6.6 Diggin' It

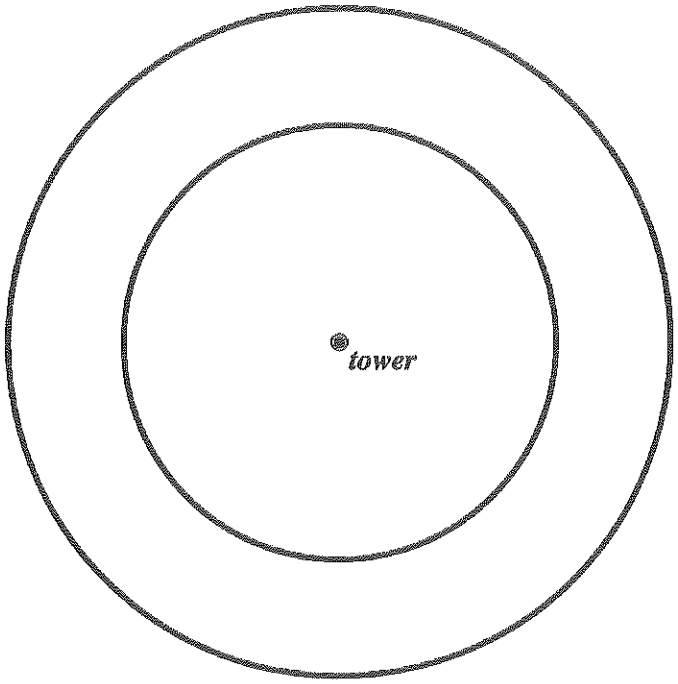
A Develop Understanding Task

Alyce, Javier, and Veronica are responsible for preparing a recently discovered archeological site. The people who used to inhabit this site built their city around a central tower. The first job of the planning team is to mark the site using stakes so they can keep track of where each discovered item was located.

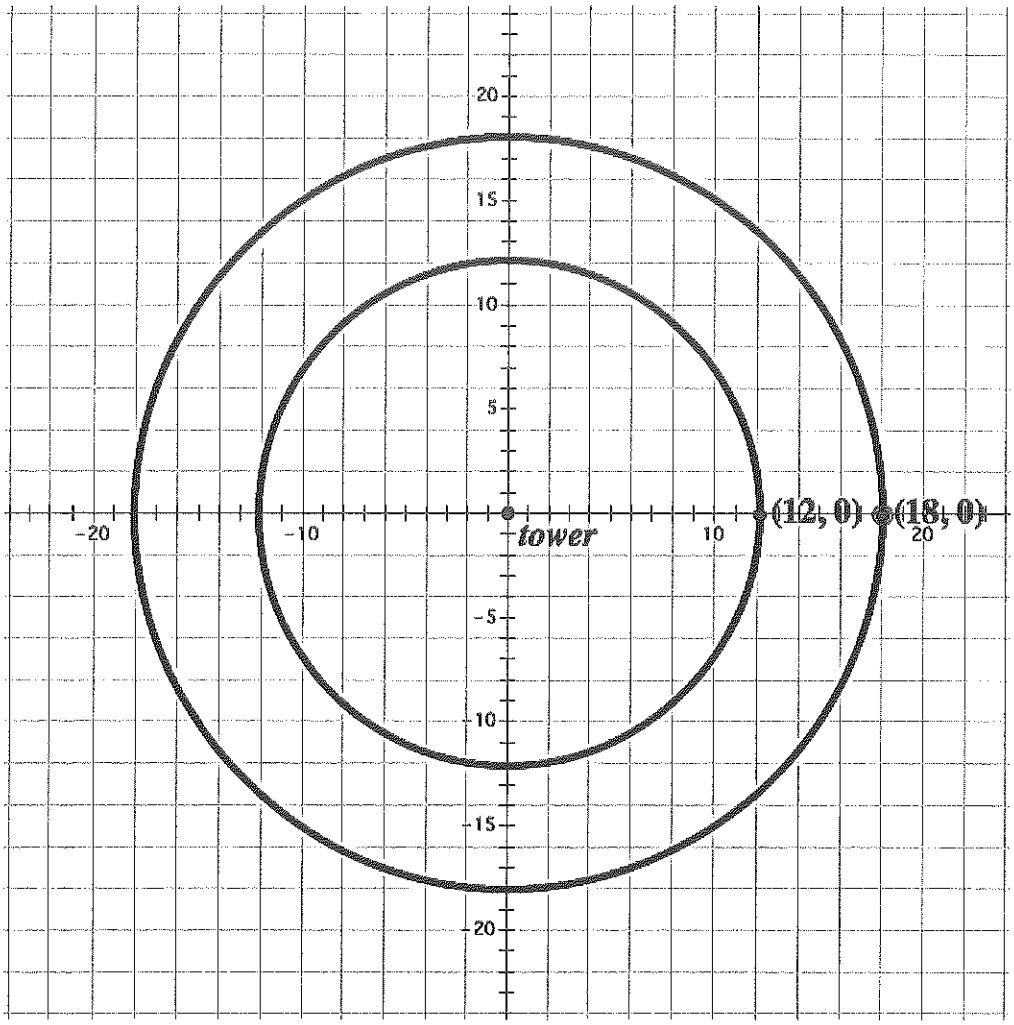
Part 1

1. Alyce suggests that the team place stakes in a circle around the tower, with the distance between the markers on each circle being equal to the radius of the circle. Javier likes this idea but says that using this strategy, the number of markers needed would depend on how far away the circle is from the center tower. Do you agree or disagree with Javier's statement? Explain.

2. Show where the stakes would be located using Alyce's method if one set of markers were to be placed on a circle 12 meters from the center and a second set on a circle 18 meters from the center.



Part 2



3. After looking at the model, Veronica says they need to have more stakes if they intend to be specific with the location of the artifacts. Since most archaeological sites use a grid to mark off sections, Veronica suggests evenly spacing 12 stakes around each circle and using the coordinate grid to label the location of these stakes. The central tower is located at the origin and the first of each set of 12 stakes for the inner and outer circles is placed at the points (12, 0) and (18, 0), respectively. Alyce also wants to make sure they record the distance around the circle to each new stake from these initial stakes. Your job is to determine the x and y-coordinates for each of the remaining stakes on each circle, as well as the arc length from the points (12, 0) or (18, 0), depending on which circle the stake is located. Keep track of the method(s) you use to find these values.

Part 3

Javier suggests they record the location of each stake and its distance around the circle for the set of stakes on each circle. Veronica suggests it might also be interesting to record the ratio of the arc length to the radius for each circle.

4. Help Javier and Veronica complete this table.

	Inner Circle: $r = 12$ meters			Outer Circle: $r = 18$ meters		
	Location	Distance from (12,0) along circular path	Ratio of arc length to radius	Location	Distance from (18,0) along circular path	Ratio of arc length to radius
Stake 1	(12, 0)	0	0	(18, 0)	0	0
Stake 2						
Stake 3						
Stake 4						
Stake 5						
Stake 6						
Stake 7						
Stake 8						
Stake 9						
Stake 10						
Stake 11						
Stake 12						

5. What interesting patterns might Alyce, Javier and Veronica notice in their work and their table? Summarize any interesting things you have noticed.

READY, SET, GO! Name Period Date

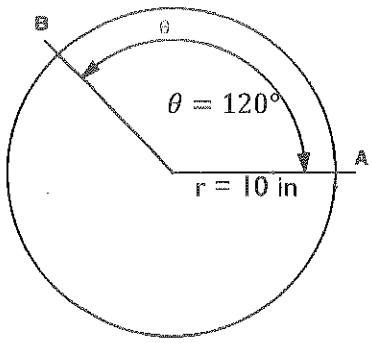
READY

Topic: Finding the length of an arc using proportions

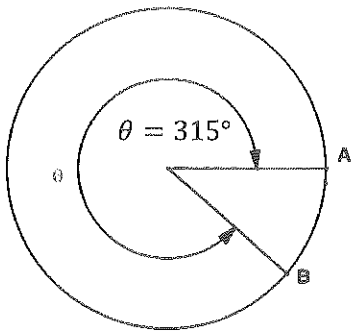
Use the given degree measure of the central angle to set up a proportion to find the length of arc AB.

Leave π in your answers. Recall $s = \frac{\theta}{360°}(d\pi)$ *where s is the arc length.*

1.

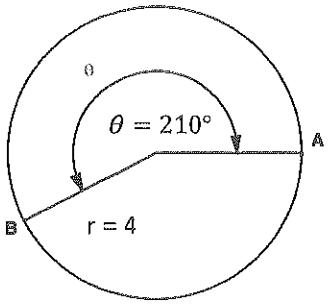


2.

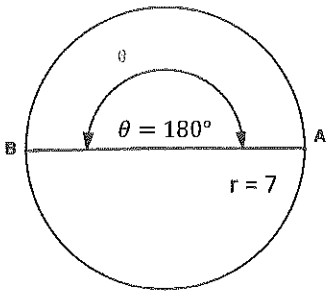


r = 16 cm

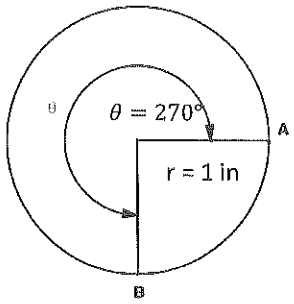
3.



4.



5.



6. The circumference of circle A is 400 meters. The circumference of circle B is 800 meters. What is the relationship between the radius of circle A and the radius of circle B?

   Justify your answer.

SET

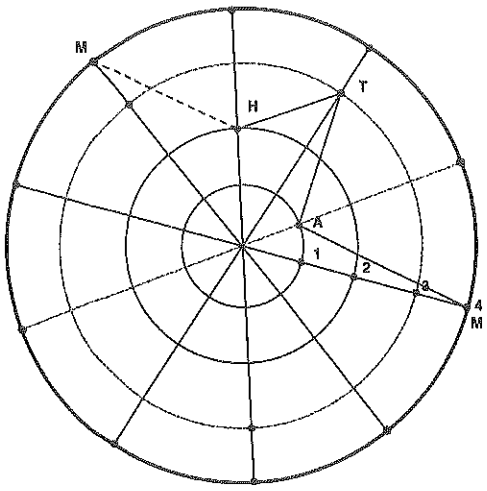
Topic: Describing the location of a point by the angle of rotation and the radius

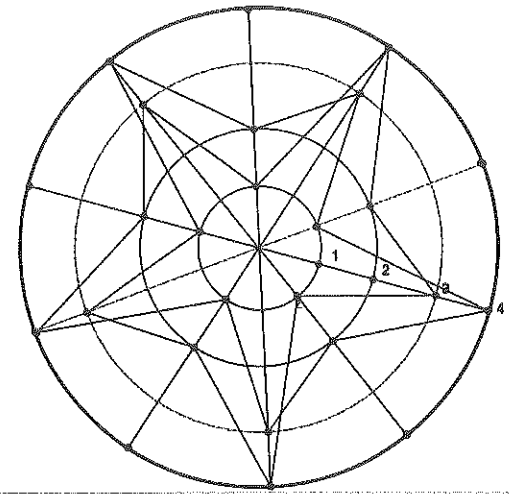
It is possible to identify the location of a point on the edge of a circle in several different ways. One way is to use rectangular coordinates (x, y). In this activity, you will be graphing "words" by using letters to identify points around a circle. The size of the rotation or θ will be the same while the length of the radius will change. First select a word. Avoid words containing 5 letters or multiples of 5. I am choosing the word MATH. Assign a number to each letter of your word according to the table below. The numbers correspond to the concentric circles. You can begin on any spoke. Move from one spoke to the next in a positive rotation. Make a dot at the intersection of the spoke and the circle corresponding with the number of the letter you are on. You will need to make more than one rotation of the circle in order to close your figure.

Circle numbers and their corresponding letters. The letters for "MATH" are high-lighted.

Circle 1: A,D,K,L,N,V,Z	**Circle 2: E, U, G, H, Q, U, X**
Circle 3: I, C, F, J, T, S, Y	**Circle 4: O, B, E, M, R, P, W**

The word MATH will use the numbered circles 4 1 3 2 in that order. You can begin on any spoke. I began on the spoke with the numbers. I made a dot on 4, rotated to the next spoke and made a dot on 1. I connected the two dots. Then I moved to circle 3, made a dot, connected the segment, and moved to circle 2. You can see MATH marked on the diagram. After marking H, I started over with M on the next spoke. (See the dotted line.) Continue spelling MATH and rotating around the circle until the figure is closed and the path repeats itself. The figure at the right is the completed graph of the word MATH. I always knew MATH was beautiful!

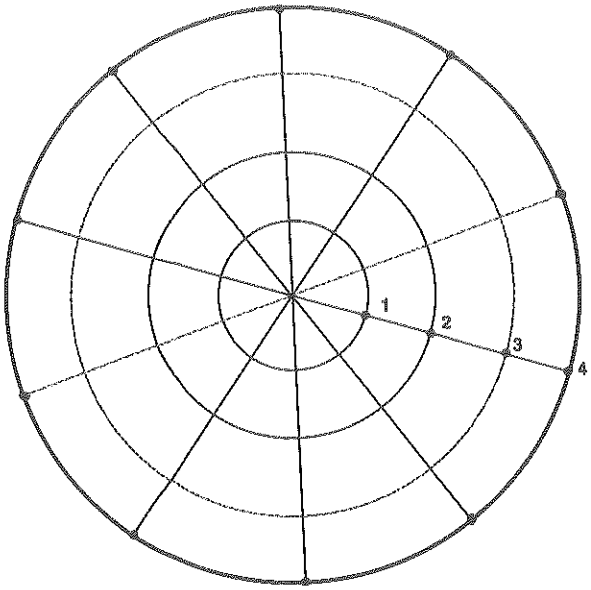




Now it's your turn. Select a word. Short ones are best. Assign the numbers and begin.

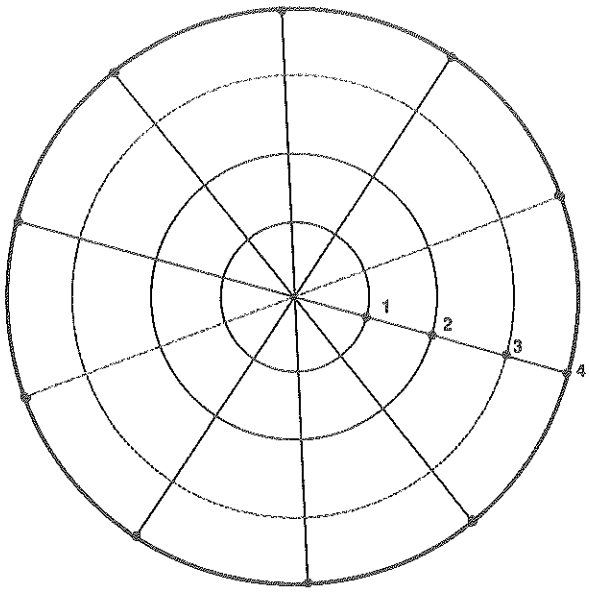
7.

word _____



8.

word _____



9. What is the angle between each spoke in the grid above?

10. How many degrees did it take to graph MATH once? (From M to H?)

11. How many degrees did it take to graph MATHM? (From M to the M again)

12. How many times did I need to spell the word MATH to complete the graph?

13. How many rotations did it take?

Can you figure out the answer to this question without counting? Explain.

GO

Topic: Converting angles between radians and degrees

Recall that there are 360 **degrees** in a full circle and 2π **radians** in a full circle. Therefore, $360º = 2\pi$ radians. If we divide both sides of the equation by 2, we create another identity $180º = 1\pi\ radians$. We can use this identity to convert degrees to radians or radians to degrees.

Since $180° = \pi\ radians$, it follows that $\frac{\pi\ radians}{180°} = \frac{180°}{\pi\ radians} = 1$.

If I want to convert 72º into radian measure, then I need the unit of degrees to cancel, so I will multiply 72º by $\frac{\pi\ radians}{180°}$, example: $72° \cdot \frac{\pi\ radians}{180°} = \frac{72º \times \pi\ radians}{180º} = \frac{2\pi\ radians}{5}$.

The unit *radians* is usually left off. Hence, an angle that measures 72º is equivalent to a radian measure of $\frac{2\pi}{5}$.

Convert the following angles from degrees to radians or radians to degrees.

14. 45°

15. 15°

16. 54°

17. 135°

18. 300°

19. 270°

20. $\frac{5\pi}{6}$

21. $\frac{\pi}{8}$

22. $\frac{3\pi}{4}$

23. $\frac{7\pi}{5}$

24. $\frac{\pi}{18}$

25. $\frac{13\pi}{12}$