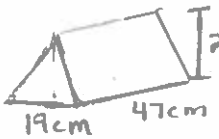
MPM 1DI Unit 9: 3-D Measurement Name:_____

Date: _____

Warm Up: Calculate the Volume and Surface area of a triangular prism. Given the base of the triangle is 19 cm, the height of the triangle is 24 cm and the height of the prism is 47 cm. $V = \frac{bh}{2} \times H$ $SA = \frac{bh}{2} \times 2 + 47(19) + 2(47)(\sqrt{1666.25})$

24, 9.5



$= \frac{19(24)}{2} \times 47$ $\doteq 19(24) + 3319.3$

$= 10716\ cm^3$ $SA \doteq 3375.3\ cm^2$

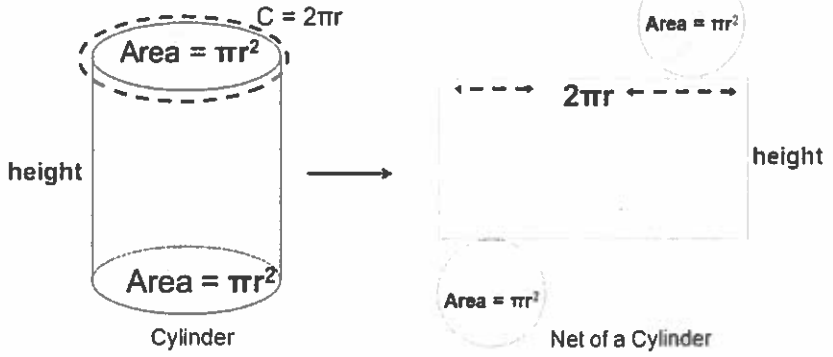
Lesson 2: Volume and Surface Area of Cylinders

A *cylinder* is a three dimensional solid with identical parallel circular bases. The lateral surface is curved and extends from one base to the other base.

The volume of a cylinder is the same as a prism:

$V = A_{base} \times$ height

or $V = \pi r^2 h$



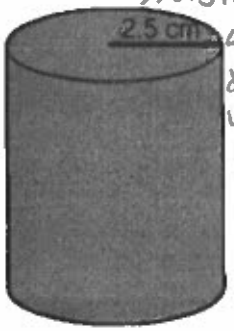
The net of a cylinder shows two circular bases and the lateral surface unfolds to reveal a simple rectangle. ~~So, the surface area of a cylinder is:~~

The height of the rectangle is the height of the prism, while the length of the rectangle is the circumference of the circular base. Therefore,

$S.A._{cylinder} = A_{2\ circles} + A_{rectangle}$

$= 2\pi r^2 + 2\pi rh$

Example 1: Calculate the volume and surface area of the following cylinder.



Convert to same units before substituting.

$V = \pi r^2 h$

$V = \pi (25)^2 (72)$

$V = 141371.6694...$

$V \doteq 141371.7\ mm^3$

OR $141.4\ cm^3$ ← to convert cubic units you must cube the conversion number.

$10mm = 1cm \Rightarrow 10^3 mm^3 = 1\ cm^3$

$SA = 2\pi r^2 + 2\pi rh$

$= 2\pi (25)^2 + 2\pi (25)(72)$

$SA \doteq 15236.7\ mm^2$

↳ OR $\div 10^2$

$SA \doteq 152.4\ cm^2$

Example 2: A can of soup has a volume of 375 mL. $= 375 cm^3$

a) If the height of the can is 12 cm determine the radius of the can. (Note: 1 mL = $1cm^3$)

$V = 375$, $h = 12$, $r = ?$ $\quad V = \pi r^2 h$

$375 = \pi r^2 (12)$

$12\pi r^2 = 375$

$r^2 = \frac{375}{12\pi}$

$r \doteq \sqrt{9.94718\ldots}$, $r > 0$

$r \doteq 3.15$

∴ the radius is about 3.15cm

b) How much paper is required to make the soup label?

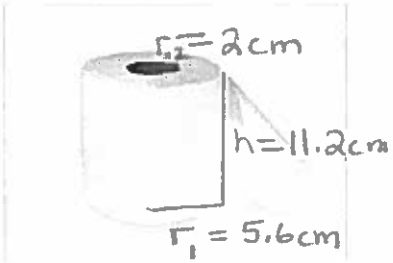
$SA = 2\pi rh$

$= 2\pi (3.15)(12)$

$\doteq 237.5$

∴ the paper required to make the label is $237.5\ cm^2$ (ignoring need for overlap at seam).

Example 3: A roll of toilet paper has a height and diameter of 11.2cm. If the inner cardboard roll is 4cm in diameter, what is the volume of toliet paper on the roll?



$V_{paper} = V_{large\ \square} - V_{small\ \square}$

$= \pi r_1^2 h - \pi r_2^2 h$

$= \pi (5.6)^2 (11.2) - \pi (2)^2 (11.2)$

$= 962.684\ldots$

$\doteq 962.7$

∴ the volume of paper on the roll is $962.7\ cm^3$

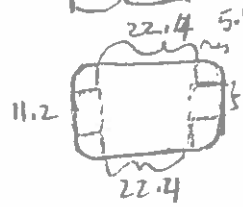
Example 4: How much plastic would be required to package 12 toilet paper rolls from example 3, if they are arranged in a 2 by 3 by 2 orientation?

$SA = A_{TOP} \times 2 + P_{TOP} \times h$

$= (22.4^2 + 11.2^2 + \pi(5.6)^2) \times 2 + (11.2 \times 6 + 11.2\pi) \times 22.4$

$= 1451.44 + 2293.44$

$SA \doteq 3744.9\ cm^2$ plus material for overlaps



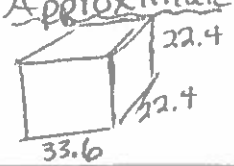
$A_{top} = 22.4^2 + 11.2 \times 11.2 + \pi(5.6)^2$

$\doteq 725.72$

$P_{top} = 11.2 \times 6 + 11.2\pi$

$\doteq 102.3858$

OR Approximate assuming square corners.



$SA = 22.4^2 \times 2 + 33.6 \times 22.4 \times 4$

$= 4014.08\ cm^2$