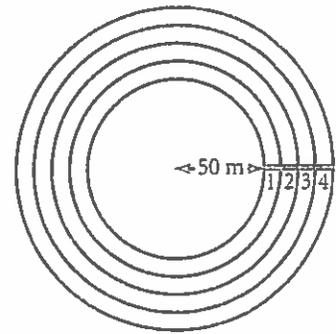


## PROJECT

### Racetrack Geometry

If you had to start and finish at the same line, which lane of the racetrack shown at right would you choose to run in? Sure, the inside lane. If the runners in the four lanes were to start and finish at the line shown, the runner in the inside lane would have an obvious advantage because that lane is the shortest. For a race to be fair, runners in the outside lanes must be given head starts.



Your task in this project is to design a four-lane oval track with straightaways and semicircular ends. The semicircular ends must have inner diameters of 50 meters, and the distance of one lap in the inner lane must be 800 meters. Draw starting and stopping segments in each lane so that an 800-meter race can be run in all four lanes.

What do you need to know to design such a track? You will need to determine the length of the straightaways. You will also need to determine the head start for each of the runners in the outer lanes so that each runs 800 meters to the finish line. Before you begin creating your racetrack, you will need to answer these questions.

- Does the radius of the circle play a part in determining the head start?
- Does the width of the lane play a part in determining the head start?
- Do the lengths of the straightaways play a part in determining the head start?

To answer these questions, try calculating the lengths of a few sample racetracks. For example, if the inner radius of the circular track shown above is 50 meters and each lane is 1 meter wide, you can calculate the distance each runner must travel in one lap, staying in his or her own lane.

Complete the table below. The radius in the table is the radius of the circle that defines the inside edge of each lane.

#### Circular Track

Inner Radius 50 m, Lane Width 1 m

Lane	Radius (m)	Circumference (m)
1	50	$100\pi$
2	51	
3		
4		

To make your race fair, look in your table to determine how much of a head start each runner in the outer lanes must have. For the circular track shown above, you can see that the runner in lane 2 must have a head start of  $2\pi$  meters over the runner in lane 1; the runner in lane 3 must have a  $2\pi$ -meters head start over the runner in lane 2; and so on. With these head starts, each runner will travel  $100\pi$  meters.

(continued)

**Project • Racetrack Geometry (continued)**

Is the head start always  $2\pi$  meters? Investigate a few other tracks to find out. You can either complete the tables below or make up some of your own.

**Circular Track**  
Inner Radius 65 m, Lane Width 1 m

Lane	Radius (m)	Circumference (m)
1	65	$130\pi$
2	66	
3		
4		

**Circular Track**  
Inner Radius 65 m, Lane Width 1.5 m

Lane	Radius (m)	Circumference (m)
1	65	$130\pi$
2	66.5	
3		
4		

From these examples you may be able to answer the first two questions. Most tracks go around a playing field and have straightaways. What about the length of the straightaways? Complete the tables below to calculate the total distance for each lane in the type of track shown below.

**Oval Track**  
Inner Radius 30 m, Straightaway 100 m, Lane Width 1 m

Lane	Radius (m)	Straightaway (m)	Total distance (m)
1	30	100	$200 + 60\pi$
2	31	100	
3	32	100	
4	33	100	

**Oval Track**  
Inner Radius 30 m, Straightaway 200 m, Lane Width 1 m

Lane	Radius (m)	Straightaway (m)	Total distance (m)
1	30	200	$400 + 60\pi$
2	31	200	
3	32	200	
4	33	200	

From these tables you may be able to answer the third question. If you can answer all three questions, you are ready to start designing your racetrack.

Again, your task in this project is to design a four-lane oval track with straightaways and semicircular ends. The semicircular ends must have inner diameters of 50 meters, and the distance of one lap in the inner lane must be 800 meters. You determine a width for the lanes. Draw starting and stopping segments in each lane so that an 800-meter race can be run in all four lanes.

On your mark, get set, GO!

Name: \_\_\_\_\_ Date: \_\_\_\_\_



**Racetrack Project Rubric**

Category	Points	Points	Points	Total Points
Q1 – Does the radius play a part in determining the head start?	Is clearly explained in complete sentences using information found in the table – 2 pts	Is somewhat explained using thought and some evidence from the table – 1 pt.	Not explained well, little to no use of tables - 0	
Q2 – Does the width of the lane play a part in determining the head start?	Is clearly explained in complete sentences using information found in the table – 2 pts	Is somewhat explained using thought and some evidence from the table – 1 pt.	Not explained well, little to no use of tables - 0	
Q3 – Do the lengths of the straightaways play a part in determining the head start?	Is clearly explained in complete sentences using information found in the table – 2 pts	Is somewhat explained using thought and some evidence from the table – 1 pt.	Not explained well, little to no use of tables - 0	
Quality of tables	Tables are clearly labeled and all information in tables is complete with all work shown to the side – 4 pts	Some of the tables are labeled, some work may be missing – 3 pts	Tables are not well labeled, work is missing or hard to read – 1-2 pts	
Quality of drawing	4 lane track is well drawn with construction tools, each part is well labeled and there is a clear, well thought out explanation of how the information was found – 5-6 pts	4 lane track is well drawn, some labels are missing, clear explanation included 3-4 pts	4 lane track is drawn without proper construction methods, missing labels, missing explanation – 1-2 pts	
Organization	Project is very well organized in order of directions with clearly labeled parts and work shown in appropriate areas – 4 pts	Project is organized, some parts out of order, small items missing - 3 pts	Project is less organized, work is scattered, hard to follow – 1-2 pts	
Total number of points out of 20				

