1 A brick in the wall ...

The problem

A brick in the wall ...

Look at this brick pyramid. Can you see how it is made?

		112		
	52		60	
	24	28	32	
11	13	15	1	
5	6	7	8	9

Each brick is the total of the two bricks that are below it. So the brick with the value of 11 is the total of 5 + 6.

This leads to some interesting patterns!

Things to think about

- How does the pyramid work? What does this tell you about the arrangements of numbers needed to give the biggest total at the top?
- How does the order of the bottom numbers effect the top number?
- Does your solution to this problem apply for other sets of starting numbers?

Your challenge

Investigate what happens when you create a brick pyramid using the numbers 1, 2, 3, 4, 5 in the bottom bricks (in any order). Which arrangements of the numbers will lead to the biggest total in the top brick?

RISING STARS
Maths

Year 3   Problem Solving and Reasoning

Background knowledge

- Children to investigate number patterns formed by arranging 'bricks' into a pyramid.
- The pyramid has five bricks at its base. The number of bricks on each row above the base then decrease by one.
- The value of the bricks on rows 2–5 are formed by adding the values of the two bricks below the brick, ultimately resulting in a single brick at the top of the pyramid.
- Children are asked to investigate this number pattern using the numbers 1, 2, 3, 4 and 5 as their base numbers. These numbers can be placed in any order.
- Children are specifically asked to work out which arrangements of the numbers 1– 5 on the bottom of the pyramid will result in the

  greatest total on the top brick.
- The arrangement which does this is 1, 3, 5, 4, 2 (or 1, 4, 5, 3, 2; 2, 4, 5, 3, 1; 2, 3, 5, 4, 1) all of which give the total of 61 in the top brick. (See problem 1b for answers).
- This arrangement with the highest number (5) in the middle, the next two highest (3 and 4) on each side, and the two lowest (1 and 2) on each end, will always give the highest possible total. Although this would be beyond most Year 3 children, you can see this would be the case by representing the wall algebraically. (see Resource sheet 1.2, Brick wall pyramid answers).
- Resource sheet 1.1 provides blank brick wall pyramids to assist children with recording.

Launching the activity

1. Introduce the problem by sharing poster 1b with the children, which just shows the pyramid with no explanation. In pairs ask the children what they notice about the pyramid.

2. Discuss what the children notice about the pyramid. Draw attention to how the numbers in the bricks of the pyramid have been calculated.

3. Share the prompt poster with the children. Ask them to discuss with a partner how they think they could make the biggest number in the top brick.

4. Discuss this as a class, recording any conjectures.

5. Provide time for the children to work on the problem with a partner or in small groups. As well as exploring which arrangements create the highest total, remind children to also keep note of anything else they noticed about the pyramid patterns.

6. At the end of the session bring the children back together and discuss which arrangements of the numbers 1–5 give the highest total in the top brick. Explore how there are multiple arrangements that give the same total, but ask, 'what's the same, what's different' about the arrangements. Also ask children to share what else they have noticed about this number pattern.

Developing reasoning

➤ *What's the same? What's different between these two arrangements of numbers?*
➤ *Convince me that this gives the highest possible total.*
➤ *Which of these arrangements is the odd one out and why?*
➤ *Give me a silly answer for the arrangement that gives the highest possible total. What makes it silly?*

➤ *Give an arrangement of the numbers 1–5 in the bottom bricks. Another, another, another.*
➤ *If we know the best arrangements for the digits 1-5, what else do we know?*

Providing differentiation

Support
Children could work on a smaller version of the pyramid (Resource sheet 1.3 contains a version of a blank pyramid with three rows). Children should initially use the digits 1, 2, 3, extending to the larger pyramid if able. It is also important to ensure that children have access to a range of familiar representations to help with the addition involved in this activity.

Extension
Children should be encouraged to generalise their findings from this problem and be able to arrange any set of numbers into the order that would give the highest total at the top of the pyramid. If the children are secure with this generalisation, they may wish to consider how this would extend to a 6, 5, 4, 3, 2, 1 or 7, 6, 5, 4, 3, 2, 1 pyramid.

💡 Key strategies

2   Another, another, another
3   Convince me
7   Odd one out
9   Silly answers
11 What else do we know?
12 What's the same? What's different?

⚙ Problem-solving approaches

Small group work
Think, pair, share

Taking it further

This activity could be used as a springboard to further work on properties of number and number patterns. The children could also explore a multiplication pyramid with the brick being the product of the numbers below, starting with the three base pyramid.