

Surface area

Year 11 General Maths
Units 1 and 2

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Learning Objectives

By the end of the lesson, I hope that you understand and can apply the following to a range of questions from the Unit 1 and 2 General Mathematics course.

- To be able to find the surface area of objects with plane surfaces, such as prisms, cuboids and pyramids.
- To be able to find the surface area of objects with curved surfaces, such as cylinders, cones and spheres.



Recap

In the previous lessons we looked at how to find the volume of the more common shapes shown below:

Rectangular prisms
Square prisms
Triangular prisms
Cylinders
Spheres
Pyramids

Having looked at the areas inside 2D shapes and the volumes (and capacities) of 3D shapes, it's time to go back and look at areas again … this time the areas of **all surfaces of a shape**.





Not under the surface …. On the surface

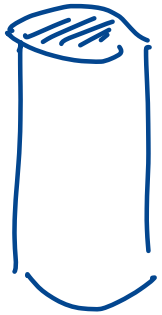
The hardest part of this whole topic is trying to work out how many surfaces a shape has!

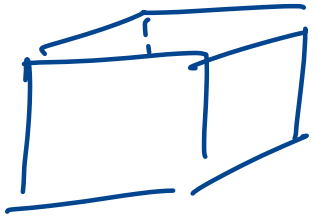
Once we identify the surfaces in shape, we then need to find the area of each surface and **add them all together**.

Easy right?

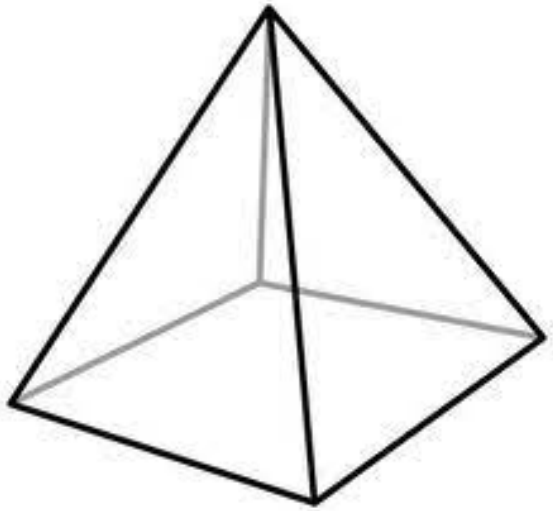
Nope!

Questions will try and trick you.





5 faces



Common tricks:
They might tell you a cylinder is open.
They might tell you that you can't "paint the bottom of a shape"
They might put two shapes together "hence creating a composite shape"

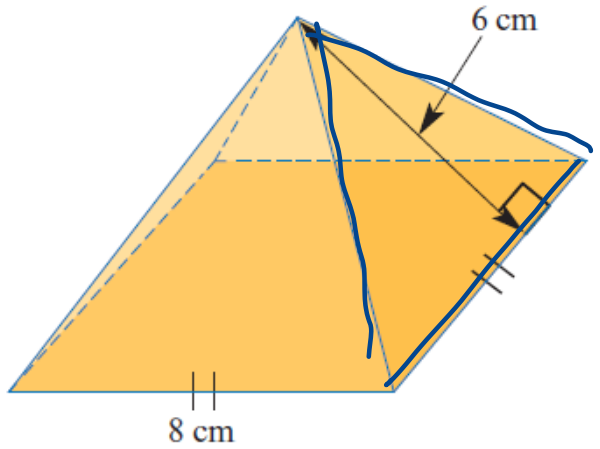


Prisms and pyramids

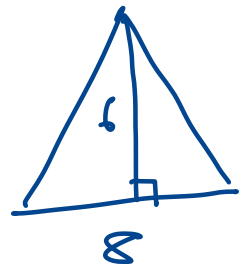
We are generally only going to need to find the surface area of a prism or pyramid. Hence, it becomes important to know how to split prisms into their respective sides (and hence shapes).

If we look at the shape on the right, we can see that the base is a square and the four sides are each triangles. In fact, they are the same triangle!

Find the surface area of this square-based pyramid.



$\frac{1}{2} \times b \times h$



$SA_{\square} = 8 \times 8 = 64 \text{ cm}^2$

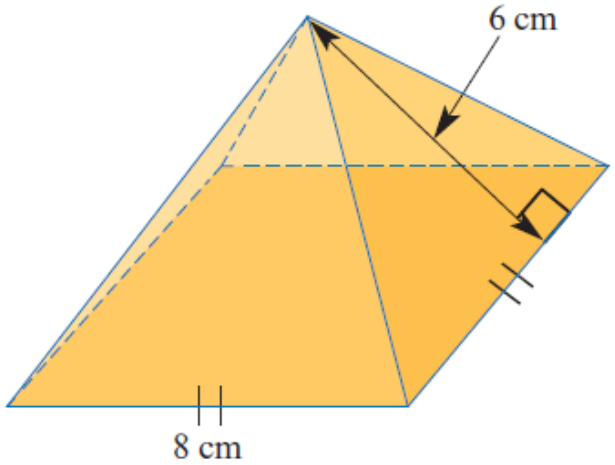
$SA_{\triangle} = \frac{1}{2} \times 8 \times 6 = 24 \text{ cm}^2$

$TSA = 64 + 4 \times 24 = 160 \text{ cm}^2$



Example: Finding the surface area of a pyramid

Find the surface area of this square-based pyramid.





Curved surface areas

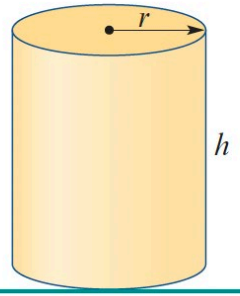
Not all shapes have flat sides. We have to deal with curves.

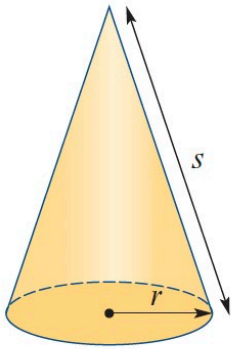
We have already looked at finding the volume of three of the most common shapes:

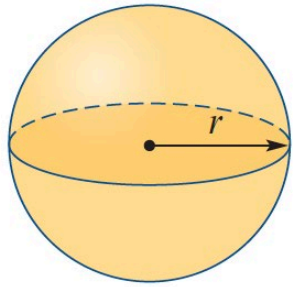
- Cylinder
- Cone
- Sphere

We can also find the surface area of each.

We really only need to know how to put values into each of the formulae using the CAS to smash this section of the course.

Shape	Surface area
Cylinder 	$SA = 2\pi r^2 + 2\pi rh$

Shape	Surface area
Cone 	$SA = \pi r^2 + \pi rs$

Shape	Surface area
Sphere 	$SA = 4\pi r^2$

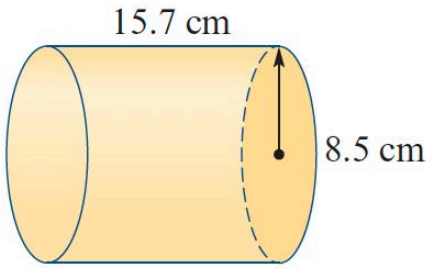
$SA = \pi r^2 + \pi r^2 + 2\pi rh$

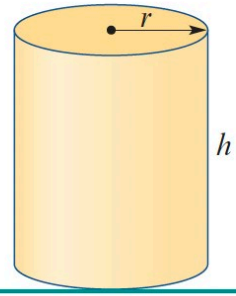
TOP BOT SIDE



Example

Find the surface area of this cylinder to one decimal place.



Shape	Surface area
Cylinder 	$SA = 2\pi r^2 + 2\pi rh$

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

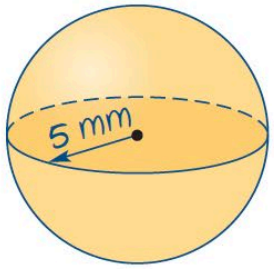
$= \pi \cdot 8 \cdot 5^2 + \pi \cdot 8 \cdot 5^2 + 2 \cdot \pi \cdot 8 \cdot 5 \cdot 15 \cdot 7$

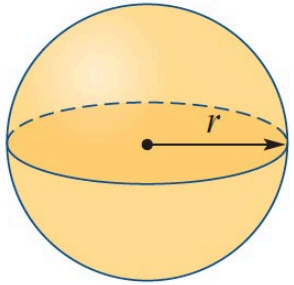
$= 1292 \cdot 5 \text{ cm}^2$



Example

Find the surface area of a sphere with radius 5 mm to two decimal places.



Shape	Surface area
Sphere 	$SA = 4\pi r^2$

$$SA = 4 \times \pi \times r^2$$

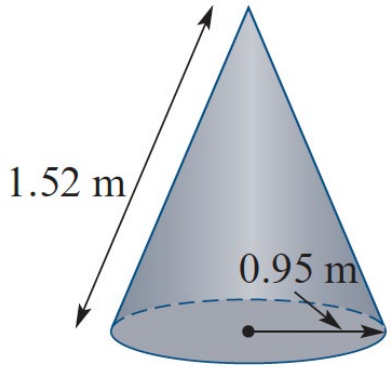
$$= 4 \times \pi \cdot 5^2$$

$$= 314.16 \text{ mm}^2$$



Example

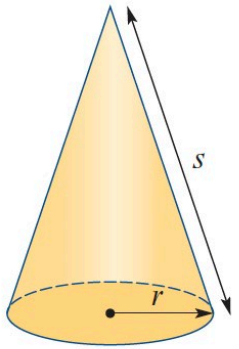
Find the surface area of the following shape:



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

$$= \pi \cdot (0.95)^2 + \pi \cdot (0.95) \cdot 1.52$$

$$= 7.37 \text{ m}^2$$

Shape	Surface area
Cone 	$SA = \pi r^2 + \pi rs$



Tricks and more tricks

They might not always give you the slant length for a cone. They might give you the height and expect you to use Pythagoras' Theorem to find the slant length.

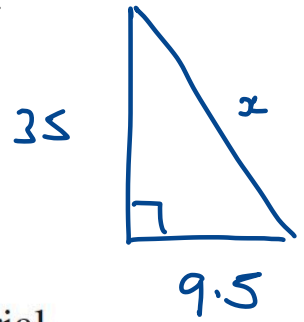
These are the types of questions you would need to look out for in the exam! We can mix more than one subject area together.

We might also ask you to find the circumference etc.

Here is an example from the Cambridge Textbook:

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

$= \pi \cdot r \cdot s$



$x^2 = 35^2 + 9.5^2$

$x = \sqrt{35^2 + 9.5^2}$

A set of 10 conical paper hats are covered with material. The height of a hat is 35 cm and the diameter is 19 cm.

a What amount of material, in m^2, will be needed? Give your answer to two decimal places.

b Tinsel is to be placed around the base of the hats. How much tinsel, to the nearest metre, is required?

$C = \pi \times D$

$= \pi \times 19 \times 10$



19cm



Work to complete

The work I am asking to be completed for this topic is shown below.

This is the minimum work which should be completed. The more questions which are answered the better your chance of success in exams. Questions towards the end of the exercises and in the Chapter Review are the best practice you can do.

Questions to complete:
Exercise 10G: All questions

