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Geometry Journey Video Series

Program #12

Surface Areas

Satellite Broadcasting
VHS
and Internet/Intranet Streaming

Program Description

By visually showing how to reduce 3D curved surfaces into 2D flat areas, the more complicated lateral area problems become simpler 2D area cases. This video can help turn a memory game -- remembering so many lateral area formulas -- into an easy, visual process to derive these formulas. The materials covered include the lateral areas of right prisms, regular pyramids, frustum of a regular pyramid, right cylinders, right cones and the surface areas of spheres. Once a student visualizes the process for deriving a formula, burdensome formula memorization is no longer required.

This program is the #12 episode in the fifteen 15-minute Geometry Journey Series.

Synopsis

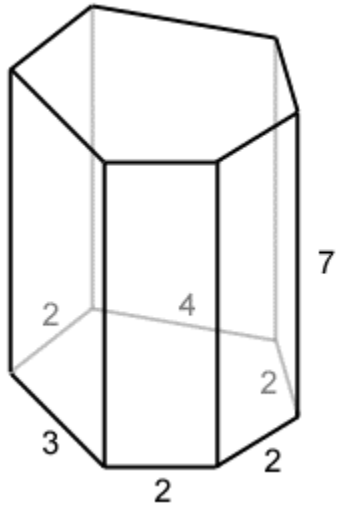
This program will cover the following topics:

1. Surface Areas of Solid Figures
2. Lateral Area of a Right Prism
3. Lateral Area of a Regular Pyramid
4. Lateral Area of a Frustum of a Regular Pyramid
5. Lateral Area of a Right Cylinder
6. Lateral Area of a Right Cone
    a) Lateral Area of a Frustum of a Right Cone
7. Surface Area of a Sphere

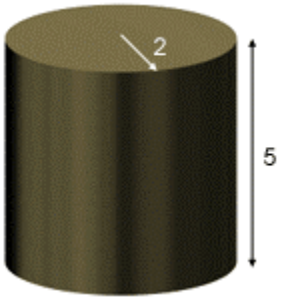
Student Worksheet

Name _____

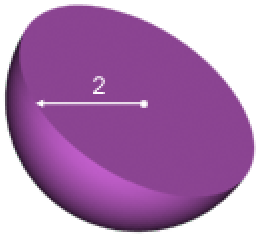
1) The height of the right prism shown in the figure is 7. The sides of the base polygon of are 2, 2, 2, 4, 2 and 3, respectively. Please calculate its lateral area.



2) What is the surface area of the cylinder shown in the figure (lateral surface + its bases' area)? The radius of its base is 2 cm and its height is 5 cm.



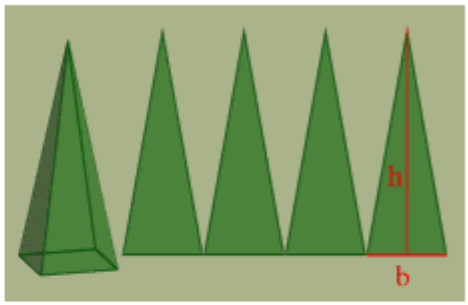
3) The hemisphere shown in the figure is produced by cutting a sphere with a plane through the center of the sphere. What is the surface area of this hemisphere (including the base circle area) if its radius is 2?

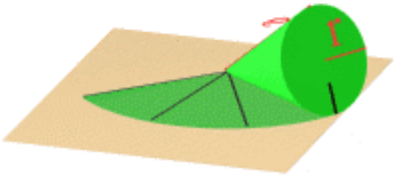


Discussion Questions

Question: The lateral surface of each of the following solids, prisms, pyramids, cylinders and cones, can be cut, peeled and unfolded to 2D shapes for easy calculations.

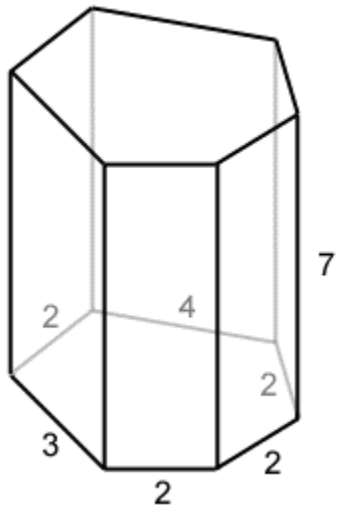
What common property do they all possess to allow the "3D" or curved surfaces to be changed into 2D shapes?





Answers to the Student Worksheet

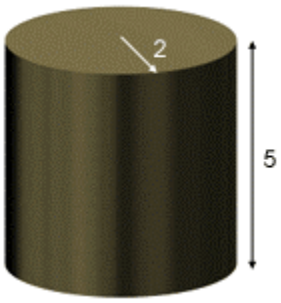
1) The height of the right prism shown in the figure is 7. The sides of the base polygon of are 2, 2, 2, 4, 2 and 3, respectively. Please calculate its lateral area.



Step 1: Height h = 7 (given)
Perimeter P = 2 + 2 + 2 + 4 + 2 + 3 = 15

Step 2: LA = Ph = 15 x 7 = 105

2) What is the surface area of the cylinder shown in the figure (lateral surface + its bases' area)? The radius of its base is 2 cm and its height is 5 cm.

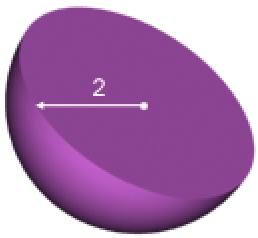


Step 1: The lateral surface
$= 2\pi rh = 2 \times 3.14 \times 2 \times 5 = 62.8\ (cm^2)$

Step 2: The area of one base
$= \pi r^2 = 3.14 \times 2^2 = 12.56\ (cm^2)$

Step 3: The surface area of the cylinder
$= 62.8 + 2 \times 12.56 = 87.96\ (cm^2)$

3) The hemisphere shown in the figure is produced by cutting a sphere with a plane through the center of the sphere. What is the surface area of this hemisphere (including the base circle area) if its radius is 2?



Step 1: Since the surface area of the whole sphere is $4\pi r^2$, the surface area of the hemisphere without its base is half of $4\pi r^2$, that is, $2\pi r^2$.

Step 2: The area of the circular base is πr^2.

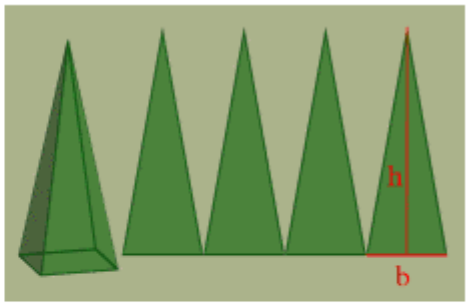
Step 3: The total surface area of the hemisphere is

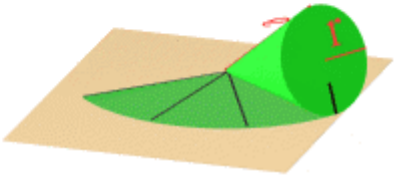
$$2\pi r^2 + \pi r^2 = 3\pi r^2 = 3 \times 3.14 \times 2^2 = 37.68$$

Hints to Discussion Questions

Question: The lateral surface of each of the following solids, prisms, pyramids, cylinders and cones, can be cut, peeled and unfolded to 2D shapes for easy calculations.

What common property do they all possess to allow the "3D" or curved surfaces to be changed into 2D shapes?





Hint: They all possess a common property called developable surface, that is, a 3D or curved surface that can be rolled out flat onto a plane without changing its area.

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