

Helping Preservice Teachers enVision Geometry

Debra Ward, PhD
Lindsey Gerber, PhD
Utah Valley University

Common Core State Standards (k-8)

- ▶ K.G.A.3: Identify shapes as two-dimensional (lying in a plane, “flat”) or three-dimensional (“solid”).
- ▶ K.G.B.4: Analyze and compare two-and three-dimensional shapes.
- ▶ 1.G.A.2: Compose two- or three-dimensional shapes to create composite shapes.
- ▶ 2.G.A.1: Recognize and draw shapes having specified attributes, such as given number of angles or a given number of equal faces.
- ▶ 3.G.A.2: Partition shapes into parts with equal areas.
- ▶ 6.G.A.1: Find the area of... polygons by composing into rectangles or decomposing into triangles.
- ▶ 6.G.A.2: Find the volume of a right rectangular prism...
- ▶ 6.G.A.4: Represent three-dimensional figures using nets made up of rectangles and triangles and use nets to find surface area of these figures.
- ▶ 7.G.A.3: Describe the two-dimensional figures that result from slicing three-dimensional figures, as in plane sections of right rectangular prisms and pyramids.
- ▶ 7.G.B.4: Know the formulas for the area and circumference of a circle. Give an informal derivation of the relationship between the circumference and area of a circle.
- ▶ 7.G.B.6: Solve real-world problems involving are, volume, and surface area of two- and three-dimensional objects...
- ▶ 8.G.C.9: Know the formulas for the volumes of cones, cylinders, and spheres and use them to solve real-world problems.

Prior knowledge

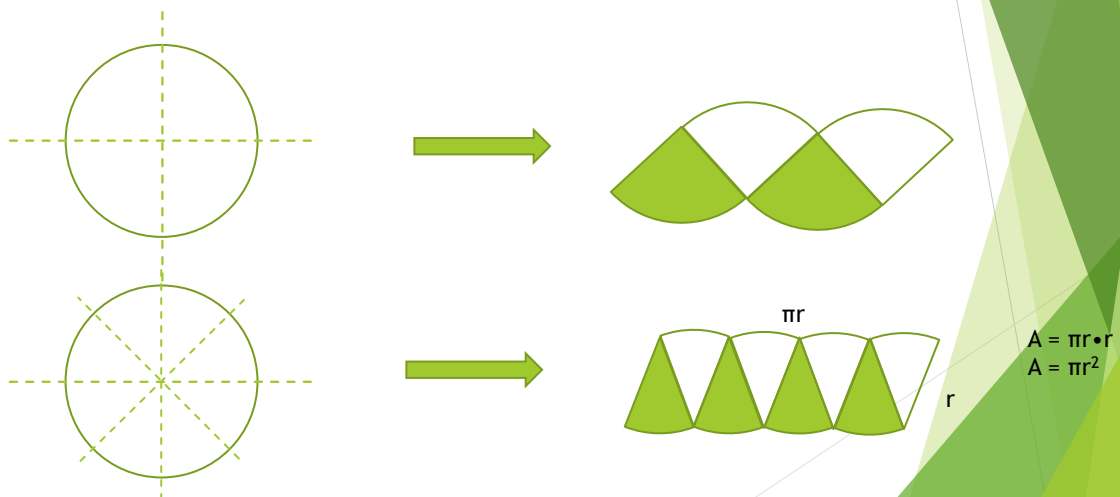
- ▶ Perimeter (including circumference)

Learning Trajectory of Activities

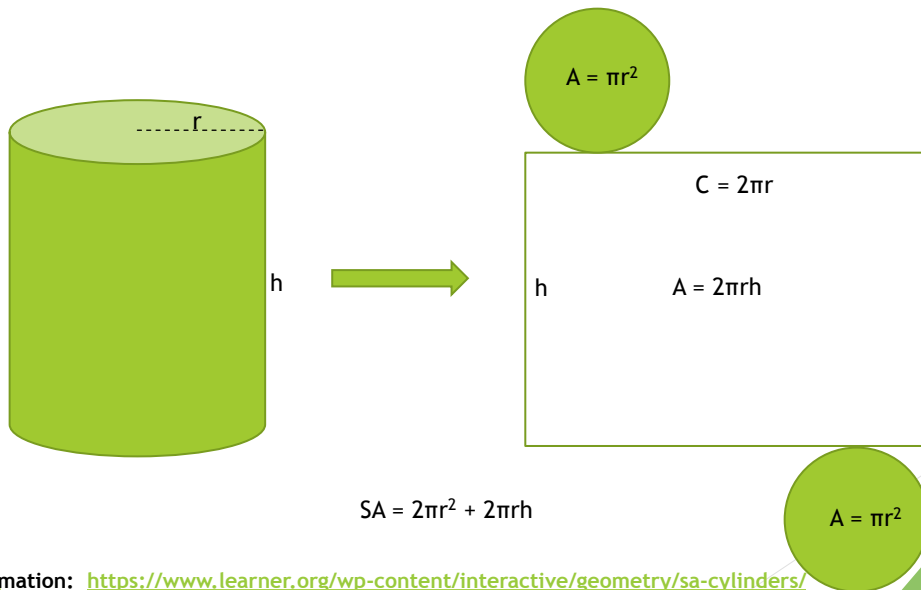
Movement from 2-dimensional to 3-dimensional

- ▶ Circle (area)
- ▶ Cylinder (surface area)
- ▶ Cylinder (volume)
- ▶ *Extension: Cone (volume)
- ▶ Hexagon (area)
- ▶ Hexagonal Prism (surface area)
- ▶ Hexagonal Prism (volume)
- ▶ *Extension: Hexagonal Pyramid (volume)

Deriving the Area of a Circle

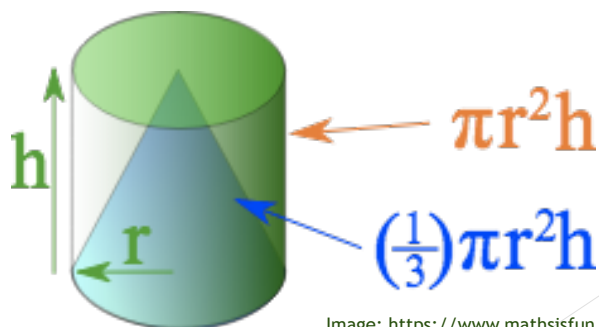


Deriving Surface Area of a Cylinder



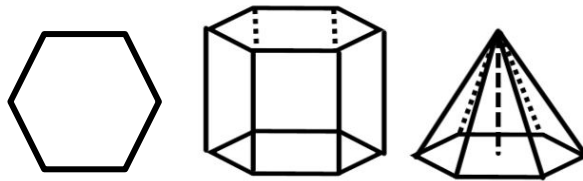
Volume of Cylinders and Cones

- Volume of a Cylinder Video for Young Students:
<https://www.youtube.com/watch?v=dujEcT2NU6A>
- Volume of a Cone:
Activity used to compare the volume of a cone to the volume of a cylinder
<https://www.youtube.com/watch?v=xwPiA0COi8k>



Regular Hexagons, Hexagonal Prisms, & Hexagonal Pyramids

- ▶ Why work with hexagons?
 - ▶ Area formula for hexagon not typically provided on formula sheets
 - ▶ Non-standard figures require problem solving strategies
 - ▶ 3.G.A.2: Partition shapes into parts with equal areas.
 - ▶ 6.G.A.4: Represent three-dimensional figures using nets made up of rectangles and triangles and use nets to find surface area of these figures.



- ▶ Desmos Volume Comparison Activity:
<https://teacher.desmos.com/activitybuilder/custom/5adce81eed2ada6785169a39>

Websites

- ▶ Deriving the formula for area of a circle:
<https://www.youtube.com/watch?v=YokKp3pwVFc>
- ▶ Understanding the formula for surface area of a cylinder:
<https://www.learner.org/wp-content/interactive/geometry/sa-cylinders/>
- ▶ Volume of a Cylinder Video for Young Students:
<https://www.youtube.com/watch?v=dujEcT2NU6A>
- ▶ Activity to compare volume of a cone to volume of a cylinder:
<https://www.youtube.com/watch?v=xwPiA0COi8k>
- ▶ Printable nets:
<https://www.math-salamanders.com/3d-geometric-shapes.html>
- ▶ Desmos Volume Comparison Activity:
<https://teacher.desmos.com/activitybuilder/custom/5adce81eed2ada6785169a39>



Q & A

Thank you!