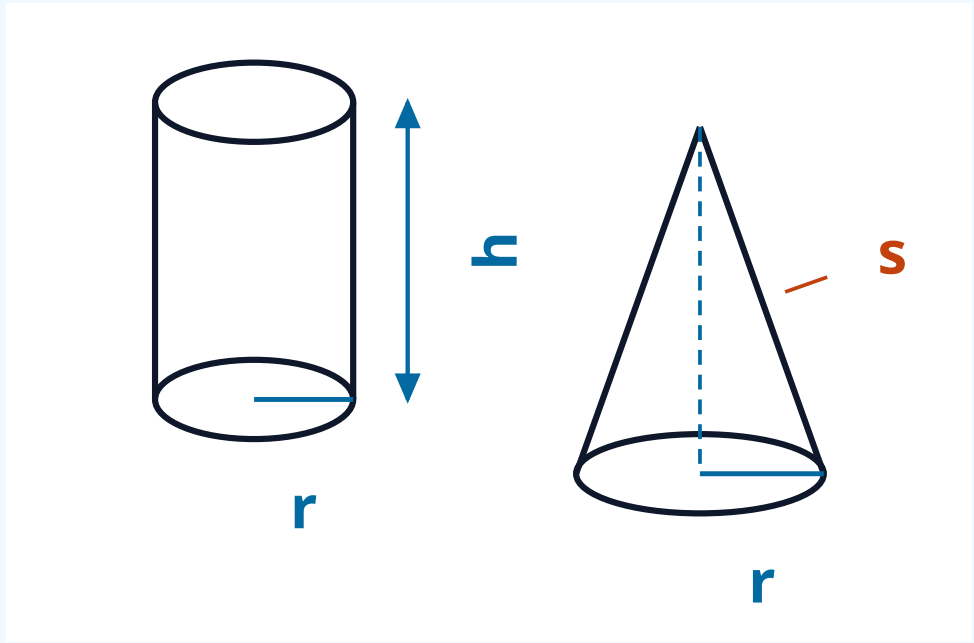
Mathematics 10-3

Unit M: Measurement in SI and imperial

Surface area of solids

Surface area in sheet metal work

- A duct fabricator orders metal for a right cylinder, and a hopper builder orders metal for a right cone.
- You order the metal that covers the outside.
- That cover is the surface area, including the ends when the formula counts the ends.



Cylinder and cone formulas

- Cylinder surface area equals $2\pi r^2$ plus $2\pi rh$.
- The letter r stands for radius, h for height, and pi is taken as 3.14.
- The two circular bases use $2\pi r^2$.
- The lateral face is a rectangle whose width is the circumference $2\pi r$ and whose height is h.
- Cone surface area equals πr^2 plus πrs.
- The letter s stands for slant height, the sloping distance along the side of the cone.



Key terms

surface area

The total cover of the outside faces of a solid, measured in square units. (SA)

slant height

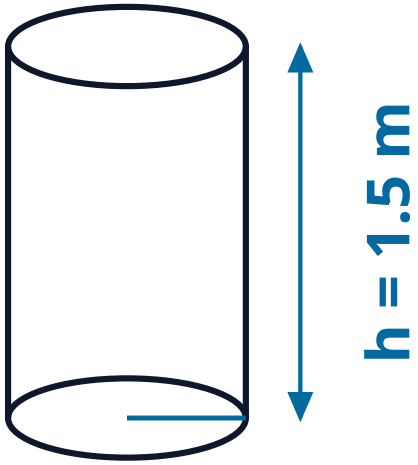
The distance along the sloping side of a right cone, from the base rim to the apex. The letter s stands for it. (s)

radius

Half the diameter. Cylinder and cone formulas in this lesson take the radius, written r. (r)

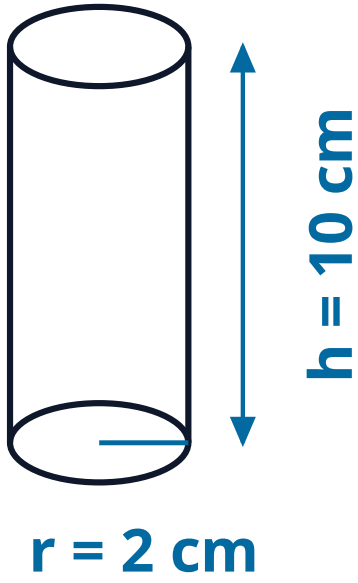
A duct with radius 0.2 metres

- The duct diameter is 0.4 metres, so the radius is half of that, 0.2 metres.
- The height is 1.5 metres and pi is 3.14.
- The two bases are 2 times 3.14 times 0.04, which equals 0.2512 square metres, because 0.2 times 0.2 equals 0.04.
- The lateral area starts with 2 times 3.14 times 0.2, which equals 1.256.
- Then 1.256 times 1.5 equals 1.884 square metres.
- Add 0.2512 and 1.884 to get 2.1352 square metres.



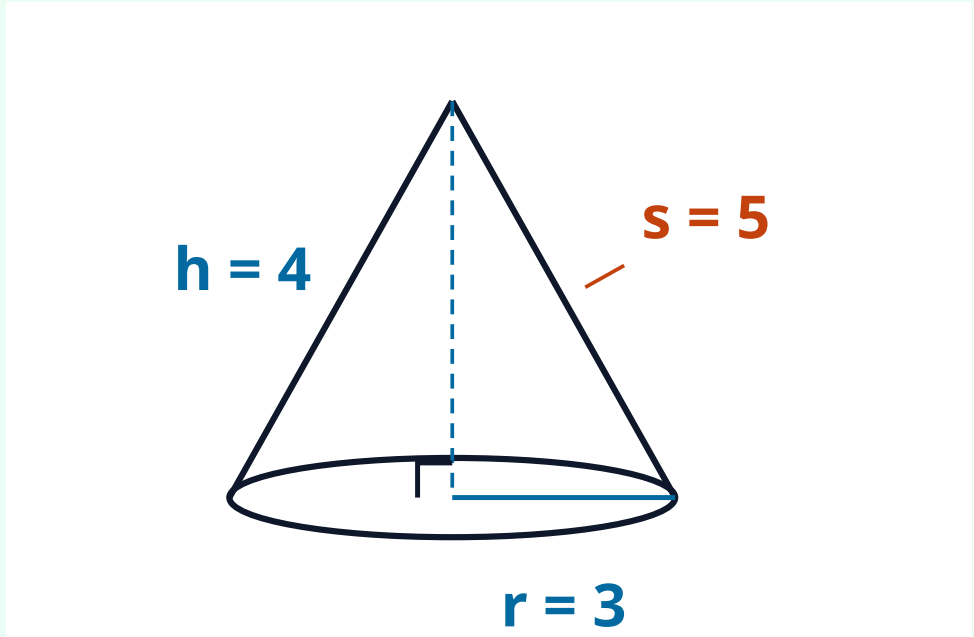
The small cylinder in centimetres

- The small cylinder has radius 2 centimetres and height 10 centimetres.
- The radius squared is 2 times 2, which equals 4.
- Two bases: 2 times 3.14 times 4 equals 25.12 square centimetres.
- The lateral face starts with 2 times 3.14, which equals 6.28.
- Then 6.28 times 2 equals 12.56, and 12.56 times 10 equals 125.6 square centimetres.
- Add 25.12 and 125.6 to get 150.72 square centimetres.



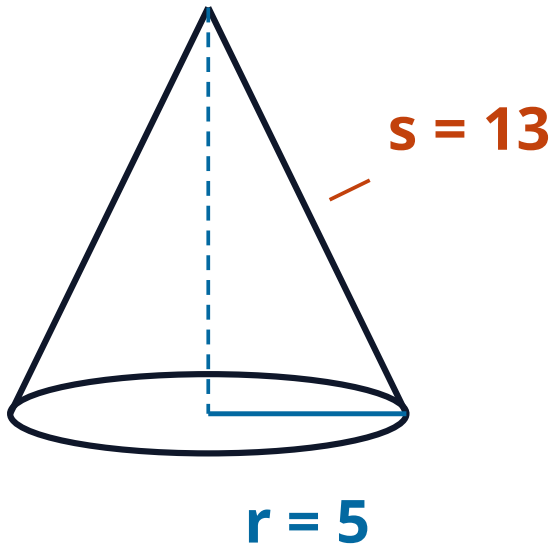
A hopper with a 3-4-5 slant

- A right cone with radius 3 and height 4 has slant height 5.
- Three squared is 9 and four squared is 16.
- Nine plus 16 equals 25, which is 5 squared.
- The surface area is πr^2 plus $\pi r s$.
- That is 9 pi plus 15 pi, which is 24 pi.
- With pi taken as 3.14, 24 times 3.14 equals 75.36 square units.



A larger cone and a sense check

- The base uses 5 times 5, which equals 25, so that part is 25π.
- The lateral face uses 5 times 13, which equals 65, so that part is 65π.
- Adding 25 and 65 equals 90, so the surface area is 90π.
- Multiplying 90 by 3.14 equals 282.6 square units.
- A sensible total is larger than one base alone.
- The duct total 2.1352 square metres is larger than one base of 0.1256 square metres.



Metal-order check

- State the radius you would substitute for a duct of diameter 0.4 metres, and the surface area 2.1352 square metres.
- State the slant you would use for radius 3 and vertical height 4, and the surface area 75.36 square units.

