

Circle and Cylinder GeomeTREE

N°. 69

INTERMEDIATE

Math



LESSON SUMMARY

Students will travel outside the classroom and begin an investigation of the many geometrical properties of circles by measuring the circumference of local trees



Activity Information

Grade Level:	Intermediate
Estimated Duration:	One or two 90 minute periods
Materials:	Meter sticks, string, scissors
Setting:	Outdoor and indoor
Key Vocabulary:	Circumference, surface area, volume, logging, basal area

Curriculum Connections

Grade 8 Math: Measurement Strand

- *measure the circumference, radius, and diameter of circular objects, using concrete materials*
- *solve problems involving the estimation and calculation of the circumference and the area of a circle;*
- *determine, through investigation using a variety of tools and strategies the relationship between the area of the base and height and the volume of a cylinder*
- *solve problems involving the surface area and the volume of cylinders, using a variety of strategies*

Mathematical Processes: Problem solving, reasoning and proving, connecting, representing, communicating

Teacher Background

The age and health of a tree can often be indicated by its diameter. During each year, trees experience a growth period (usually corresponding to the summer months) during which their trunk grows outward. If we look at a cross-section of previously cut down trees, we can see these growth periods as rings, with thicker rings corresponding to particularly good years of growth. As such, the larger the diameter of a tree, the more indication we have that it has been successful in acquiring the light, nutrients, and water that it needs to continue growing.

In this lesson, students will travel outside the classroom and begin an investigation of the many geometrical properties of circles by measuring the circumference of local trees. This will spark a series of inquiries that will lead the students to the concepts of surface area and volume of cylinders. Along the way, efforts can be made to keep these concepts grounded in their practical application to forestry.

This lesson would be best used after the students have learned/reviewed the concepts and formulas for circumference and area of a circle. It will serve as a transition into cylinder geometry, with the students having the opportunity to develop the formulas for the volume and surface area of a cylinder. In this later goal, the students should feel the challenge of trying it on their own, with you there to provide helpful/subtle hints as necessary.

ACTIVITY

Step 1 – Review the concept of circumference as the distance around the perimeter of an object. Have the students recall the formula and identify each of its components. Discuss the importance of a tree's circumference with the class (health of tree, use for logging, etc.).

Step 2 – Assign students into groups of 2-4 and take them outside to measure the circumference of one different tree per group. Students should use string to circle the tree and cut it, allowing for its measurement back in the classroom.

Step 3 – Back in the classroom, ask students to find the diameter and radius of the tree. Ask them to find the area of a cross-section of the tree, if the tree had been cut where they measured it. Drawing a diagram may be beneficial. Introduce this surface area as the 'basal area' in the context of forestry.

Step 4 – Pose the following problem to each group:

We've figured out the circumference of the tree and the area of its cross section. Think back to what we've learned about volume in the past. Now figure out the volume of the tree stump if your tree was cut at 0.5 metres above the ground. Write down an equation to find volume of a cylinder. Assume the stump does not get wider nearer the ground, but is a perfect cylinder.

Students can have access to recycled cans to help them visualize the problem. If needed, specifically address how the volume of a rectangular prism is calculated by finding the area of one end, then multiplying it by the depth (or length) of the object. Use this to help lead them to the formula for area of a cylinder with the same logic.

Step 5 – When students have created their own formula, have them use a hollowed out can and ask them to calculate its volume with their formula. Students will then test their prediction by measuring out the equivalent amount of water and seeing if it fills the can (you can help with converting units as necessary). Help correct students mistakes as necessary.

Step 6 – Once a group successfully masters volume, have them problem solve the surface area of a cylinder. Students can begin first with the outside of the stump, and then finish by considering the top. Helping students to recognize the similarity between this formula and the volume formula can help. Also, if you have a can with a label on it, demonstrating that the label corresponds to the outside surface area, and that you can remove it by slicing it down 1 side. Hold up the resulting rectangle and ask them to identify its relationship to the original cylinder.