Problem

Aunt Sybil wants to plant herbs to sell at the market. The herb garden is to be a rectangular plot measuring 5 metres by 12 metres. She wants five different herbs, each in a square patch, as follows:

- a 1 m by 1 m square of rosemary;
- a 2 m by 2 m square of sage;
- a 3 m by 3 m square of thyme;
- a 4 m by 4 m square of basil;
- a 5 m by 5 m square of parsley.

Will all of these fit in her plot? Explain your reasoning, and sketch a plan for her garden if possible, using the grid below. How many square metres does Aunt Sybil have unplanted?

Plan for Aunt Sybil’s Herb Garden (5 m by 12 m)

Extensions:

1. a) If Aunt Sybil’s plot is only 5 metres by 11 metres, would her five square patches fit? Explain.

Herb Garden (5 m by 11 m)
b) What if she decides the individual plots do not have to be squares, but must have the same areas as above? Can she then fit them into a $5 \times 11$ plot? Explain.

Herb Garden (5 m by 11 m)
Hints

**Hint 1** - Which of the five plots should Aunt Sybil fit first into her plan? Why?

*Extension 1a)*:
**Hint 1** - If you place the $5 \times 5$ square plot at one end, will there be enough space for the $4 \times 4$ square and the $3 \times 3$ square?

*Extension 1 b)*:
**Hint 1** - What is the total area required for all five plots?

**Hint 2** - What is the area of the garden?
Solution

Yes, Aunt Sybil can fit all the desired square patches in a 5 metre by 12 metre garden plot. One way to do this is shown at right.

**Extension:**

1 a) If the plot is only 5 metres by 11 metres, then she cannot fit all five square patches, as there is no way to fit both the $3 \times 3$ metre and $4 \times 4$ metre patches in the $5 \times 6$ metre rectangle remaining after the $5 \times 5$ metre patch is placed.

1 b) If the patches for each herb do not have to be squares, then she needs the following areas:

- 25 square metres for parsley;
- 16 square metres for basil;
- 9 square metres for thyme;
- 4 square metres for sage;
- 1 square metre for rosemary.

This gives a total of 55 square metres, which is all the area of a $5 \times 11$ metre plot. Thus there are many ways she can fit the desired areas; two are shown below.

**Suggestion:** Give students the right-hand diagram below, and challenge them to explain why the diagonal patches have the correct areas.