A cylinder can be considered as a prism whose base is an n-sided polygon where n is very large. Therefore:

Volume of cylinder = Base area × Height

When the base radius is r units and the height is h units, we have the following formula:

Volume of cylinder = $\pi r^2 h$

From the net of the cylinder, we can see that
AA' = circumference of the base circle
$= 2\pi r$
$\therefore$ Area of curved surface = Area of rectangle $AA'D'D$
$= 2\pi r \times h$
$= 2\pi rh$

Base area of a cylinder = area of circular base = πr^2

Remark

Total surface area of a closed cylinder = Area of curved surface + 2 × Base area.
Thus we have the following formula:

Total surface area of a closed cylinder = $2\pi rh + 2\pi r^2$

If a cylinder has only one end face, it is an open cylinder. A solid cylinder is a closed cylinder.

Remark

Example 9

The base radius of a solid cylinder is 3 cm and its height is 8 cm. Find
(a) the volume of the cylinder,
(b) the total surface area of the cylinder.
(Leave your answers in terms of π.)

Solution

(a) When $r = 3$ and $h = 8$, we have:
Volume of the cylinder $= \pi r^2 h$
$= \pi \times 3^2 \times 8$
$= 72\pi \text{ cm}^3$

(b) Total surface area of the cylinder $= 2\pi rh + 2\pi r^2$
$= 2\pi \times 3 \times 8 + 2\pi \times 3^2$
$= 66\pi \text{ cm}^2$

Try It 9!

The base radius of a solid cylinder is 2 cm and its height is 7 cm. Find
(a) the volume of the cylinder,
(b) the total surface area of the cylinder.
(Leave your answers in terms of π.)