

Circumference and area: circles, semi-circles and problem-solving

Lesson Map: <u>http://esriaustralia.com.au/education/SpatialActivity81</u>

Engage

Finding the circumference and area of a circle

- Click on the map URL above to open the lesson map. Satellite imagery of Australia is displayed. Under the 'Bookmarks' tab, select Western Australia. The map extent will refocus on Western Australia. You can use the bookmarks to quickly jump to different locations in the world.
 - Bookmarks Find address or pla Bookmarked places × Australia Perth CBD Lycopodium Ltd building Abu Dhabi Sun City, Arizone Arc de Triomphe, Paris Stonehence
- → Go to the 'Bookmarks' tab again and select *Perth CBD*. The map extent will focus on Perth's Central Busines District (CBD).
- ➤ Three red dots will be displayed on the map extent. Click on a red dot to bring up a name for that location. Once you have located the red dot that represents the location of *The Circus*, zoom in on this location. Zoom in so that the circular road and park is clearly visible.



? Record the formula for finding the circumference of a circle. Record your response below this question or in your subject book. [Circumference of a circle = $2\pi r$ or $2 \times \pi r$.]

Download student worksheet here.

Time 30 minutes

Activity

Investigate the circumference and area of circles and ovals.

Learning Outcome

Students will be able to:

- Find the circumference and area of circles
- Find the perimeter and area of semi-circles
- Find the area of ovals
- Solve word problems
- Engage with ICTs and locate shapes for measurement in Australian cities

ACARA Curriculum Link

Year 8 Mathematics: Geometry and measurement

ACMMG197

Teacher Feedback:

To share your feedback on this, or any Spatial Activity, please contact education@esriaustralia.com.au



→ Locate and click on the 'Measurement' tab. Click the 'Distance' icon and ensure that 'metres' is selected. You will use the measurement tool to measure key distances like radius and diameter.

	<mark>Measure</mark>		Bookmar <mark>k</mark> s	
Find area, length, or location				
			Meters 💌	

Ensuring the measurement tab is enabled, click on the red dot once. Drag your mouse out to the inner edge of the circular road and then double-click to lock in a measurement.



- **?** What is the radius of the circular park area? [39.3m. Note: measurements may vary slightly depending on accuracy of student measurement.]
- ? Now that you have measured the radius, find the circumference of the grassed area. Round your answer to 2 decimal places. [Circumference of a circle = $2\pi r$. Circumference = $2 \times \pi \times 39.3m$. Circumference = 246.93m.]
- **?** Record the formula for finding the area of a circle. Record your response below this question or in your subject book. [*Area of a circle* = πr^2 or $\pi \times r^2$.]
- **?** Calculate the area of the grassed area of *The Circus*. Round your answer to 2 decimal places. [*Area of a circle =* πr^2 . *Area =* $\pi x 39.3m^2$. *Area =* $4842.16m^2$.]

Explore

Finding the perimeter and area of a semi-circle

 Click the 'Bookmarks' tab and select Lycopodium Ltd building, which can also be identified by the red dot on top of the roof. This building is owned by an engineering



firm named Lycopodium Limited.

- ? The map currently shows a bird's eye (from above) view of the building. What 2D shape does the building's roof represent? [Semi-circle.]
- **?** Record the formula for finding the perimeter of a semi-circle. Record your response below this question or in your subject book. [*Perimeter of a semi-circle = \pi r + d, where 'r' is the radius and 'd' is the diameter.*]
- ? Use the formula for finding the perimeter of a semi-circle to find the perimeter of the *Lycopodium Ltd* roof. Use the measurement tool to assist you in measuring key lengths and round your response to two decimal places. [*Perimeter of Lycopodium* roof = $\pi r + d$. Perimeter = $\pi x 50m + 100m$. Perimeter of roof = 257.08m.]
- **?** Record the formula for finding the area of a semi-circle. Record your response below this question or in your subject book. [*Area of a semi-circle* = $\pi r^2 \div 2$.]
- ? Use the formula for finding the area of a semi-circle to find the area of the *Lycopodium Ltd* roof. Round your response to two decimal places. [*Area of a Lycopodium Ltd roof* = $\pi r^2 \div 2$. *Area* = $\pi x 50^2 \div 2$. *Area of roof* = 3926.99m².]

Explain

Problem solving (circles)

- Click the 'Bookmarks' tab and select Arc de Triomphe, Paris. The Arc de Triomphe is in Paris, France and is a monument symbolizing France's national identity. Click on the red dot to bring up a photo of the monument. If you click on the small thumbnail image, it will open a larger photo in a new tab.
- Zoom in closer to the monument. You can notice that a large roundabout surrounds the *Arc de Triomphe* and that tourists can actually walk under and through the monument in the footpath area.
- ? The roundabout surface (road) surrounding the monument needs to be replaced. Road construction crews will need to lay fresh bitumen. Before they do, they need to calculate how much bitumen they will need to complete the job. Find the road surface area so that road construction can begin. Use the measurement tool to assist you in finding key lengths like radius. Show all steps of your working and round your answer to two decimal places.

Working	Road surface area = Area of Roundabout circle (A1) – Area of monument walking area circle (A2)
	Area of roundabout circle (A1) = πr^2 Area of roundabout circle (A1) = $\pi x 82.5^2$.



	Area of roundabout circle (A1) = 21382.46m ² .
	Area of monument walking area circle (A2) = πr^2 Area of monument walking area circle (A2) = $\pi \times 44^2$. Area of monument walking area circle (A2) = 6082.12m ² .
	Area of road surface = A1 – A2 Area of road surface = 21382.46m² - 6082.12m² Area of road surface = 15300.34m²
Final answer	Road construction workers will need to prepare enough bitumen to cover 15300.34m ² of road surface.

- Click the 'Bookmarks' tab and select Sun City, Arizona. You will notice that several housing estates are set out in circular patterns. At the centre of one housing estate is a shopping centre and large carpark. This is marked by a red dot. Zoom in closer to see this more clearly.
- ➤ You will notice that this particular housing estate has 5 separate ring roads that extend out from the midpoint of the circular estate.
- ? Jim lives in the circular estate and runs each day to keep fit. In the morning, Jim has time for a 2.5km run before getting ready for work. What ring road provides the most appropriate distance for Jim's morning run so that he does not have to begin a second lap? Use the measurement tool to assist you in finding key measurements. Show all working and record your answers to two decimal places. Note: the innermost ring can be referred to as 'Ring 1' whereas, the outermost ring can be referred to as 'Ring 5'.

Working	Students will be required to use the measurement tool to find radius lengths for a number of ring roads before being able to determine the most appropriate ring road. Working for the correct ring road (Ring 4) has been shown below: Circumference of Ring 4 = $2\pi r$ Circumference of Ring 4 = $2 \times \pi \times 456.9m$ Circumference of Ring 4 = $2870.79m$
Final answer	After calculating the circumference of several ring roads, Ring road 4 is the most appropriate road for Jim's morning run as it is 2870.79m long, meaning that Jim doesn't have to begin a second lap to reach his target distance. NOTE: distances may differ based on student use of the measurement tool.



Extend

Finding the area of an oval

- Click the 'Bookmarks' tab and return to *Perth CBD*. Locate Perth Stadium, which is marked by a red dot.
- Click on the red dot to see a photo of inside the stadium. If you click on this image, it will open a larger copy of the image in a new tab. Perth Stadium has an oval playing field, which is used for cricket and AFL matches.
- → The formula for finding the area of an oval is: Area of Oval = $\pi x r_1 x r_2$. A perfect oval has two different radius lengths, which is represented by r_1 and r_2 .



- ? Zoom in on Perth Stadium so that you can clearly see the oval. Although the northern edge of the oval can't be seen due to the roofing, you still have enough information to find the area of the playing ground. Use the measurement tool and the formula above to find the area of the playing ground. Round to two decimal places. [*Area of Oval* = $\pi x r_1 x r_2$. *Area of Oval* = $\pi x 67.5m x 85m$. *Area* = $18024.89m^2$. Note: answers will vary slightly depending on accuracy of student measurements.]
- ➤ You have completed the worksheet. If you would like to practice or revise with more circles, click on the 'Bookmarks' tab. You will notice that there are several locations that were not visited in this worksheet: Abu Dhabi, Stonehenge.
- ➤ You can also visit <u>A World of Circles</u> StoryMap, exploring some of Earth's circular landmarks.

Next Steps:

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