

# Surface area and volume



Starter worksheet

There are many industries where you need to work out the surface area or volume of an object. If a company manufactures steel pipes for a factory, they need to know how much steel they'll need to buy and will have to calculate the surface area of the pipes.

Most companies have to store materials in a warehouse. They need to know how much warehouse space they'll need and so will have to estimate the volume of the materials they need to store. The company can't ask for too little warehouse space but if they ask for a lot more space than they need, they'll have to pay the cost for that space and so reduce their final profits.

Circumference $C$ of a circle with radius $r$	$C = 2 \pi r$
Area $A$ of a circle with radius $r$	$A = \pi r^2$
Volume $V$ of a cylinder with radius $r$ and height $h$	$V = \pi r^2 h$

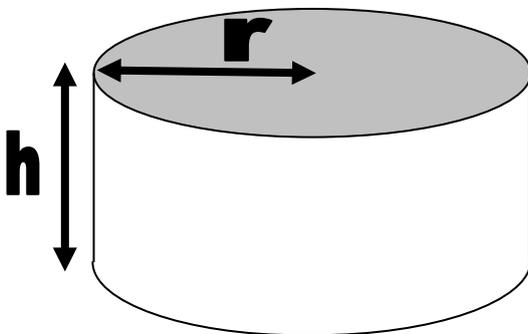
Using the formulas given in the table above, answer the questions below. Remember that the diameter of a circle is twice its radius. The number  $\pi$  is 3.14 to 2 decimal places.

1. What is the area of a circle of radius 6cm?
2. If a circle has circumference 44cm, what is its radius to the nearest centimetre?
3. If a cylindrical steel pipe has radius 60cm and length 200cm, what is its surface area? (You will have to think about the formula for this one. Draw a picture!)
4. What is the surface area in square metres of a cylindrical steel pipe which has radius 40cm and length 5 metres? (You'll need to convert the units to metres.)
5. What is the volume in cubic metres of a cylindrical steel drum which has radius 50cm and height 1 metre?
6. What would the formula be for the total surface area of a closed cylindrical steel drum with radius  $r$  and height  $h$ ? (A closed drum has a curved surface, a top and a bottom.)
7. What is the total surface area in square **metres** of a closed cylindrical steel drum with radius 30cm and height 80cm?

# Surface area and volume

You work for a company called Kitchips that makes nutritious cat food. They are bringing out a new product and you will have to decide how the product should be sold and at what price.

**Remember to convert all units first!**



Basic Mix costs £200 per cubic metre.  
Superior Mix costs £250 per cubic metre.  
Top Quality Mix costs £280 per cubic metre.

Aluminium costs £15 per square metre.

You have to work out the cost of producing a tin of cat food. Suppose that the radius  $r$  of a tin is 6cm and its height  $h$  is 7cm.

You need to add two costs together for each tin: the aluminium needed to make the tin and the cost of filling the tin with one of the mixes. Use the information above.

	Basic Mix	Superior Mix	Top Quality Mix
Cost of making the tin			
Cost of filling the tin with mix			
Total cost			

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## Results of the Marketing Survey

Kitchips commissioned a survey to find out what sizes of tin people would buy. The conclusions were:

The volume of the tin should be between  $400\text{cm}^3$  and  $600\text{cm}^3$ .  
The ratio of diameter to height should be between 1.5 and 1.7.  
The tin should be between 8cm and 16cm in diameter.  
The tin should be between 4cm and 10cm in height.

Find a size of tin satisfying the conclusions of the survey. To make things easier for your production staff, the radius and height should each be a whole number of centimetres.

Height of tin	
Radius of tin	

Use your work from previous sheets to help you complete the table below, using the size of tin you just worked out.

Total cost of tin of Basic Mix	
Total cost of tin of Superior Mix	
Total cost of tin of Top Quality Mix	