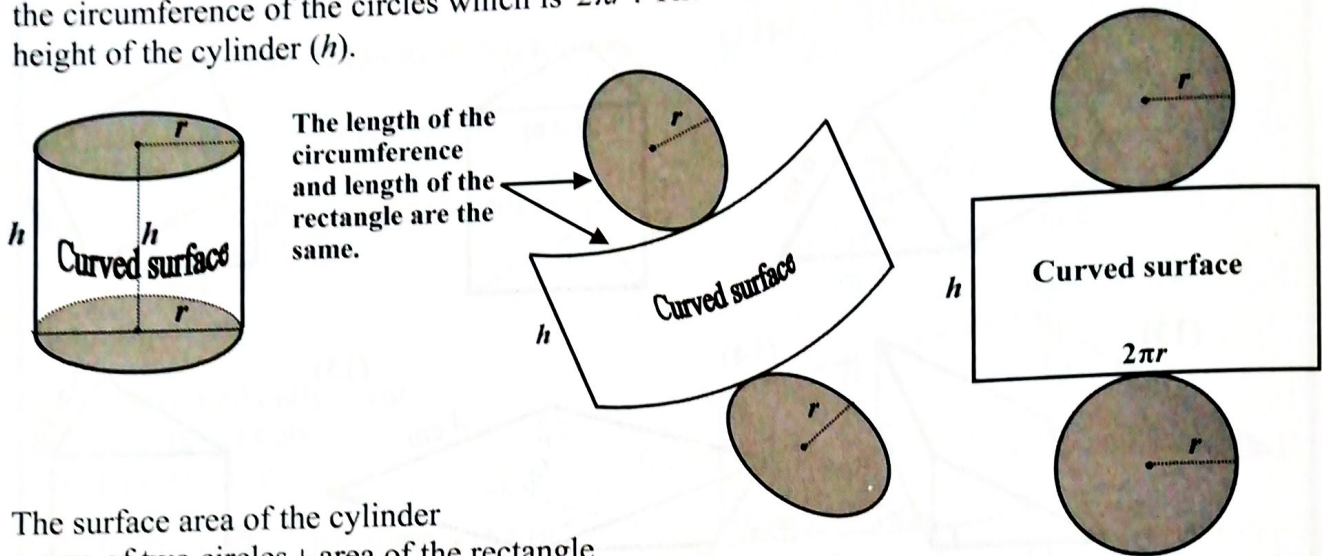


## Surface area and volume of a cylinder

A cylinder is a solid with two circles as bases and a curved surface which is not a flat surface. Therefore, although the cylinder is a prism (has two congruent parallel bases), it is not a polyhedron (not all faces are flat polygons). If the cylinder is opened up and flattened, the net will be made up of two identical circles and a rectangle. The rectangle has the same length as the circumference of the circles which is  $2\pi r$ . The width of the rectangle will be equal to the height of the cylinder ( $h$ ).



The surface area of the cylinder  
 = area of two circles + area of the rectangle  
 =  $\pi r^2 + \pi r^2 + 2\pi r \times h$   
 =  $2\pi r^2 + 2\pi r h$

The volume of the cylinder  
 = area of chosen base  $\times$  height (distance moved by the base)  
 =  $\pi r^2 \times h$   
 =  $\pi r^2 h$

### Example 6

Calculate the surface area and volume of the cylinder if:

- the cylinder is closed on all sides
  - the cylinder is open on top.
- Round off your answers to two decimal places.

### Solution

- Surface area of the cylinder  
 = area of two circles + area of the rectangle

The radius is 7 cm which is half of the diameter.

$\therefore$  Area of circle

$$= \pi(7)^2$$

The area of the curved surface is calculated using the formula  $2\pi r h$ .

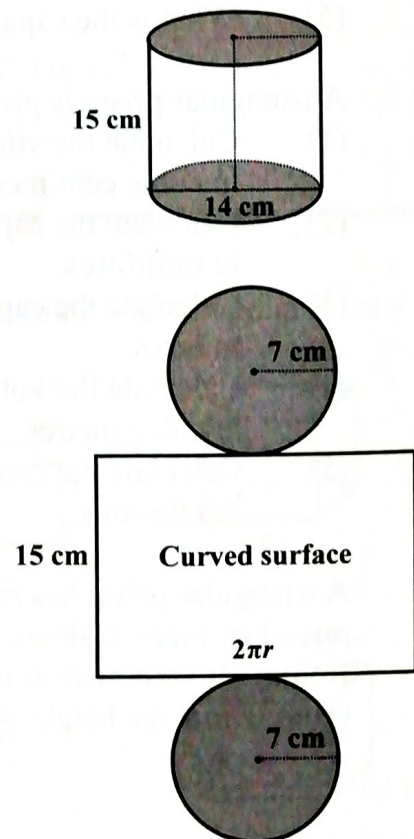
The length of the curved surface is  $2\pi(7)$  and the width is 15 cm (same as the height of the cylinder).

Area of curved surface

$$= \text{length} \times \text{width}$$

$$= (2\pi r) \times h$$

$$= 2\pi(7)(15)$$



The surface area of the cylinder

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

$$= 2\pi(7)^2 + 2\pi(7)(15)$$

$$= (98\pi) + (210\pi)$$

$$= (308\pi)$$

$$= 967,61 \text{ cm}^2$$

The volume of the cylinder  
= area of chosen base height

$$= \pi r^2 \times h$$

$$= \pi(7)^2(15)$$

$$= \pi(49)(15)$$

$$= (735\pi)$$

$$= 2309,07 \text{ cm}^3$$

(b) The top circle is missing.

Surface area

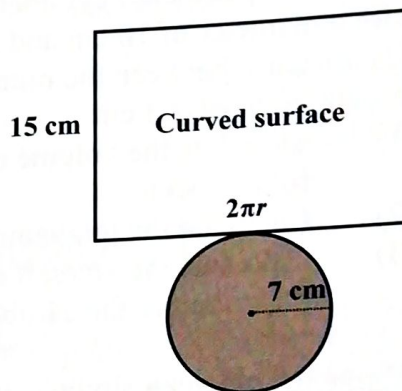
$$= \pi(7)^2 + 2\pi(7)(15)$$

$$= (49\pi) + (210\pi)$$

$$= (259\pi)$$

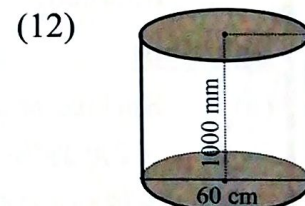
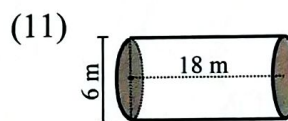
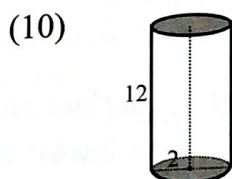
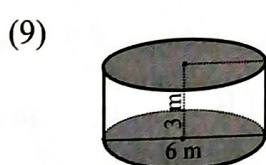
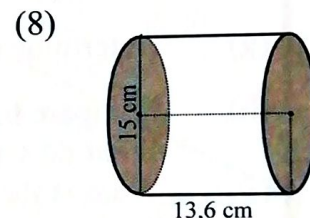
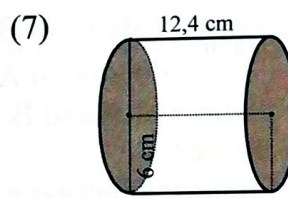
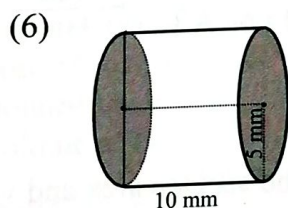
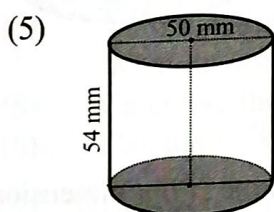
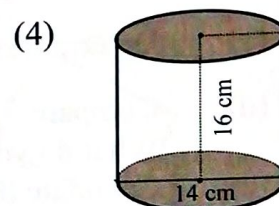
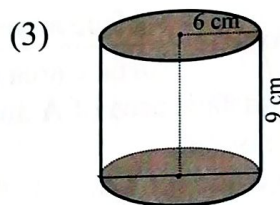
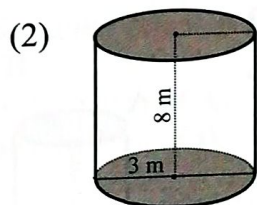
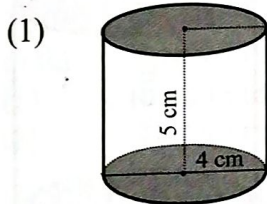
$$= 813,67 \text{ cm}^2$$

The volume will remain the same.



#### EXERCISE 4

(a) Calculate the surface area and volume of the following cylinders. Round your answers off to two decimal places.



(b) A cylindrical drinking glass is made up of a solid base and a top curved part which is hollow and open on top.

- (1) Calculate the total volume of the drinking glass.
- (2) What is the capacity of the drinking glass in ml?
- (3) What is the capacity of the drinking glass in l?
- (4) Calculate the surface area of the top curved part.

