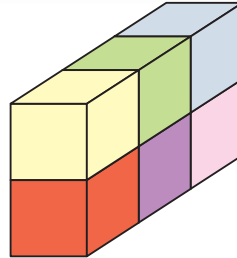


4.3

Surface Area of a Right Rectangular Prism

Focus Find the surface area of a right rectangular prism.

This rectangular prism is made from 1-cm cubes.
What is the surface area of the prism?



Investigate

Work with a partner.
You will need an empty cereal box, scissors, and a ruler.

- Open the bottom of the box without tearing the edges. Then cut along one edge to make a net.
- Find the area of the net.
What measurements did you make?
- Did you find any shortcuts? Explain.
How does the area of the net relate to the area of the surface of the cereal box?
- Describe a method to find the area of the surface of any right rectangular prism.



Reflect & Share

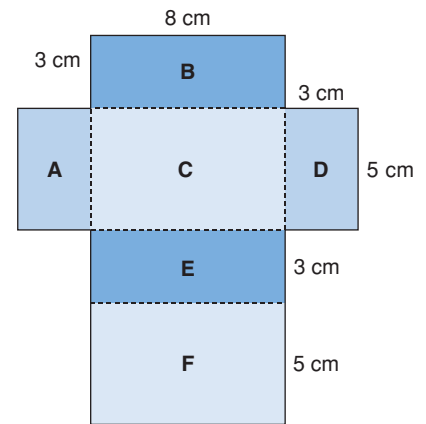
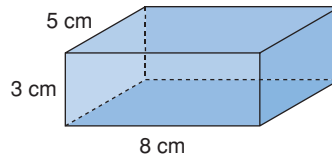
Compare your method with that of another pair of classmates.
How were your methods similar?
How were they different?
Do both methods work? How could you check?

Connect

Here is a right rectangular prism and its net.

The net has 6 rectangles,
labelled A to F.

The area of the net is the sum of
the areas of the 6 rectangles.



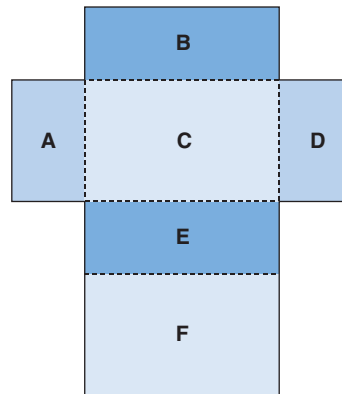
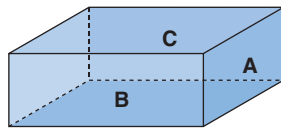
$$\begin{aligned}
 \text{The area of the net} &= \text{area of Rectangle A} + \text{area of Rectangle B} \\
 &\quad + \text{area of Rectangle C} + \text{area of Rectangle D} \\
 &\quad + \text{area of Rectangle E} + \text{area of Rectangle F} \\
 &= (3 \times 5) + (8 \times 3) + (8 \times 5) + (3 \times 5) \\
 &\quad + (8 \times 3) + (8 \times 5) \\
 &= 15 + 24 + 40 + 15 + 24 + 40 \\
 &= 158
 \end{aligned}$$

The area of the net is 158 cm^2 .

We say that the **surface area** of the rectangular prism is 158 cm^2 .

The surface area of an object is the sum of the areas of its faces.

We can use the net of a rectangular prism to find its surface area.



There are 3 pairs of congruent rectangles in the net
of a rectangular prism.

So, we can write the surface area a shorter way.

$$\begin{aligned}
 \text{Surface area} &= 2 \times \text{area of Rectangle A} \\
 &\quad + 2 \times \text{area of Rectangle B} \\
 &\quad + 2 \times \text{area of Rectangle C}
 \end{aligned}$$

Example 1

Find the surface area of this right rectangular prism.

▶ A Solution

Identify each rectangle with a letter.

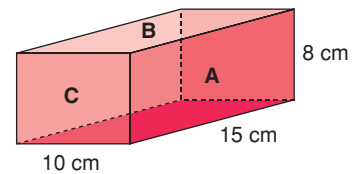
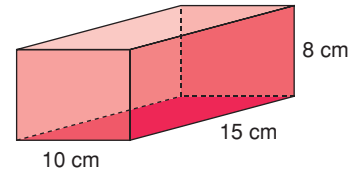
Rectangle A has area: $15 \times 8 = 120$

Rectangle B has area: $15 \times 10 = 150$

Rectangle C has area: $8 \times 10 = 80$

$$\begin{aligned}\text{So, surface area} &= 2(120) + 2(150) + 2(80) \\ &= 240 + 300 + 160 \\ &= 700\end{aligned}$$

The surface area of the rectangular prism is 700 cm^2 .



Example 2

The school is holding elections for student council.

The ballot box is to be painted.

The ballot box is a cube with edge length 30 cm.

There is a slot on the top.

The slot has length 16 cm and width 1 cm.

What is the total surface area to be painted?

Assume the base is to be painted.

▶ A Solution

Draw a labelled picture.

The cube has 6 congruent square faces.

Each face has area: $30 \text{ cm} \times 30 \text{ cm} = 900 \text{ cm}^2$

So, the surface area of the cube is:

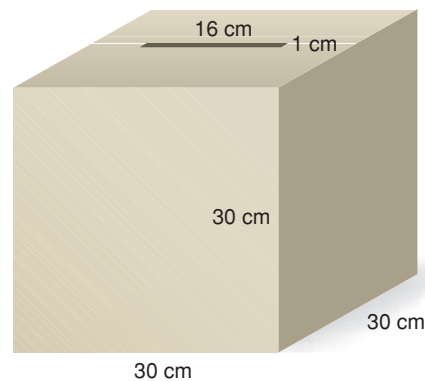
$$6 \times 900 \text{ cm}^2 = 5400 \text{ cm}^2$$

The area of the slot is: $16 \text{ cm} \times 1 \text{ cm} = 16 \text{ cm}^2$

The surface area of the ballot box is:

$$\begin{aligned}\text{Surface area of cube} - \text{area of slot} &= 5400 \text{ cm}^2 - 16 \text{ cm}^2 \\ &= 5384 \text{ cm}^2\end{aligned}$$

The surface area to be painted is 5384 cm^2 .



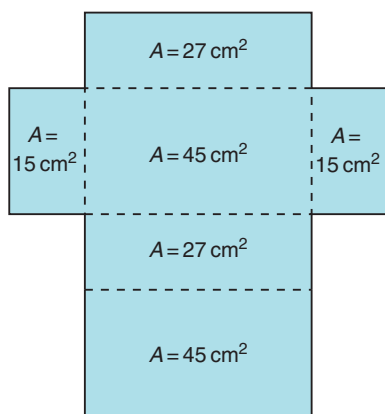
Discuss the ideas

1. Explain how the net of a rectangular prism can help you find the surface area of the prism.
2. Suppose the rectangular prism in *Example 1* was open at the top. How would this affect its surface area?
3. In *Example 2*, suppose it was decided not to paint the base. What is the total surface area to be painted?

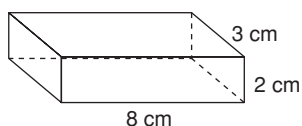
Practice

Check

4. Here is the net of a right rectangular prism. The area of each face is given. What is the surface area of the prism? How did you find out?

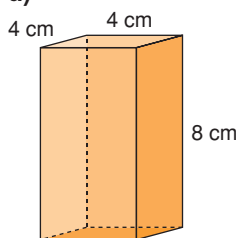


5. Sketch a net of this right rectangular prism. What is its surface area?

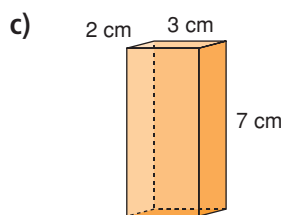
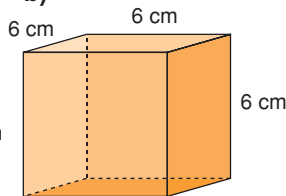


6. Find the surface area of each right rectangular prism.

a)



b)



7. Find the surface area of a right rectangular prism with these dimensions.

- a) 4 m by 3 m by 10 m
- b) 3 cm by 5 cm by 8 cm

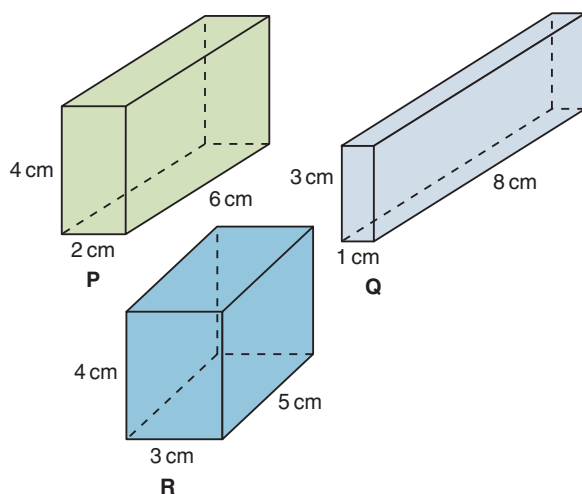
Apply

8. Find a right rectangular prism in the classroom. Measure its faces. Find its surface area.
9. Tanya paints the walls of her family room. The room measures 7 m by 4 m by 3 m. The walls need 2 coats of paint. A 4-L can of paint covers 40 m^2 .
- a) How much paint should Tanya buy?
 - b) What assumptions do you make? Explain.
10. The surface area of a cube is 54 cm^2 .
- a) What is the area of one face of the cube?
 - b) What is the length of one edge of the cube?

11. A window washing company is hired to wash the windows in a condominium. The building is 50 m by 30 m by 300 m. Windows cover about one-quarter of the building. What is the total surface area of the windows to be washed? What assumptions do you make?

12. The Sandberg Institute building in Amsterdam generates revenue by selling advertising space on the exterior of the building. The building is a rectangular prism with dimensions 50 m by 40 m by 75 m. Suppose it costs 1 Euro per month to rent an advertising space of 50 cm^2 . Each of the 4 walls of the building is covered with advertisements. How much money will the institute earn in one month?

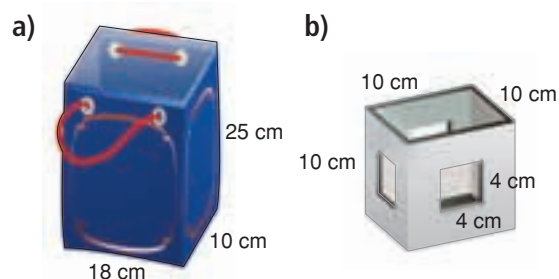
13. Which prism has the greatest surface area? The least surface area?



14. Assessment Focus Sketch a right rectangular prism. Label its dimensions. Answer the question below. Justify your answer. What do you think happens to the surface area of a prism in each case?

- Its length is doubled.
- Its length is halved.

15. Each object has the shape of a rectangular prism, but one face or parts of faces are missing. Find each surface area.



16. Take It Further A right rectangular prism has a square base with area 4 m^2 . The surface area of the prism is 48 m^2 . What are the dimensions of the prism?

17. Take It Further A right rectangular prism has faces with these areas: 12 cm^2 , 24 cm^2 , and 18 cm^2 . What are the dimensions of the prism? How did you find out?

Reflect

Explain how you would find the surface area of a rectangular prism. Include a diagram in your explanation. How does a net help you find the surface area?