**Course: <u>MFM2P Gr. 10 Applied</u>** **Lesson: <u>54</u>**

**Unit: <u>Volume and Surface Area</u>** **Topic: <u>Surface Area and Volume of Cylinders</u>**

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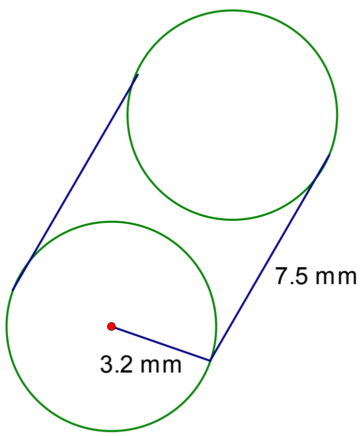
- ***homework check:*** **<u>FM10</u> p. 376 #3 – 6, 11**

- ***note:*** **<u>Surface Area and Volume of Cylinder</u>**

The surface area of a cylinder is the sum of the faces of all three sides. The circular faces of the top and bottom are identical and the side of the cylinder can be opened up into a rectangular shape with a length the same as the circumference of the circular face. For this reason, the formula for the surface area of a cylinder is $SA = 2\pi r^2 + 2\pi rh$ . The area of the circular faces (the top and bottom are equal) is $2\pi r^2$ . The circumference of the circular face is $2\pi r$ which is multiplied by the height to represent the area of the side of the cylinder.

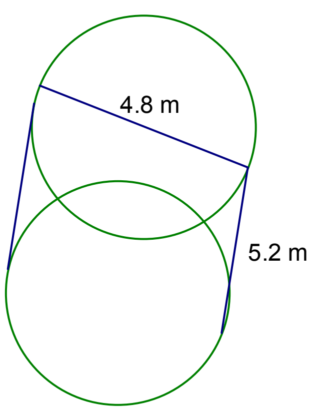
The volume of a cylinder can be found by multiplying the base area by the height just as in any other prism. For a cylinder the formula for volume is $V = \pi r^2 h$ .

For example, find the volume and surface of each of the following cylinders.




$$SA = 2\pi r^2 + 2\pi rh$$
$$= 2\pi(3.2)^2 + 2\pi(3.2)(7.5)$$
$$= 64.34 + 150.80$$
$$= 215.14mm^2$$

$$V = \pi r^2 h$$
$$= \pi(3.2)^2(7.5)$$
$$= 241.3mm^3$$




$$SA = 2\pi r^2 + 2\pi rh$$
$$= 2\pi(2.4)^2 + 2\pi(2.4)(5.2)$$
$$= 36.19 + 78.4$$
$$= 150.78m^2$$

$$V = \pi r^2 h$$
$$= \pi(2.4)^2(5.2)$$
$$= 3.5mm^3$$

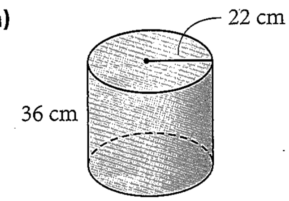
- ***homework assignment:*** **<u>FM10</u> p. 386 # 1, 4, 5, 10, 11**

## Practise the Concepts A

**For help with question 1, refer to Example 1.**

1. Find the surface area and the volume of each cylinder.

a)

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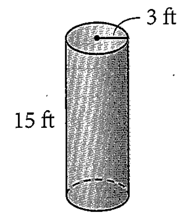
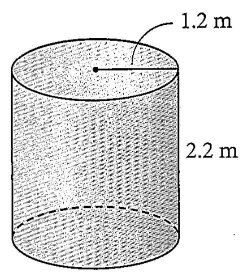
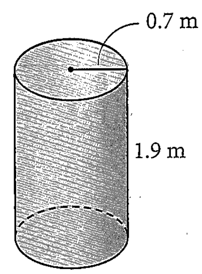



c)



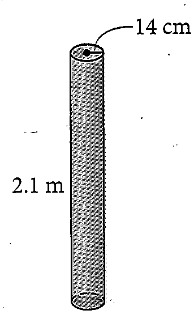

d)




**For help with questions 2 and 3, refer to Example 2.**

2. Find the surface area of each cylinder.

a)

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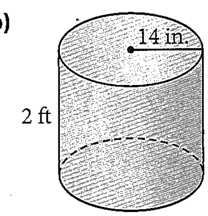


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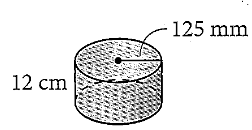


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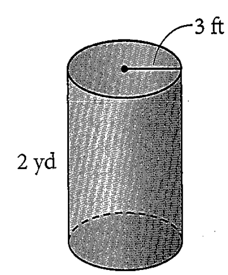
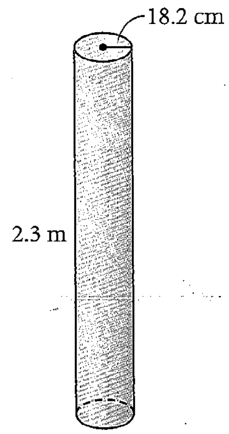


3. Find the volume of each cylinder.

a)

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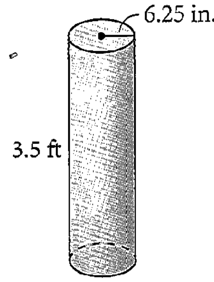


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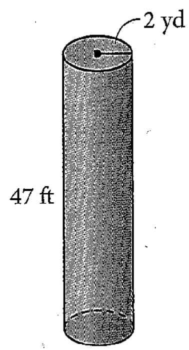


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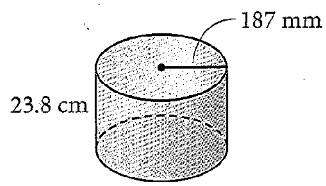
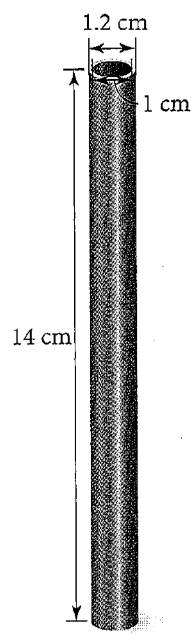
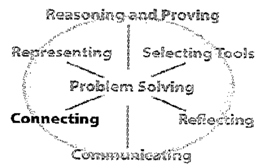



## Apply the Concepts B

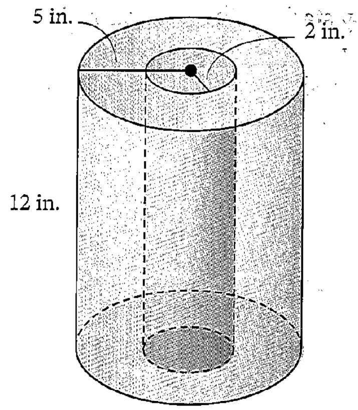
**For help with question 4, refer to Example 3.**

4. A cylindrical copper bolt sleeve is made by drilling out the centre of a cylindrical piece of copper. The radius of the piece of copper is 1.2 cm and the radius of the hole is 1 cm. The length of the piece of copper is 14 cm.
   **a)** Find the total volume of the copper bolt sleeve and the hole.
   **b)** Find the volume of the hole in the bolt sleeve.
   **c)** Find the amount of copper that is in the sleeve.






**5.** Find the amount of material needed to make this hollow cylinder.




**For help with questions 6 to 8, refer to Example 4.**

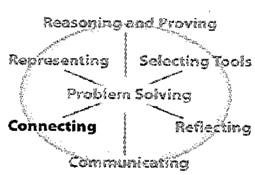
**6.** A cylinder has volume 425 $cm^3$ and height 22 cm. Find the radius of the cylinder to the nearest tenth of a centimetre.

**7.** A cylinder with radius 14 in. has volume 267.3 $in.^3$. Find the height of the cylinder to the nearest tenth of an inch.

**8.** A log with a uniform diameter of 26 cm is cut into 27 equal pieces, each with height 35 cm. The pieces are then to be painted on all surfaces.

**a)** Find the surface area of one piece.

**b)** What is the total area to be painted?




**9.** A building is in the shape of a cylinder with a radius of 30 m. The height of each floor is 3.4 m. The mechanical engineer needs to determine the volume of air the building will contain to help design the air exchange system. If there are 22 floors in the building, how much air is contained within the building?

**10.** A paint can is marked as containing 972 mL of paint. The can has a diameter of 10.6 cm and a height of 11.4 cm.

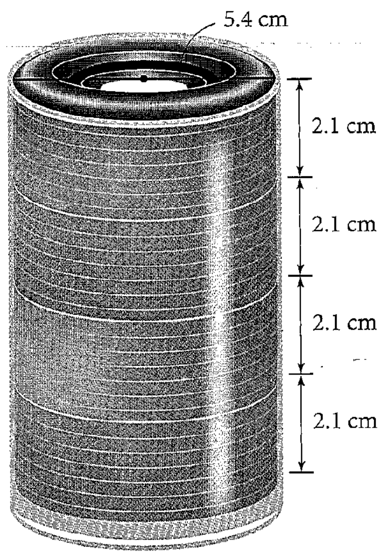
**a)** Find the volume of the can in cubic centimetres.

**b)** $1\ cm^3 = 1$ mL. Will 972 mL of paint fit in the can? How do you know?

**c)** Work with a partner. Why would the volume of the paint in the can not be 1000 mL or 1 L?

**Chapter Problem**

**11.** Vanessa plans to market replacement skateboard wheels in a tube by stacking four wheels inside a clear plastic cylinder that is slightly taller and wider than the wheels. Each wheel has diameter 5.4 cm and is 2.1 cm thick. The plastic to make the cylinder costs 35¢/cm$^2$. Suppose she designs the container so the radius of the cylinder is 0.8 mm greater than the radius of the wheel and the height is 0.1 cm greater than the height of a stack of four wheels.




**a)** What are the dimensions of the tube?

**b)** What is the surface area of one tube?

**c)** Find the cost to produce 10 000 tubes.

**12.** Work with a partner. You will each need a piece of paper with dimensions 8.5" by 11". Roll your piece of paper along the width to form a cylinder with the greatest possible diameter. Your partner rolls the other piece of paper along its length to form a cylinder with the greatest possible diameter. Which cylinder has greater volume? Justify your answer.