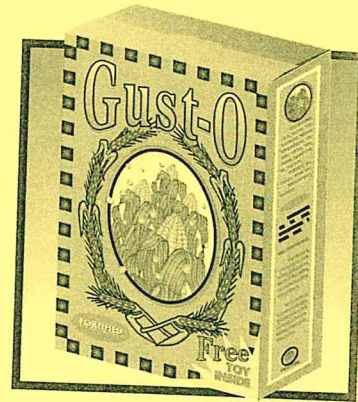


## 8.6 Surface Area

### Activity: Measure the Container

To work out the cost of making a package, a manufacturer needs to know the amount of material needed. It is useful to know the sum of the areas of the faces of the package. The sum of the areas of the faces of a three-dimensional figure is called the **surface area** of the figure. Consider the surface area of a cereal box.



#### Inquire

- How many faces does the box have?
- List any pairs of faces with the same area.
- Measure the height, length, and width of the box.
- Calculate the area of each face.
- Calculate the surface area of the box.
- Have you accounted for all the cardboard in the box? If not, describe how to improve the method.

One way to calculate the surface area of a figure is to use a net of the figure.

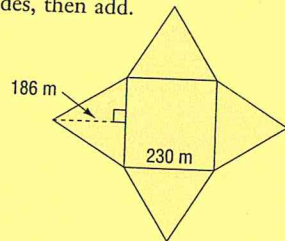
#### Example

The pyramid of Khufu was built around 2500 B.C. Calculate its surface area.



#### Solution

Draw a net of the pyramid. The surface area includes the area of the base, which is 230 m by 230 m. The sides are 4 identical triangles, each 186 m high and with a base of 230 m. Calculate the areas of the base and the 4 sides, then add.



$$\begin{aligned} \text{Area of base} &= 230 \times 230 = 52\,900 \\ \text{Area of side} &= \frac{1}{2} \times 230 \times 186 = 21\,390 \\ \text{Area of 4 sides} &= 4 \times 21\,390 = 85\,560 \end{aligned}$$

$$\begin{aligned} 200 \times 200 &= 40\,000 \\ \frac{1}{2} \times 200 \times 200 &= 20\,000 \\ 4 \times 20\,000 &= 80\,000 \\ 40\,000 + 80\,000 &= 120\,000 \end{aligned}$$

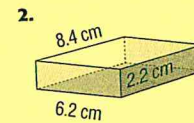
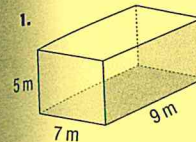
$$\text{Surface area} = 52\,900 + 85\,560 = 138\,460$$

The surface area is  $138\,460 \text{ m}^2$ .

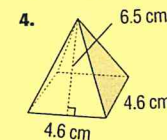
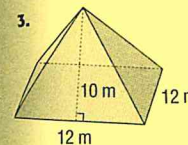
How could you use subtraction to check your answer?

### Practice

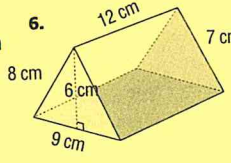
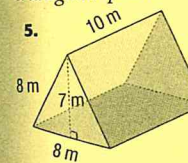
Calculate the surface area of each rectangular prism.



Calculate the surface area of each pyramid.

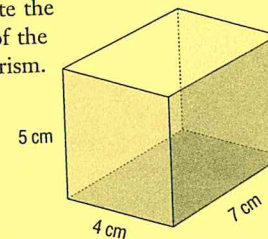


Calculate the surface area of each triangular prism.



### Problems and Applications

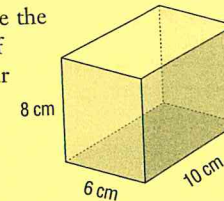
7. a) Calculate the surface area of the rectangular prism.



b) Double each dimension, then calculate the surface area of the new prism.

c) What happens to the surface area of a rectangular prism when the dimensions are doubled?

8. a) Calculate the surface area of the rectangular prism.



b) Halve each dimension, then calculate the surface area of the new prism.

c) What happens to the surface area of a rectangular prism when the dimensions are halved?

9. a) From your answers to questions 7 and 8, state what happens to the surface area of a polyhedron when each of the dimensions is multiplied by the same number.

b) Test your conclusion on a polyhedron of your choice.

10. The skeleton of a cube is made from 60 cm of wire. Cardboard faces are added to form a cubic shell. What is the surface area of the shell?

11. a) What is the surface area of a solid cube with 10-cm sides?

b) The solid cube is cut into 2 equal pieces along a plane of symmetry parallel to a face of the cube. What is the total surface area of the 2 new pieces?

c) What happens to the total surface area when any solid polyhedron is cut into smaller pieces? Explain.

## NUMBER POWER

There are 4 numbers less than 100 that each have exactly 3 different factors, including themselves and 1. What are the numbers?