

## Problem 1.1 Making Cubic Boxes

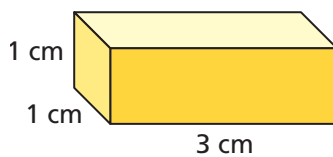
On grid paper, draw nets that can be folded to make a unit cube.

- How many different nets can you make that will fold into a box shaped like a unit cube?
- What is the total area of each net, in square units?

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## 1.2 Making Rectangular Boxes

Many boxes are not shaped like cubes. The rectangular box below has square ends, but the remaining faces are non-square rectangles.



## Problem 1.2 Making Rectangular Boxes

- On grid paper, draw two different nets for the rectangular box above. Cut each pattern out and fold it into a box.
- Describe the faces of the box formed from each net you made. What are the dimensions of each face?
- Find the total area of each net you made in Question A.
- How many centimeter cubes will fit into the box formed from each net you made? Explain your reasoning.
- Suppose you stand the rectangular 1 centimeter  $\times$  1 centimeter  $\times$  3 centimeters box on its end. Does the area of a net for the box or the number of cubes needed to fill the box change?

**ACE** Homework starts on page 10.

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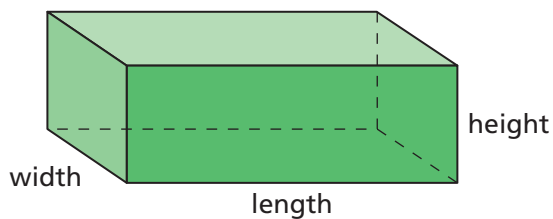
## 1.3 Testing Nets

All the boxes you have made so far are rectangular prisms. A **rectangular prism** is a three-dimensional shape with six rectangular faces. The size of a rectangular prism can be described by giving its *dimensions*. The dimensions are the length, the width, and the height.

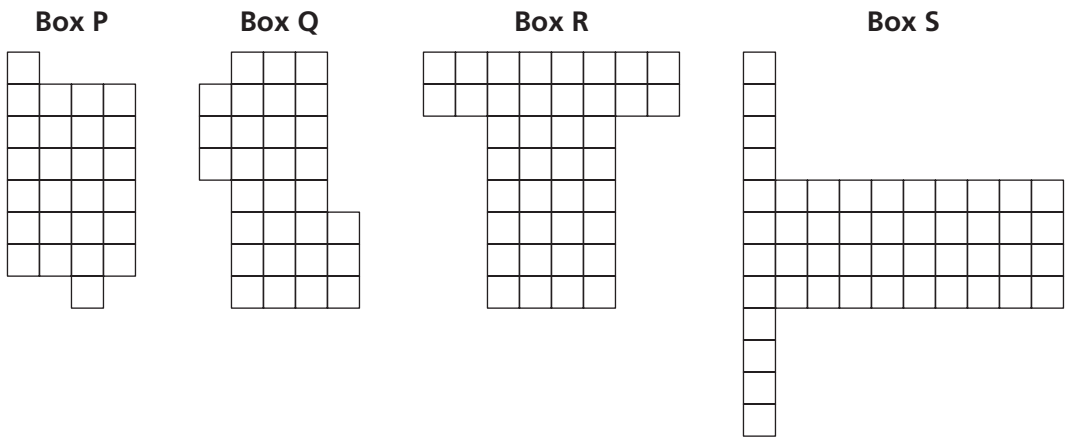
The **base** of a rectangular prism is the face on the bottom (the face that rests on the table or floor). The length and width of a prism are the length and width of its rectangular base. The height is the distance from the base of the prism to its top.

### Getting Ready for Problem 1.3

- Suppose you want to cut the box in the figure below to make a net for the box. Along which edges can you make the cut?
- Are there different choices of edges to cut that will work?



An engineer at the Save-a-Tree packaging company drew the nets below. He lost the notes that indicated the dimensions of the boxes. Use your thinking from the Getting Ready section to work backwards and determine the dimensions for him.



### Problem 1.3 Rectangular Prisms

- A. Using a copy of the diagram above, draw in fold lines and cut each pattern and fold it to form a box. What are the dimensions of each box?
- B. How are the dimensions of each box related to the dimensions of its faces?
- C. What is the total area, in square units, of all the faces of each box?
- D. Fill each box with unit cubes. How many unit cubes does it take to fill each box?
- E. Design a net for a box that has a different shape than Box P but holds the same number of cubes as Box P.

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## 1.4 Flattening a Box

Amy is a packaging engineer at the Save-a-Tree packaging company. Mr. Shu asks Amy to come to his class and explain her job to his students. She gives each student a box to do some exploring.

## Problem 1.4 Surface Area of a Rectangular Prism

Your teacher will give you a box.

- A. Find the dimensions of the box.
- B. Use the dimensions of the box to make a net on centimeter grid paper. You may find it helpful to put the box on the paper, outline the base, and then roll the box over so a new face touches the paper.
- C. Match each face of the box to your net in Question B. Label the net to show how the faces match.
- D. Amy explained that one thing she considers when designing a box is the cost of the material. Suppose the material for the box costs  $\frac{1}{10}$  of a cent per square centimeter. What is the total cost of the material for the box? Why might this information be useful?
- E. What other information do you think is important to consider when designing a box?

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## Did You Know?

It is possible to receive a college degree in packaging. A packaging degree prepares a person to develop and produce packages for a variety of products. The designer must pay attention to cost, durability, transportability, safety and environmental regulations, and visual appeal. Many manufacturing companies want people with packaging degrees. However, there are only a few colleges or universities that offer a bachelor's degree in packaging.



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