13-3 Volumes of spheres, cones and cylinders.

$3\text{-}D\, ft^3$

Measure   Area
1-D ft   2-D ft^2

Objective: I can find the volume of spheres, cones and cylinders.
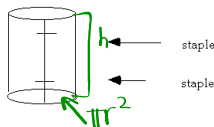

Discovering the Volume of a Cylinder

Take a piece of paper in your hand.

How do you calculate the area of this rectangle? $\ell \cdot h$

BxH

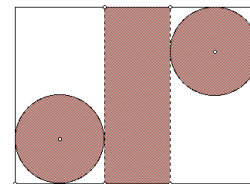Now fold this 2 dimensional piece of paper into a 3 dimensional cylinder.

h ← staple
← staple

πr^2

Find the volume of this rectangle transformed into 3 dimensions.

Hint: Find the BxH for the new figure.

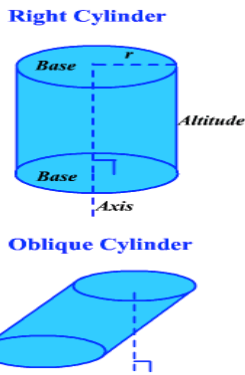
Volume of a cylinder   base circle   height

Base X Height = $(\pi r^2)h$

Think of it this way. The space taken up by the cylinder is the area of a circle stacked on top of each other for as tall as the height is.

Panel 1:

Remember: Cylinders may be oblique. Height is always perpendicular to the base.

Right Cylinder
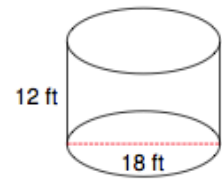
Base
r
Altitude
Base
Axis

Oblique Cylinder

Panel 2:

Find the volume of the cylinder. $V = \pi r^2 h \rightarrow$ height
radius

1.

$V = \pi (3^2) 5$
$V = \pi 45$
$V = 141.4 \text{ in}^3$

2.

10 yd

4·10
$V = \pi (2^2) 10$
$V = 40\pi$
$V = 125.7 \text{ yd}^3$

4 yd
r = 2

You try

12 ft

18 ft

$V = \pi (9^2) 12$
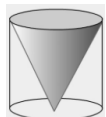30536.3 ft^3

Panel 3:

Volume of a Cone

Remember the volume of a prism vs. the volume of a pyramid.
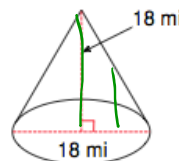
What do you conjecture the volume of a cone is (based on the volume of a cylinder)?
$\frac{1}{3} bh = \frac{1}{3} \pi r^2 h$

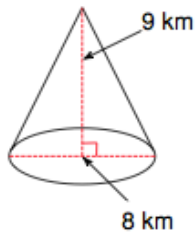*Check conjecture by seeing how many cones of water will fill the cylinder!

Panel 4:

Find the volume of the cone. $\frac{1}{3} \pi r^2 h \rightarrow$ height
radius

18 mi

18 mi

$\frac{1}{3} \pi (9^2) 18$
$V = 1526.8 \text{ mi}^3$

You Try

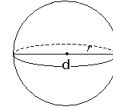Find the volume of the cone.

$V = \frac{1}{3}\pi r^2 h$

9 km

$V = \frac{1}{3}\pi (4^2) 9$

$150.8 km^3$

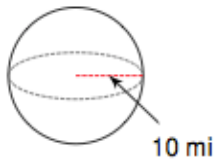8 km
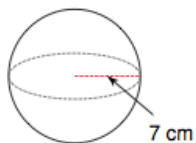

Volume of a sphere: $V = \frac{4}{3}\pi r^3$ radius

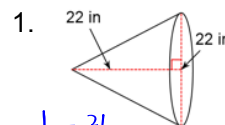Find the volume of the sphere.

$\frac{4}{3}\pi (10)^3 = 4188.79 mi^3$

10 mi

You Try

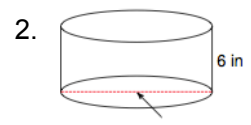$\frac{4}{3}\pi (7^3) = 1436.76 cm^3$

7 cm

Check for understanding.

Find the volume of each figure.

1. 22 in, 22 in

$V = \frac{1}{3}\pi r^2 h$
$= \frac{1}{3}\pi (11^2) 22$
$= 2787.64 in^3$

2. 6 in, 14 in

$V = \pi r^2 h$
$= \pi 7^2 \cdot 6$
$= 923.63 in^3$

3. 12 cm

$\frac{4}{3}\pi r^3 \quad \frac{4}{3}\pi 6^3$
$V = 904.78 cm^3$