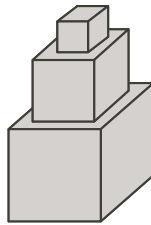# Problem of the Week
Grade 7 and 8

Stack 'Em Up
Solution

Problem

Three cubes with side lengths 1 m, 2 m and 3 m are stacked on top of each other as shown. Determine the total surface area of the stack, including the bottom.
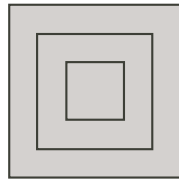

Solution

To determine the areas we will primarily use $Area = length \times width$.

Each cube has four exposed square sides so the total area of all the sides is
$4 \times (1 \times 1) + 4 \times (2 \times 2) + 4 \times (3 \times 3) = 4 \times (1) + 4 \times (4) + 4 \times (9) = 4 + 16 + 36 = 56$ m^2.

To determine the exposed top area of each of the cubes look down on the tower and see a cross-section like the one below.

This exposed area is exactly the same as the side area of one face of the largest cube. Therefore, the top exposed area is $3 \times 3 = 9$ m^2. The top area and the bottom area are the same. Therefore, the bottom area is 9 m^2.

The total surface area is $56 + 9 + 9 = 74$ m^2.

Extension: Three cubes with side lengths x, y and z are stacked on top of each other in a similar manner to the original problem such that $0 < x < y < z$. Show that the total surface area of the stack, including the bottom, is $6z^2 + 4y^2 + 4x^2$.