

2013-2014 Primary Solutions Round 1

P1.1

A sculpture consists of three large cubes stacked one on top of another without overhanging. The largest cube has edge 3 metres and its base is on the ground. The next cube has edge 2 metres and the top cube has edge 1 metre.

The exposed surface is to be painted blue. Each tin of paint will cover ten square metres. How many tins of paint will be needed?

Solution

The sum of the areas of the exposed top surfaces of the two smaller cubes equals the covered area of the top surface of the largest cube.

So the total horizontal area to be painted is $3 \times 3 = 9 \text{ m}^2$.

Total area of the vertical surfaces is $4 \times (3 \times 3 + 2 \times 2 + 1 \times 1) = 56 \text{ m}^2$.

So the total area is $9 + 56 = 65 \text{ m}^2$.

Hence 7 tins of paint needed (with a half tin left over).

P1.2

Louise's house has a staircase with EIGHT steps. She can go down either one step or two steps at a time. For example, she could go down

1, 2, 2, 1, 2,

In how many different ways can she go down the staircase taking 1 step or 2 steps each time?

Solution

For a staircase with 1 step there is 1 way.

For a staircase with 2 steps there are 2 ways: (1,1) and (2).

For a staircase with 3 steps, Louise must start with

either 1 step, followed by 2 ways of completing the remaining 2 steps

or 2 steps, followed by 1 way of completing the remaining 1 step.

i.e. 3 ways.

...

For a staircase with 8 steps, Louise must start with

either 1 step, followed by the number of ways of completing the remaining 7 steps

or 2 steps, followed by the number of ways of completing the remaining 6 steps

i.e. the sum of the previous two staircases.

So the sequence is 1, 2, 3, 5, 8, 13, 21, 34.

So for a staircase with 8 steps there are 34 possible ways.

P1.3

A corner deli stocks 4 kinds of bread, 5 kinds of meat and 3 kinds of cheese. It sells three types of sandwiches, each made from one kind of bread with either one kind of meat or one kind of cheese or a slice of meat and a slice of cheese as filling.

How many different sandwiches are on sale?

Solution

one bread and one meat: $4 \times 5 = 20$ ways

one bread and one cheese: $4 \times 3 = 12$ ways

one bread, one meat and one cheese: $4 \times 5 \times 3 = 60$ ways

Thus the total number of combinations is 92.