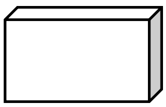
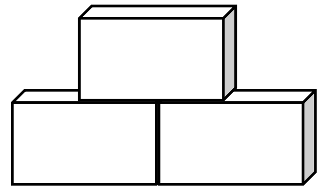
Blocks of Ice

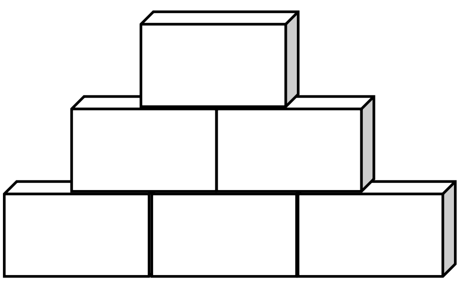
Extension Activity



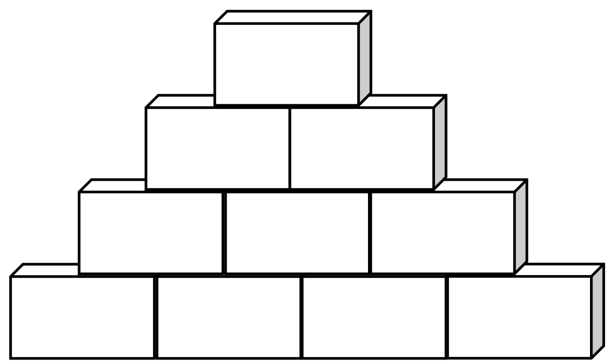
1st



2nd



3rd



4th

Q1. How is this wall being built up?

What stays the same, what changes?

Q2. How many bricks in the 10th or 20th wall?

Q3. What about the …

37th wall?
100th wall ?
any wall?

Blocks of ice

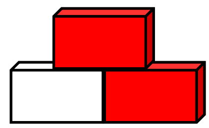
Extension Activity Answers

Q1. How is this wall being built up?

What stays the same, what changes?

The wall can be built in different ways, but whichever way the wall is built, the number of blocks added is always the same as the number of the wall's position in the sequence.

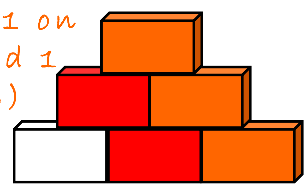
1st



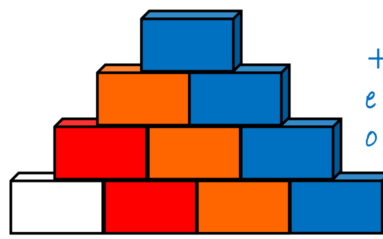
2nd

+ 2 blocks (1 on the bottom and 1 on the top)

+ 3 blocks (1 on each row and 1 on the top)

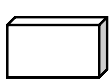


3rd

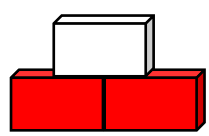


4th

+ 4 blocks (1 on each row and 1 on the top)



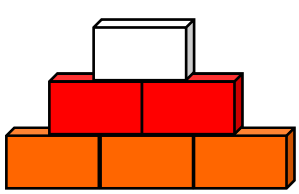
1st



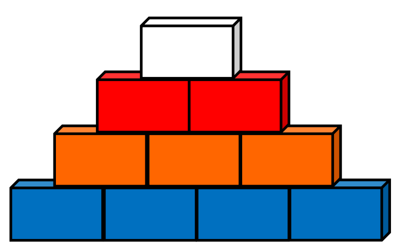
2nd

+ 2 blocks on the bottom

+ 3 blocks on the bottom



3rd



4th

+ 4 blocks on the bottom

Blocks of ice

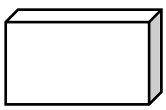
Extension Activity Answers

Q2. How many bricks in the 10th or 20th wall?

The answers for these walls could be worked out by building the walls practically.

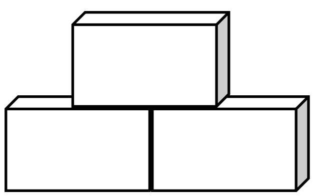
But what if we want to calculate the answers?
1. We can start by writing out what we already know.

1st



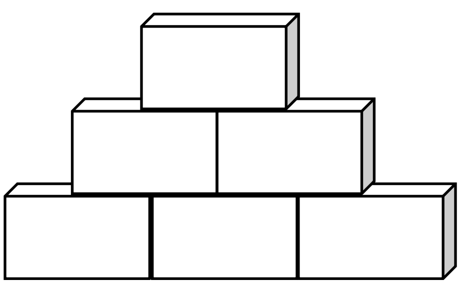
1

2nd



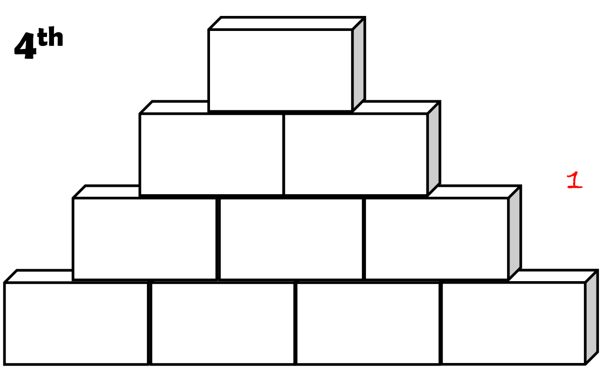
1 + 2

3rd



1 + 2 + 3

4th



1 + 2 + 3 + 4

So we can calculate how many bricks there will be in the 10th wall with the following calculation:

1+2+3+4+5+6+7+8+9+10

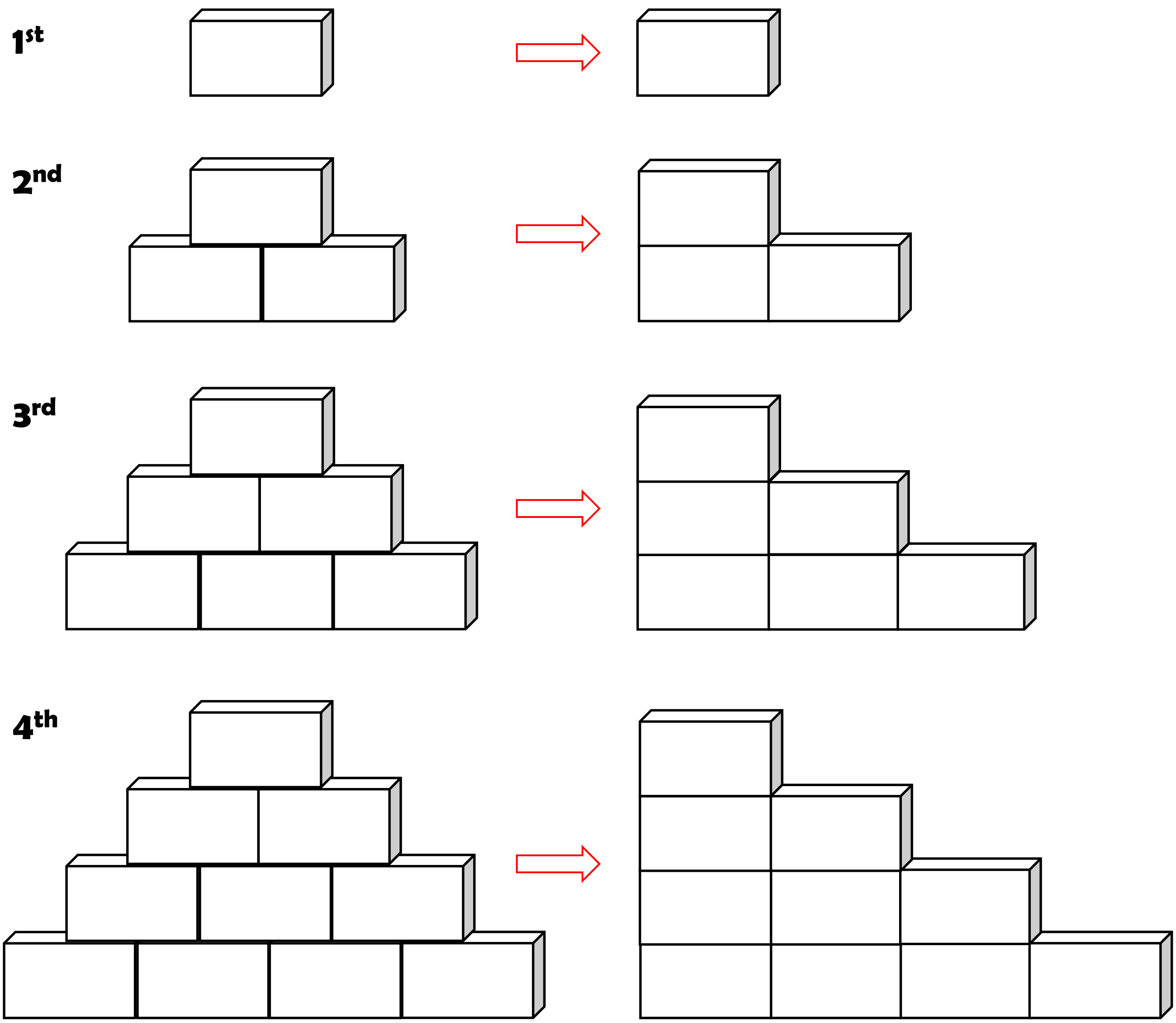
(But this is not a very efficient way to calculate the number of bricks in chosen walls.)

Blocks of ice

Extension Activity Answers

Q2. How many bricks in the 10^{th} or 20^{th} wall?

2. Sometimes thinking about a pattern in a different way is helpful (without changing the way the walls are essentially constructed)?



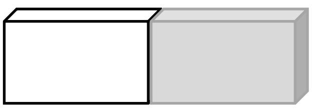
Blocks of ice

Extension Activity Answers

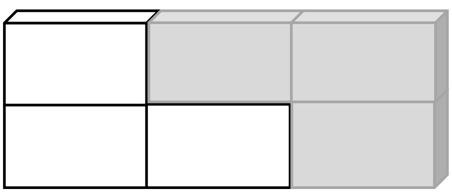
Q2. How many bricks in the 10th or 20th wall?

3. Calculating the number of bricks in a 'stepped' shape is hard, but calculating the number of bricks in a rectangular shape is much easier.
   As we work towards an algebraic solution, we can start by making our brick walls into rectangles by doubling the number of bricks for each wall like this:

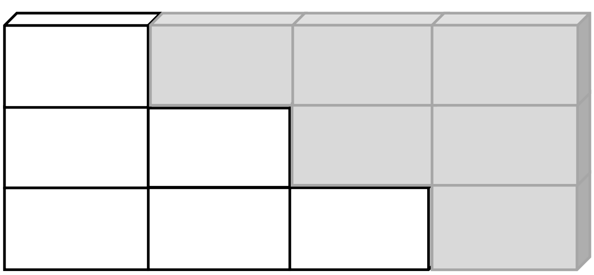
1st



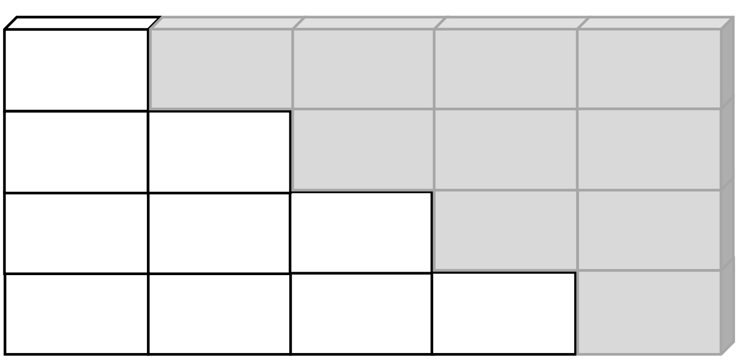
2nd



3rd



4th



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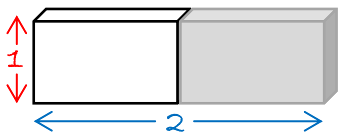
Extension Activity Answers

Q2. How many bricks in the 10th or 20th wall?

4. Now we can more easily calculate the number of bricks in each wall by multiplying its height by its width (using the number of bricks as our measurement).

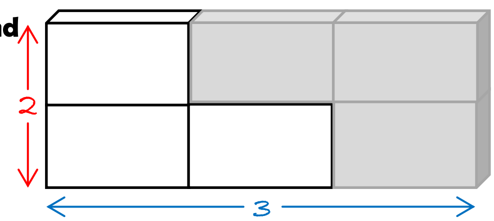
   And finally, we will need to halve this answer to find the number of white bricks only for each wall.

1st



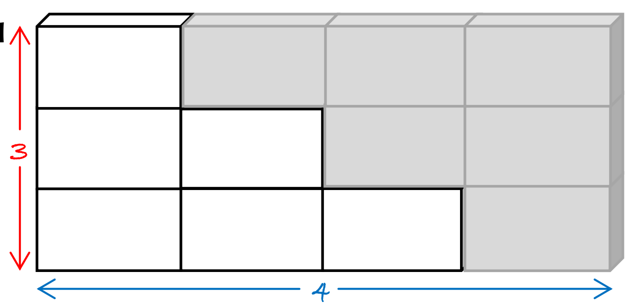
$(1 \times 2) \div 2 = 1$

2nd



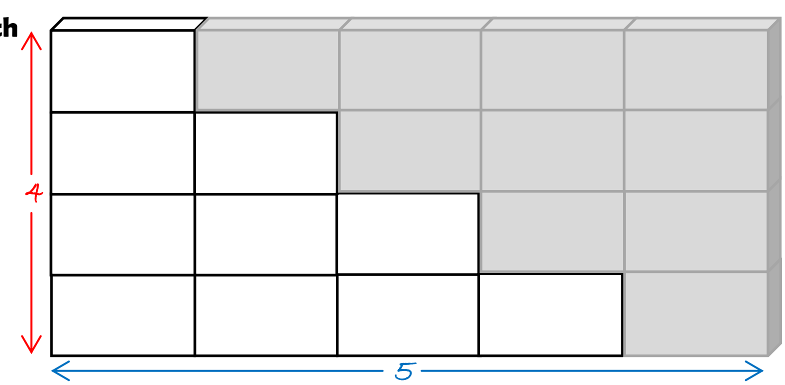
$(2 \times 3) \div 2 = 3$

3rd



$(3 \times 4) \div 2 = 6$

4th



$(4 \times 5) \div 2 = 10$

Blocks of Ice

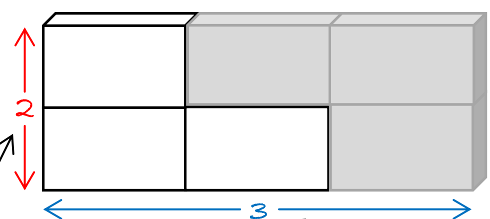
Extension Activity Answers

Q2. How many bricks in the 10th or 20th wall?

5. We have now identified enough of a pattern to write these calculations as an algebraic formula.

The position of the wall in the sequence, or N

2nd



The height of the wall is the same as the wall's position in the sequence, so we can call it n

The width of the wall is always one more than its height, or $n+1$

So

$$(2 \times 3) \div 2 = 3$$

becomes

$$(n \times (n+1)) \div 2 = \text{number of blocks}$$

Which we can simplify to

$$n(n+1) \div 2 = B$$

Note: The algebraic formula we present here is in the simplest form that we deem relevant to the upper primary aged children (9 to 11 years) this challenge is directed towards.

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Extension Activity Answers

Q2. How many bricks in the 10th or 20th wall?

Q3. What about the …

37th wall?
100th wall ?
any wall?

5. We can now use our algebraic formula to complete Q2 and Q3 of the challenge.

$$n(n+1) \div 2 = B$$

Q2. 20th wall…

$$20(20+1) \div 2 = 210$$

Q3. 37th wall…

$$37(37+1) \div 2 = 703$$

100th wall…

$$100(100+1) \div 2 = 5{,}050$$

And so on!