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extracts from

You Do the Maths: Design a Skyscraper

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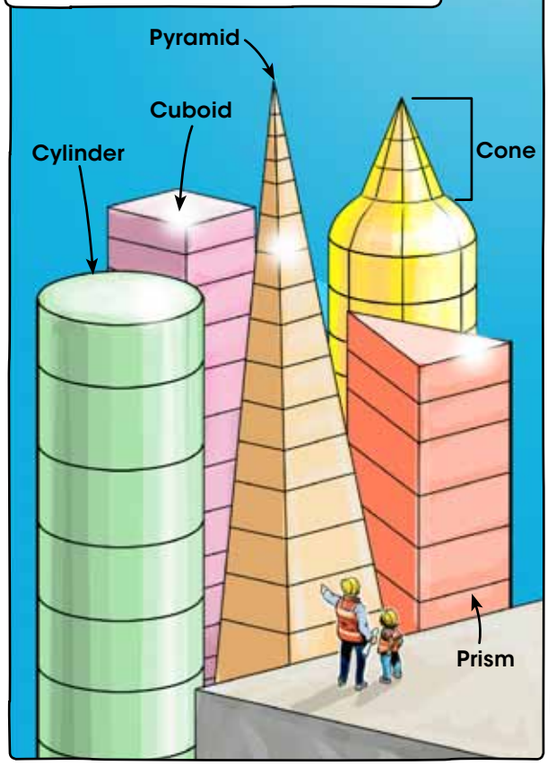
SHAPES OF SKYSCRAPERS

You have been asked to design a towering skyscraper using the latest designs and cutting-edge technology and materials.

Skyscrapers come in lots of different shapes and sizes.



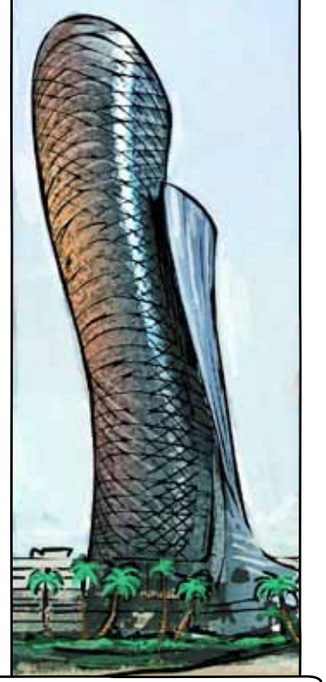
These shapes include cylinders, cuboids, **prisms**, **pyramids** and cones, or a combination of these.



The Gherkin, London, UK



The ADNEC, Abu Dhabi, UAE

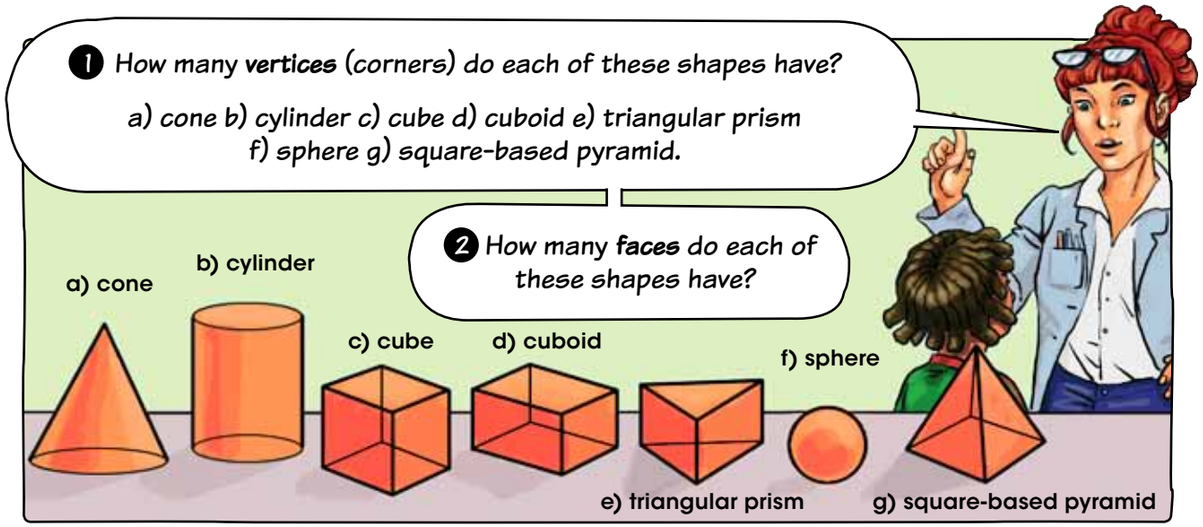


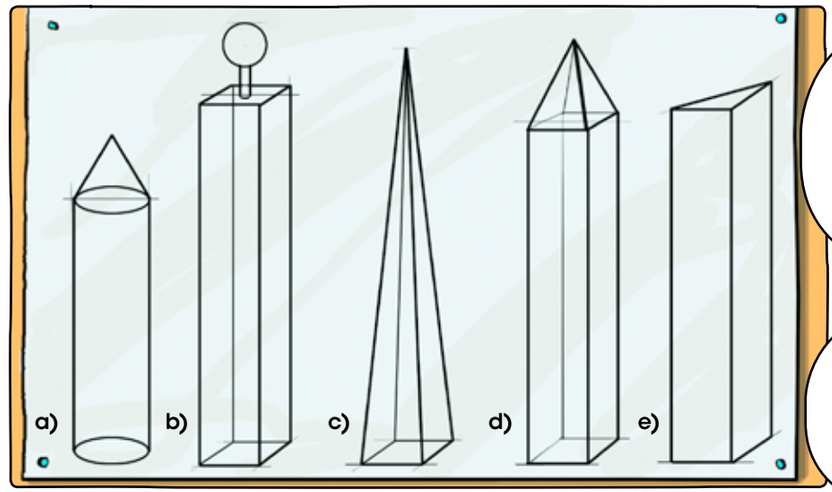
Modern skyscrapers also come in unusual curved shapes, like the two shown here.

1 How many **vertices** (corners) do each of these shapes have?

a) cone b) cylinder c) cube d) cuboid e) triangular prism f) sphere g) square-based pyramid.

2 How many **faces** do each of these shapes have?

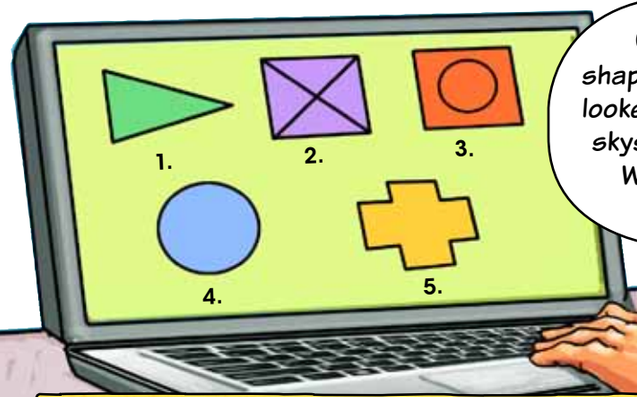




3 Write the names of the 3D shapes used in these skyscrapers. Some of them use more than one 3D shape.

4 How many faces on each of the skyscrapers in question 3 are open to the air?

5 Which of these shapes would you see if you looked straight down on the skyscrapers in question 3. Which shape wouldn't you see?



WHAT ABOUT THIS?

Think about the shape of the skyscraper you would like to build. What shape would it be? Would the faces be curved or flat?

RECORD-BREAKING SKYSCRAPERS

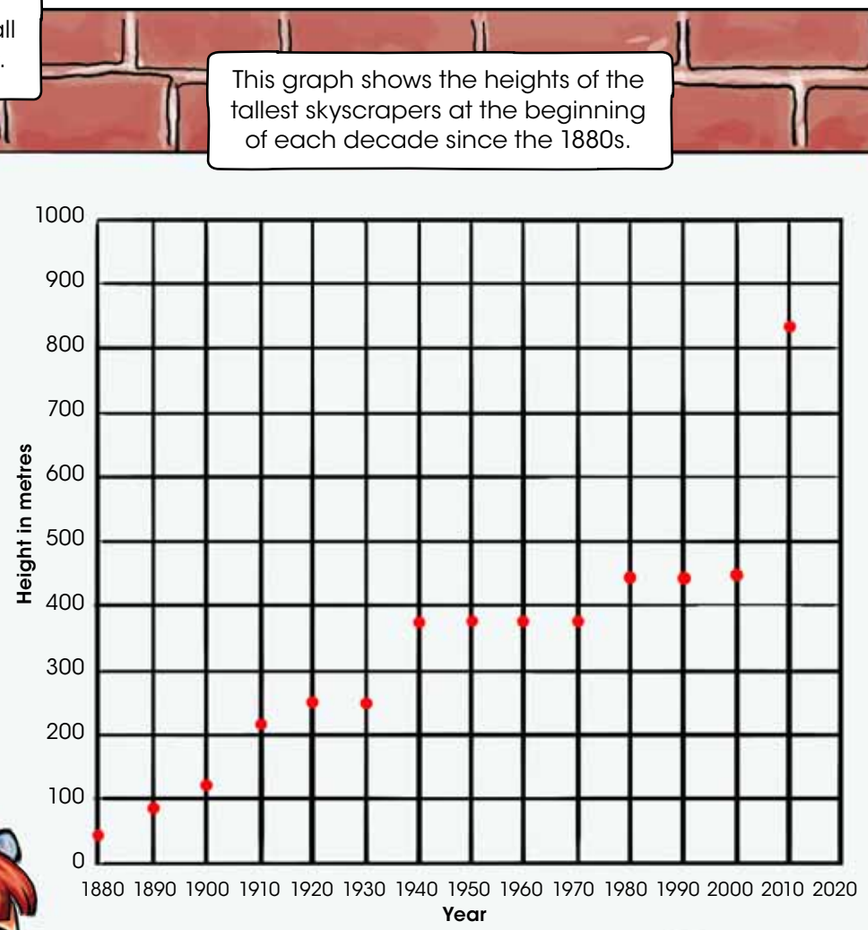
As part of your research into other tall buildings, you have been looking into the history of skyscrapers.

The term 'skyscraper' was first used for a tall building in the 1880s.



The Home Insurance Building in Chicago, USA, was built in 1884 and is considered the world's first skyscraper.

This graph shows the heights of the tallest skyscrapers at the beginning of each decade since the 1880s.

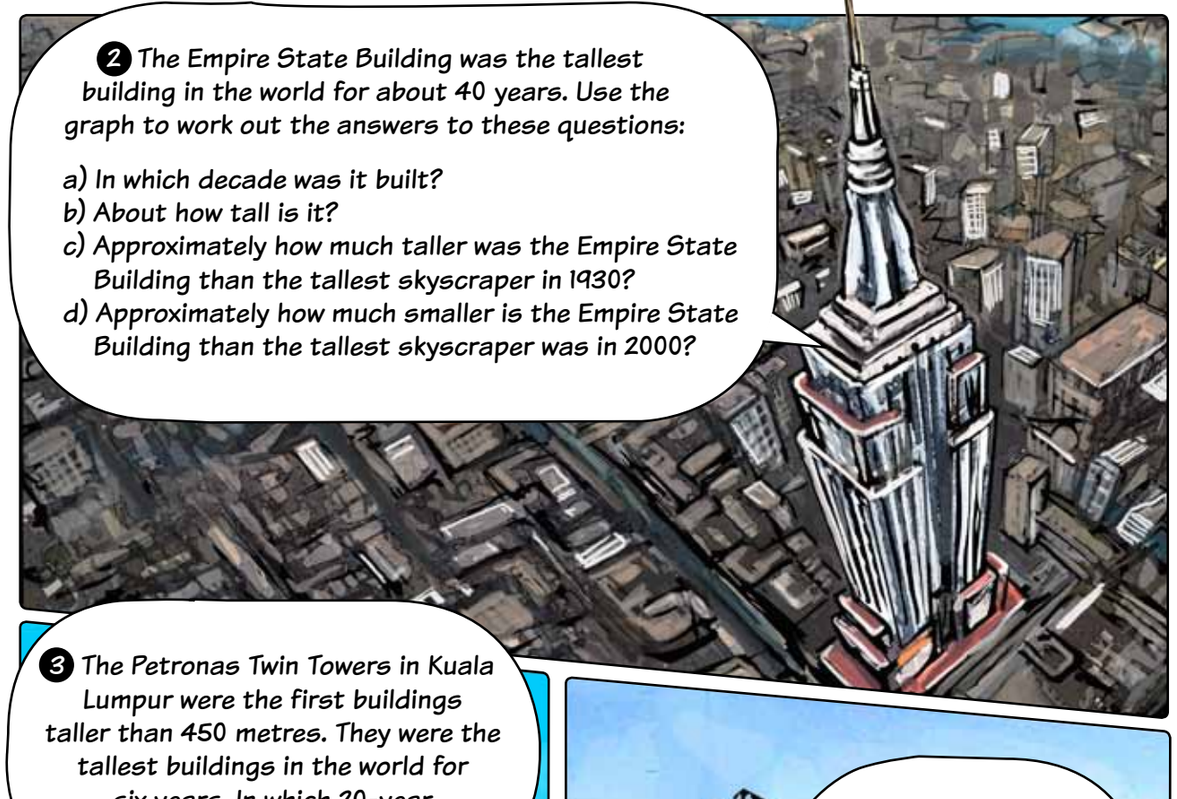


1 Approximately what was the height of the tallest skyscraper in:

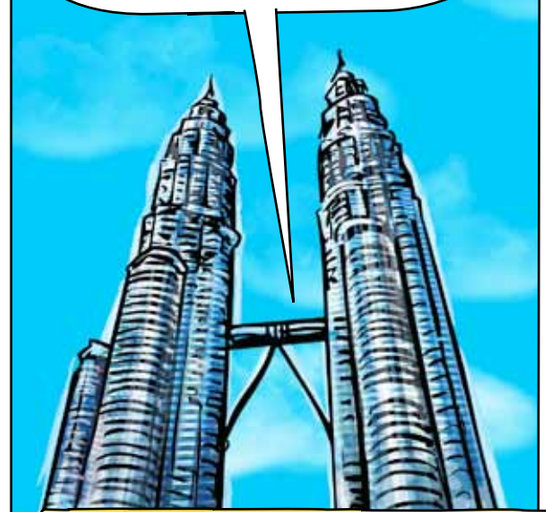
a) 1880? b) 1900?
c) 1940? d) 2000?

2 The Empire State Building was the tallest building in the world for about 40 years. Use the graph to work out the answers to these questions:

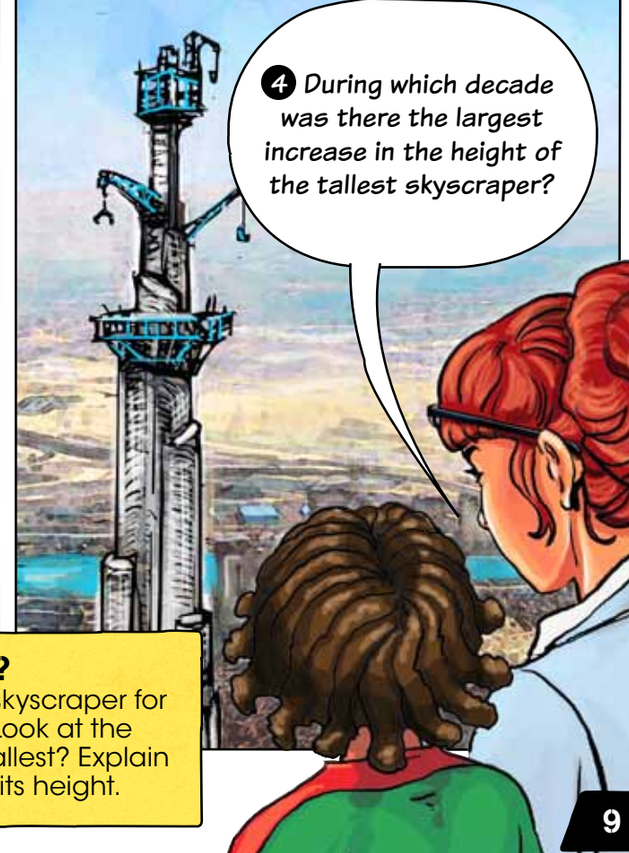
a) In which decade was it built?
b) About how tall is it?
c) Approximately how much taller was the Empire State Building than the tallest skyscraper in 1930?
d) Approximately how much smaller is the Empire State Building than the tallest skyscraper was in 2000?



3 The Petronas Twin Towers in Kuala Lumpur were the first buildings taller than 450 metres. They were the tallest buildings in the world for six years. In which 20-year period were they the tallest?



4 During which decade was there the largest increase in the height of the tallest skyscraper?



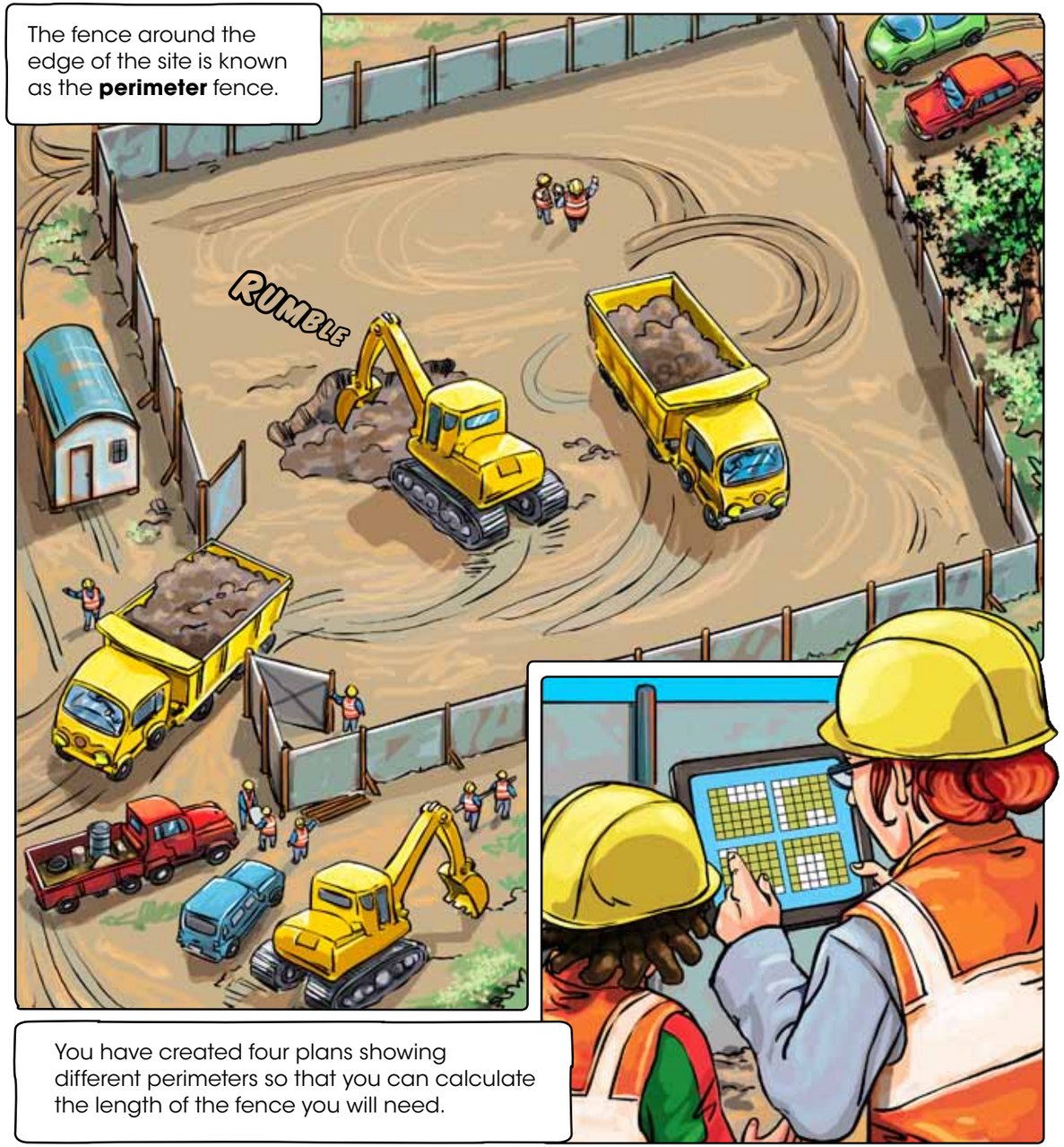
WHAT ABOUT THIS?

The Taipei 101 Tower was the tallest skyscraper for six years, measuring 509 metres. Look at the graph. In which decade was it the tallest? Explain why there is not a mark showing its height.

SECURING THE SITE

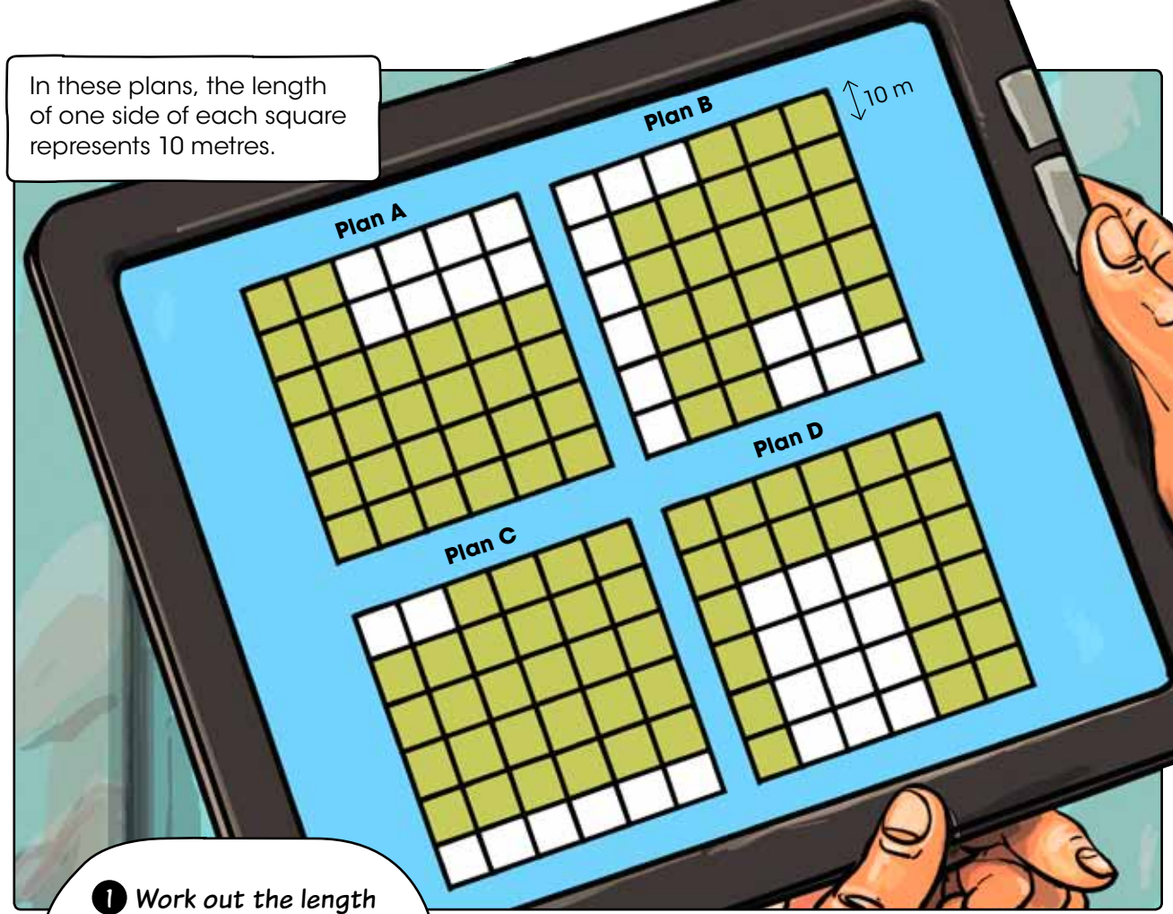
Once the site has been cleared, you'll need to fence it off for security and safety reasons before building work can begin.

The fence around the edge of the site is known as the **perimeter** fence.



You have created four plans showing different perimeters so that you can calculate the length of the fence you will need.

In these plans, the length of one side of each square represents 10 metres.



1. *Work out the length of the perimeter fence of each plan.*
2. *Count the squares of each plan.*
3. *Does the plan with the longest perimeter have the largest area?*
4. *Each square represents an area of 100 m² in real life. Multiply the number of squares in each plan by 100 to find its area.*
5. *Is it possible to have two or more plans with the same length perimeter fence but of different areas? Give examples.*

WHAT ABOUT THIS?

If the area of the skyscraper you want to build on the site is 25,000 m² and it will have a height of 500 metres, what will be the **volume** of the skyscraper?