

**Notes for parents (1).****The purpose of the activity is to help your student to:**

- Find patterns in square and cubic numbers.
- Apply volume and area in context.
- Accurately calculate using multiplication and addition.

**Here is what to do:**

Read the task together and clarify what is being asked. A unit cube is a single cube the size of the 'penthouse' of the skyscraper. If you have cube shaped blocks at home, you may want to make the building. Having a model can support some students to structure the task.

Let your student attempt to find the volume independently. If they encounter difficulties these questions may help.

*Is there a pattern in the sections of the skyscraper?*

(Note that the sections are  $1 \times 1 \times 1$ ,  $2 \times 2 \times 2$ ,  $3 \times 3 \times 3$ ,  $4 \times 4 \times 4$ , and  $5 \times 5 \times 5$ )

*Is there a mathematical name for numbers like that?* For example, what is  $4 \times 4 \times 4$  called? (Four cubed since it is the volume of a cube with edges of four)

*How can cubic numbers be written?* ( $4 \times 4 \times 4 = 4^3$ )

*How could you record the volumes of each section to make the task easier?*

**Creating a table might help.**

Section	Calculation	Volume (unit cubes)
1	$1 \times 1 \times 1$	1
2	$2 \times 2 \times 2$	8
3	$3 \times 3 \times 3$	27
4	$4 \times 4 \times 4$	64
5	$5 \times 5 \times 5$	125
	Total	225

The second part of the task involves calculating the surface area of the building. Surface area means the amount of flat space that lies on the 'skin' of the building. Calculating the area is made more complicated by the fact that sections of the building overlap and that the bottom face of the building is not made of glass.

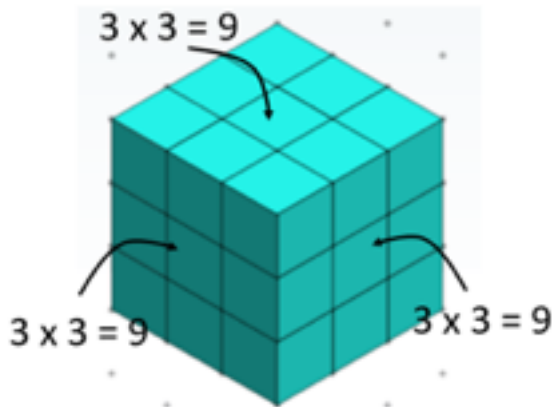


## Notes for parents (2).

It might be best to clarify surface area as an idea. You might choose one section of the building to do so, for example the  $3 \times 3 \times 3 = 3^3$  cubes.

Ask, "What is the surface area of this section? How do you work that out?"

Notice how the faces of the cube all have an area of  $3 \times 3 = 9$  square units. Since the cube has six faces the total surface area is  $6 \times 9 = 54$  square units.

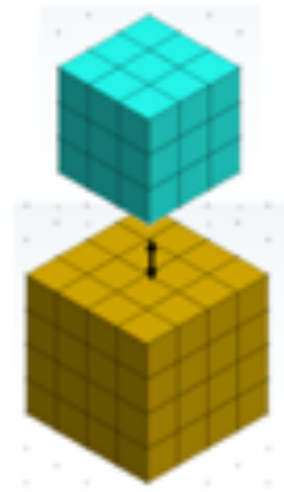


The surface area of each section could be worked out and organised in a table as well.

Section	Calculation	Surface area (unit squares)
1	$6 \times 1 \times 1$	6
2	$6 \times 2 \times 2$	24
3	$6 \times 3 \times 3$	54
4	$6 \times 4 \times 4$	96
5	$6 \times 5 \times 5$	150
	Total	330

When the sections are joined some surface area is lost. For example, when the  $3^3$  and  $4^3$  sections join two squares of area

$3 \times 3$  are no longer on the surface of the building.



## Notes for parents (3). Activity next page.

Considering all the area that is lost with the joins and on the base of the skyscraper can be thought of like this:

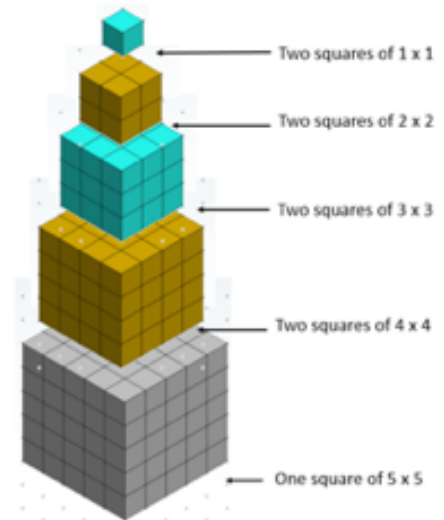
In total  $2 + 8 + 18 + 32 + 25 = 75$  square units of surface area are lost. So the exposed surface area is  $330 - 75 = 255$  square units.

### Points to note:

Volume and area are attributes or characteristics of an object. Area is the amount of flat space enclosed in some boundary. For example, this triangle has an area of  $12.5 \text{ m}^2$  ( $12\frac{1}{2}$  square metres). Notice that the units we commonly use for area are squares, even though squares do not always fit tidily into the shape. Squares fit together with no gaps or overlaps and are the same size in both directions.

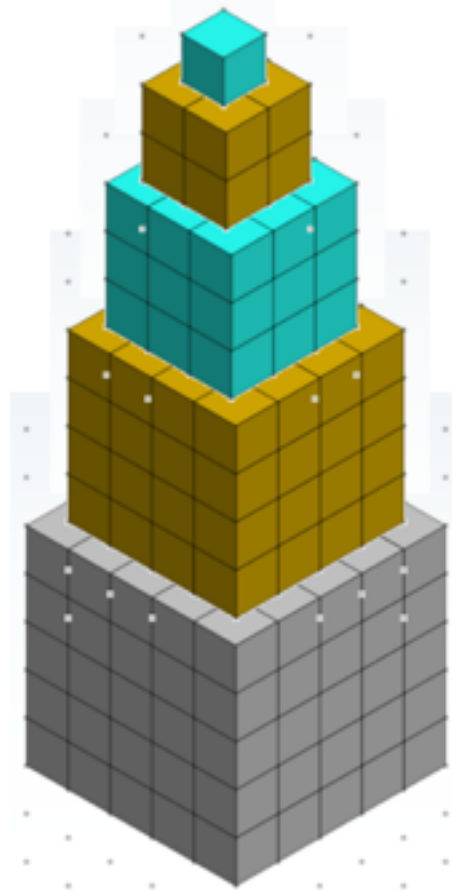
Similarly, cubes are used to measure the volume of three-dimensional objects. Volume is the amount of space enclosed in a bounded solid object. Like squares, cubes fit together with no gaps or overlaps and are the same size in three directions. That does not mean that cubes fit tidily into all solid objects. For example, the volume of a cylinder is measured in cubic centimetres ( $\text{cm}^3$ ), but cubes will not fit neatly inside the curved surface.

Surface area is an important idea in everyday life. That is the amount of flat space on the outside of an object. If you want washing to dry more quickly you maximise the surface area exposed to the air. To calculate the amount of paint you need for a house you need to get some measure of the surface area. Volume and surface area are easily confused, just like area and perimeter are confused with two-dimensional shapes. Since surface area is flat space it is measured in square units. Volume is three-dimensional so it is measured in cubic units.



This is a skyscraper. It is made of unit cubes.

*What is the volume of the whole building in unit cubes?*



Each external face is made of glass.

*How many unit squares of glass need to be cleaned to wash the whole building?*