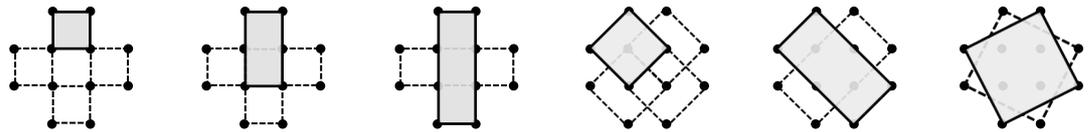


- 23 N Since each of the digits 1, 2, 3, 4, 5 and 6 is to be used, J and M cannot contain the same digit, and hence to minimise the difference between “JKL” and “MNO” J must be only 1 greater than M. To further minimise the difference, we should choose “KL” to be as small as possible and “NO” to be as large as possible. This means that the calculation becomes $412 - 365 = 47$ giving an answer of N.
- 24 2 If we can find the units digit of Cataldi’s number, we can find its remainder after dividing by 5. Looking at 2, then 2×2 , then $2 \times 2 \times 2$, then $2 \times 2 \times 2 \times 2$, we notice that the sequence of units digits repeats every four times: 2, 4, 8, 6, 2, 4, 8, 6, Hence we can find that 2^{19} ends in 8, and so $2^{19} - 1$ ends in 7. If you divide a number whose units digit is 7 by 5, you will have a remainder of 2.
- 25 19 The diagrams below show the six types of rectangle (or square) which can be found:



5 squares 4 rectangles 2 rectangles 4 squares 2 rectangles 2 squares
Hence there are 19 rectangles altogether.

Some notes and possibilities for further problems

- Q3 Suppose you start with a triangle and cut off the three corners as in the question. How many sides are left on the original shape? Is there a formula that tells us how many sides are left after cutting off all of the corners of a shape with n sides? Does it depend on exactly how you cut off the corners?
- Q4 “I have 90p and buy three items at 20p each.” Write down a calculation that gives how much money I have left. Make up some more problems and show how the answer can be calculated.
[NB: the word *aftermath* (meaning a *consequence* or a *period following a disastrous event*) has nothing whatsoever to do with math(ematic)s, but comes from the Old English *mæth*, a word related to the English word *to mow*; *aftermath* was originally the new growth of crops *after* a field had been *mown*.]
- Q6 Is it possible for Bognor Rocks FC to get a total of 17 points after 6 matches; or 14 points; or 13 points? There are two ways in which they could have scored 12 points. What are they?
It might be worth drawing up a chart showing all possible outcomes of 6 matches in the season.
- Q7 Is the distance travelled in 20 minutes at 12 mph the same as that for 12 minutes at 20 mph? Why?
- Q8 Can pupils find the next time the year number and the sum of its digits are *both* prime? It is 2027.
- Q11 How many of the same triangles would be needed to make the next complete large triangle? And what will the perimeter of this large triangle be? The number of small triangles needed to make large triangles is always a square number. There is a formula linking the number of small triangles to the perimeter of the large triangle. Can pupils think about this formula in words or write it in mathematical symbols? ($P = 15 \times \sqrt{n}$).
- Q22 Pupils can try to make up age problems of their own. It is easy if you start with the ages of two people and try to find links between them. For example, suppose Shamila is 10 and Shalima is 2. A table can be written out to show their ages:
- | | | | | | | | | | | | | | |
|---------|---|---|----|----|----|----|----|----|----|----|----|----|----|
| Shamila | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| Shalima | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
- Last year Shamila was nine times as old as Shalima. This year she is five times as old.
What age will Shamila be when she is three times Shalima’s age, or twice as old?
- Q25 How many rectangles can be drawn by joining four points of this larger diagram? Remember to look for all the different sizes, especially the ones that go slantwise. How many rhombuses, or kites, or trapeziums, ... or quadrilaterals?!

