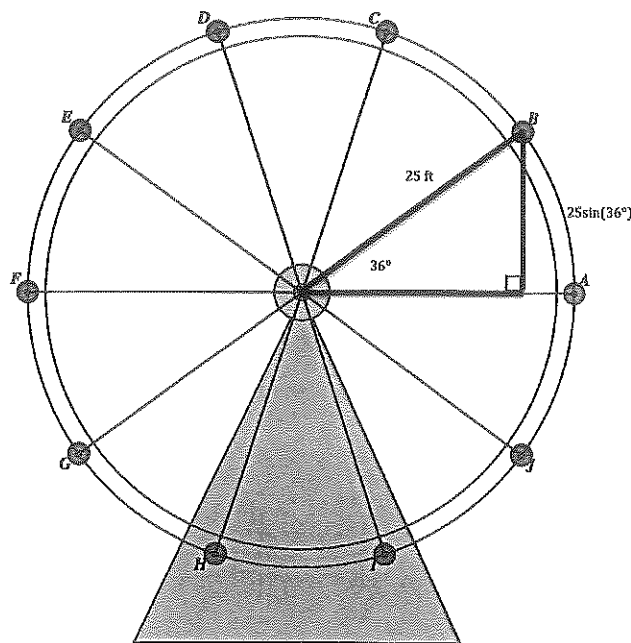
To describe the location of Carlos' shadow as it moves back and forth on the ground beneath him, we could measure the shadow's horizontal distance (in feet) to the right or left of the point directly beneath the center of the Ferris wheel, with locations to the right of the center having positive value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



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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 at the right.



Elapsed time since passing position A	Calculations	Horizontal position of the rider
1 sec		
2 sec		
3 sec		
4 sec		
8 sec		
14 sec		
18 sec		
23 sec		
28 sec		
40 sec		

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

READY, SET, GO!

Name

Period

Date

READY

Topic: Comparing radius and arc length

Stage coaches and wagons in the 1800s had wheels that were smaller in the front than in the back. The front wheels had 12 spokes. The top of the front wheel measured 44 inches from the ground. The rear wheels had 16 spokes. The top of the rear wheel measured 59 inches from the ground. (For these problems disregard the hub at the center of the wheel. Assume the spokes meet in the center at a point. Leave π in your answers.)

1. Find the area and the circumference of each wheel.
2. Determine the central angle between the spokes on each wheel.
3. Find the distance on the circumference between two consecutive spokes for each wheel.
4. The wagons could cover a distance of 15 miles per day. How many more times would the front wheel turn than the back wheel on an average day?
5. A wheel rotates r times per minute. Write a formula for how many degrees it rotates in t seconds.

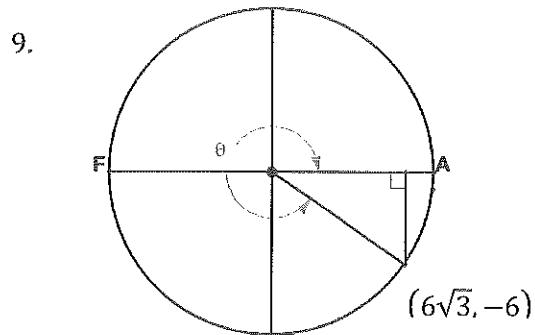
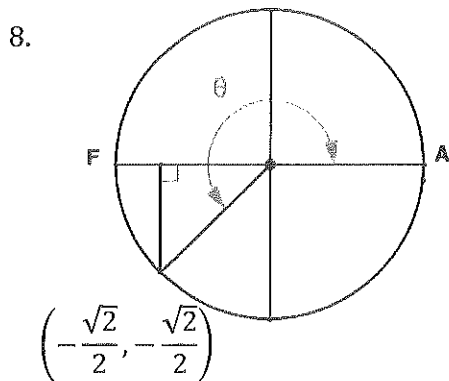
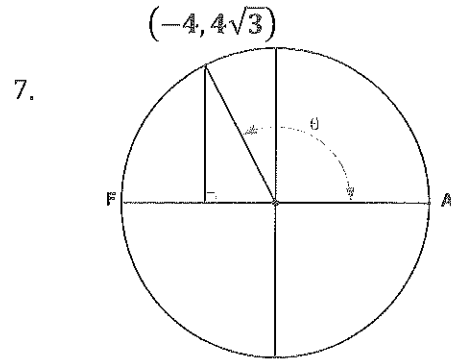
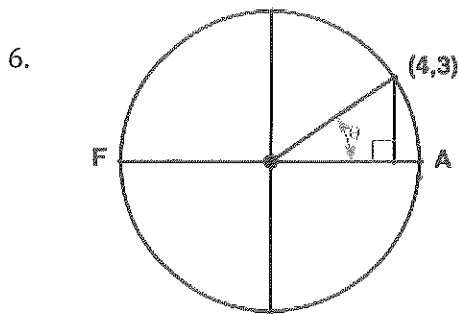
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SET

Topic: Determining values of cosine in a circle

Use the given point on the circle to find the value of cosine.

Recall $r = \sqrt{x^2 + y^2}$ and $\cos \theta = \frac{x}{r}$.

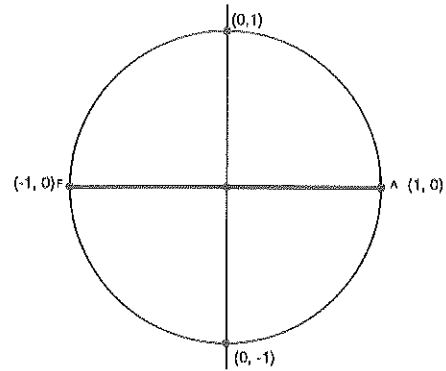


10. In each graph, the angle of rotation is indicated by an arc and θ . Describe the angles of rotation that make the x-values of the points positive and the angles of rotation that make the x-values negative.

11. What do you notice about the x-values and the value of cosine in the graphs?

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12. In the graph at the right, the radius of the circle is 1.
 The intersections of the circle and the axes are labeled.
 Based on your observation in #11, what do you think
 the value of cosine might be for the following values of θ :



90°? 180°? 270°? 360°?

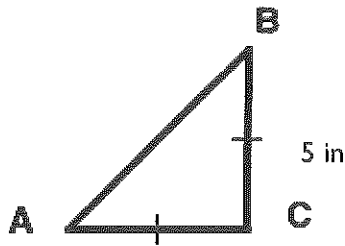
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Topic: Reviewing the measurements in special triangles

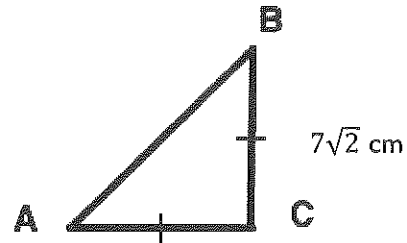
Use the given information to find the missing sides and the missing angles.

Triangle ABC is a right triangle. Angle C is the right angle. Write the exact values for the sides.

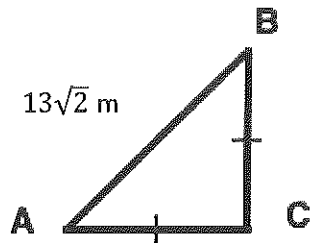
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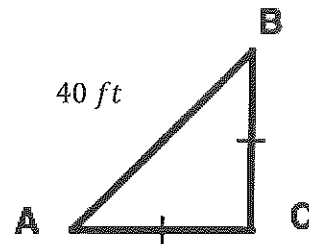
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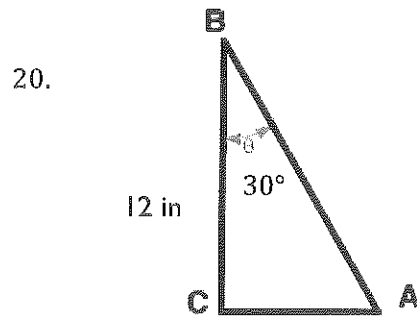
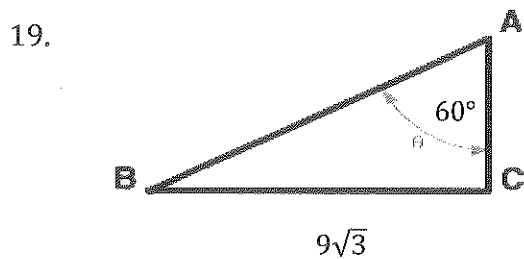
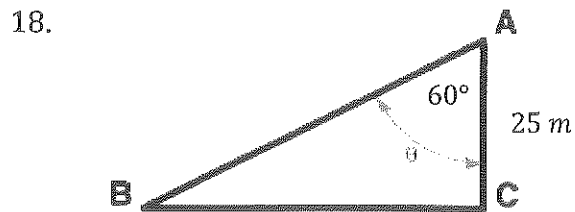
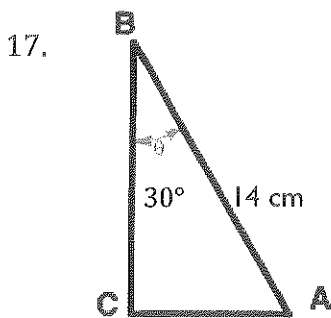
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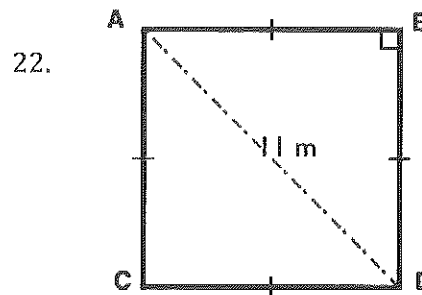
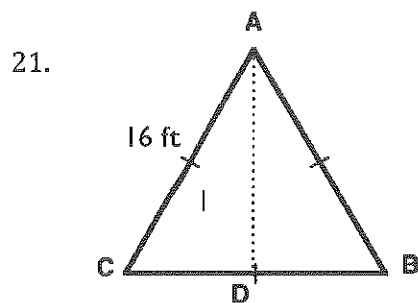
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Find AD in the figures below.



Remember that π is simply a number.

23. If you purchased π gallons of gasoline, about how many gallons of gas did you buy?
24. If you were paid 5π dollars per hour, about how many dollars would you make in 8 hours?
25. If you slept 2π hours each night, about how many hours of sleep would you get per night.

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