Packing Boxes	
Problem wording	**Part 1:** 1. Draw a square measuring 6*6. 2. Find the area of the square. **Part 2:** 3. Find the area of a little square measuring 2*2. 4. Draw a little 2*2 square inside the upper right corner of the square shown below. Suppose we remove the small 2*2 square from the 6*6 square. Find the area of the new figure. 5. Find the area of a little square measuring 4* 4. 6. Draw a little square measuring 4*4 inside the upper right corner of the square shown below. Suppose we remove the small 4*4 square from the 6*6 square. Find the area of the new figure. **Part 3:** 7. Draw a small square in the upper right corner. How would you explain to a friend how to find the area of a square when you don't know its size? 8. Now suppose that the little square measures S*S. Could you find the area now? 9. Suppose we remove the small square measuring S*S from the square measuring 6*6. Find the area of the new figure. 10. Do you think the answer could be in decimals? What about negative numbers? 11. Imagine the smallest possible square inside the larger square. How much would its sides measure? What about the largest one possible? How much would its sides measure? 12. How much would the smallest possible new figure measure? How much would the largest possible new figure measure? 13. How small and how large do you think S could be? **Part 4** 14. Now draw a small square measuring S*S inside all four corners of a square measuring 6*6. 15. Imagine you remove all four small squares. Find the area of the new figure. 16. Do you think the answer could be in decimals? What about negative numbers?

17. Now imagine the smallest possible square inside the larger square. How much would its sides measure? What about the largest one possible? How much would its sides measure?

18. How small and how large could S be in this case?

Part 5

19. Now draw two small squares inside opposite corners of a square measuring 6*6.

20. If we know the two small squares are different, how could we symbolise their sizes?

21. What would the area of the new figure be?

22. Do you think the answer could be in decimals? What about negative numbers?

23. Now imagine the smallest possible small square. How much would its sides measure? And the other square?

24. And now the largest possible small square. How much would its sides measure? And the other square?

25. How small and how large could the sides of one of the squares be? And the other one?

Part 6

The exercise involves a square with measuring 6*6 from which a square of unknown size is removed from one of the corners. Students are asked to draw the squares and find the area of the figure resulting from removing the corner squares (Figure 1). We call this the four-corner task.

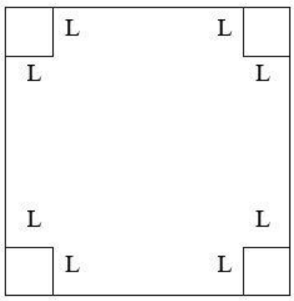
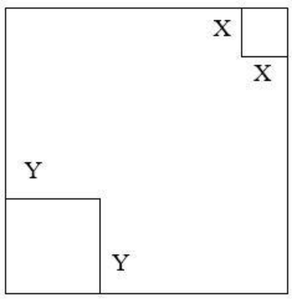


Figure 1. Drawing for part 6

Students should establish the relationship between the size of the corner square and the figure resulting from removing the four corners. We analyse whether or not students always use the same representation and whether they realise that the larger the size, the smaller the resulting area (inversely related variables). We check as well to see if they use the same variable for all four corners.

	Students are asked if L (for 'side' in Spanish) can be in decimals or a negative number to work on the idea of continuous variable. We also work with the maximum and minimum values of the variable: ($L_{min} = 0, L_{max} = 3$) and the maximum and minimum values of the resulting area: ($A_{min} = 0, A_{max} = 36$), noting as well whether students give a range of values for both or just specific values. **Part 7** The exercise involves a 6 *6 square from which two smaller squares at opposite corners are removed. Their size is unknown, although the two are not necessarily the same size. Students are asked to draw the squares and find the area of the figure resulting from removing the corner squares (Figure 2). We call this task the two-corner task.  *Figure 2.* Drawing for part 7 Students should establish the relationship between the size of the corner square and the figure resulting from removing two opposite corners. We analyse whether or not they always use the same representation and whether they realise that the larger the size, the smaller the resulting area (inversely related variables). We also confirm whether or not they use different variables for each corner: different letters, different values… and whether or not they inter-relate them. Students are asked if L (for 'side' in Spanish) can be in decimals or a negative number to work on the idea of continuous variable. We also work with the maximum and minimum values of the variable, the relationship between them (the sum of the sides of the two must be 6 to fill the whole square) and the maximum and minimum values of the resulting area: ($A_{min} = 0, A_{max} = 36$), noting as well whether the students give a range of values for both or just specific values.
Purpose	• To establish the relationship between the size of the corner square and the sizes of the box. • To differentiate between integers, natural numbers and decimals in the variables. • To recognise the maximum and minimum values and the range of values that can be adopted by a variable.

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<td>Suggestions for classroom delivery</td>
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Part 1 (10 minutes)

Students are asked to find the area of a square measuring 6*6 to introduce them to the context of a task involving the idea of area and how it is found (Figure 3).

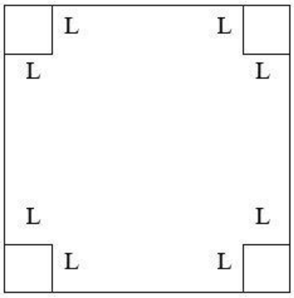

Figure 3. Drawing for part 1

Part 2 (15 minutes)

The task consists in removing first a 2*2 and then a 4*4 square from the upper right corner of a 6*6 square. Students are asked to draw the squares and find the area of the figure resulting from removing the corner squares (Figure 4).

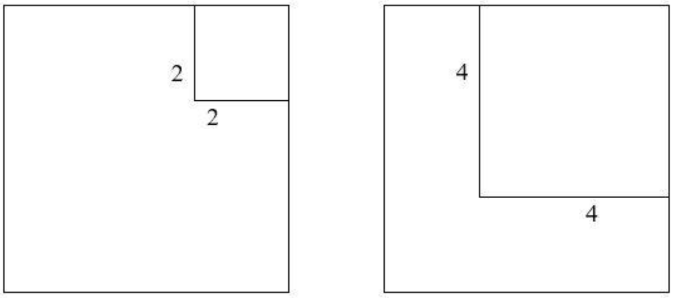

Figure 4. Drawing for part 2

Part 3 (15 minutes)

The task involves removing a square of unknown size from the upper right corner of a 6*6 square. Students are asked to draw the squares and find the area of the figure resulting from removing the corner square (Figure 5).

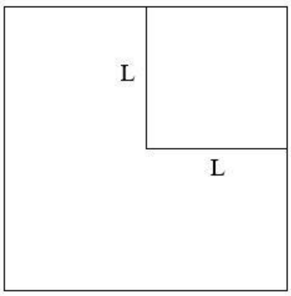

Figure 5. Drawing for part 3

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	The third task is meant to help students generalise the preceding two situations. Now aware of how to find the area, they should establish the relationship between the size of the corner square and area of the resulting figure. We analyse the representation used and whether or not students realise that the larger the square, the smaller the resulting area (inversely related variables). Students are asked if L (for 'side' in Spanish) can be in decimals or a negative number to work on the idea of continuous variable. We also work with the maximum and minimum values of the variable: ($L_{min} = 0, L_{max} = 6$) and the maximum and minimum values of the resulting area: ($A_{min} = 0, A_{max} = 36$), noting as well whether students give a range of values for both or just specific values.