



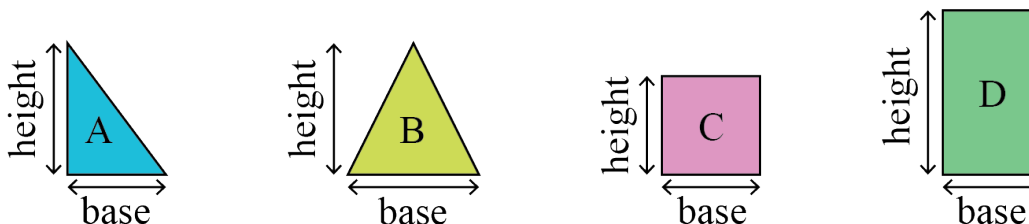
## Problem of the Week

### Problem B and Solution

#### Another Dimension

##### Problem

Kalle draws four shapes on grid paper. Shape  $A$  is a right-angled triangle, shape  $B$  is an isosceles triangle, shape  $C$  is a square, and shape  $D$  is a rectangle. Each shape has a horizontal base and a vertical height.



Using the following clues, determine the base and height for each shape.

1. The base of shape  $A$  is equal to the base of shape  $D$ .
2. The base of shape  $A$  is one unit less than the base of shape  $B$ .
3. The height of shape  $C$  is equal to the base of shape  $A$ .
4. The height of shape  $B$ , the height of shape  $A$ , and the base of shape  $B$  are all equal.
5. The area of shape  $C$  is 9 square units.
6. The total area of all four shapes is 38 square units.



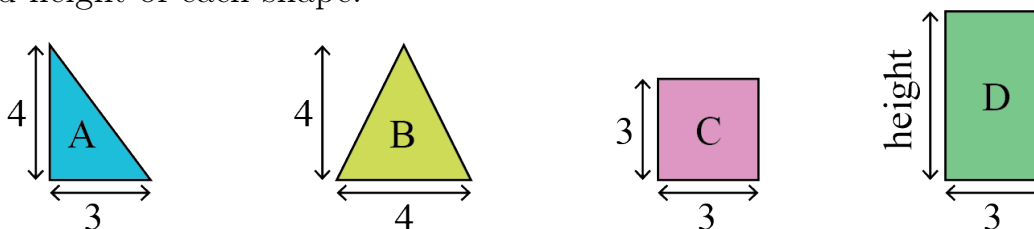
## Solution

First we look at clue 5. Since the area of shape  $C$  is 9 square units and we know shape  $C$  is a square, then it must have a side length of 3 units, since  $3 \times 3 = 9$ . Thus, the base and height of shape  $C$  are each 3 units.

Then from clue 3 we can determine that the base of shape  $A$  is 3 units. Then from clue 1 we can determine that the base of shape  $D$  is also 3 units.

Then from clue 2 we can determine that the base of shape  $B$  must be one unit greater than the base of shape  $A$ . Thus, the base of shape  $B$  is  $3 + 1 = 4$  units.

Then from clue 4 we can determine that the height of shape  $B$  and the height of shape  $A$  are also 4 units. We now fill in the information we know so far about the base and height of each shape.



Thus, the only information we still need is the height of shape  $D$ . We can determine this using clue 6. First we will calculate the area of each shape.

- Shape  $A$  is a triangle, so its area is  
 $\text{base} \times \text{height} \div 2 = 3 \times 4 \div 2 = 12 \div 2 = 6$  square units.
- Shape  $B$  is a triangle, so its area is  
 $\text{base} \times \text{height} \div 2 = 4 \times 4 \div 2 = 16 \div 2 = 8$  square units.
- Shape  $C$  is a square, so its area is  $\text{base} \times \text{height} = 3 \times 3 = 9$  square units.

Thus, the total area of shapes  $A$ ,  $B$ , and  $C$  is  $6 + 8 + 9 = 23$  square units. Since the total area of all four shapes is 38 square meters, it follows that the area of shape  $D$  must be  $38 - 23 = 15$  square units.

Shape  $D$  is a rectangle, so its area is  $\text{base} \times \text{height} = 3 \times \text{height} = 15$  square units. It follows that its height must be 5 units since  $3 \times 5 = 15$ .

The base and height of each shape are as shown.

