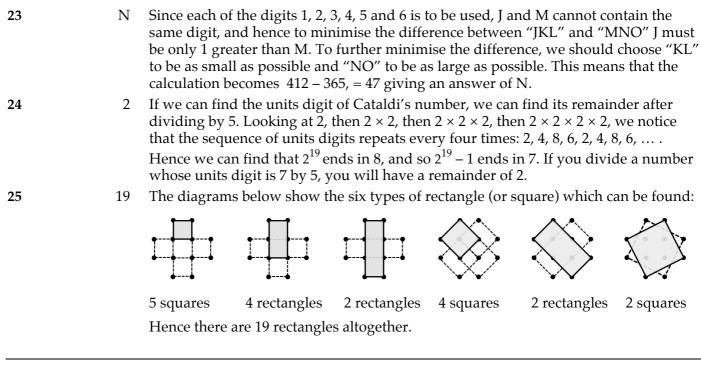
Primary Mathematics Challenge – November 2014

Answers and Notes

These notes provide a brief look at how the problems can be solved. There are sometimes many ways of approaching problems, and not all can be given here. Suggestions for further work based on some of these problems are also provided.

P1 C (18) P2 A (between 1 m and 3 m)

1	С	1234	This is 1 thousand, 2 hundreds, 3 tens and 4 units added together.								
2	Ε	£1.20	The cost, in pence, is $3 \times 20 + 20 \times 3 = 60 + 60 = 120$.								
3	D	octagon	Cutting off the three corners as shown will result in three additional edges.								
4	Α	27 ÷ 4	Since we are sharing the cost of £27 between four books, we must divide 27 by 4.								
5	C	35	Since November 1914 falls after Einstein's March birthday, subtract 1879 from 1914.								
6	В	1	After six matches, the team could have had a total of 18 points from 6 wins. Having 3 points fewer than this must be because of a single loss.								
7	С	4	Since 20 minutes is a third of an hour, I will have cycled for a third of 12 miles.								
8	В	4	In 2015, 2016 and 2017, the digits of the year have sums of 8, 9 and 10 respectively; however, the digits of 2018 have a sum of 11, which is a prime number.								
9	В	$\frac{1}{3}$	It should be evident that the 4 shaded triangles and the shaded square can be moved to form a rectangle occupying a third of the square.								
10	Ε	7 × 77	For the original calculations, $7 \times 77 > 7 \times 71 > 7 \times 17 > 1 \times 71 > 1 \times 11$.								
11	B	30 cm	Each side of the four equilateral triangles has length 5 cm. The new triangle, formed as shown, will require 6 of these sides on its perimeter.								
12	Α	south	A turn of 630° is one full turn followed by a further 270°. Having turned 360°, I will be again facing East. After a further 270° anti-clockwise, I will have made three-quarters of a turn, and will be facing South.								
13	D	kite	The square and rectangle both have <i>four</i> equal angles, the parallelogram has <i>two</i> pairs of equal angles, and the trapezium does <i>not</i> have two pairs of equal sides.								
14	Α	14	Drawing in the missing tiles, we can count columns of 2, 3, 3, 2 and 4 tiles, hence 14 tiles are missing.								
15	Ε	Wednesday	If the day before the day before yesterday was Thursday, today must be three days later, that is Sunday. So, three days after that will be Wednesday.								
16	С	14	Every two in five fruits Glug eats are tomatoes, so the slug eats $\frac{2}{5} \times 35 = 14$ tomatoes.								
17	C	23	The queue looks like this: $\xrightarrow{********} G H \xrightarrow{******} G H \xrightarrow{*******} \longrightarrow$								
18	D	$\frac{1}{6}$	Dividing the equilateral triangle into three isosceles triangles as shown leaves the hexagon divided into six congruent isosceles triangles.								
19	D	Dipesh	Amy eats 60% (36 biscuits), Ben 48, Cleo half (30), Dipesh $\frac{5}{6}$ (50), and Emil 0.75 or $\frac{3}{4}$ (45 biscuits). So Dipesh eats the most biscuits.								
20	Α	35 minutes	Lorna will take $60 \div 4 \times 7 = 105$ minutes to mow 7 small fields, and $100 \div 5 \times 7 = 140$ minutes for the large fields, so that the large fields will take 35 minutes longer.								
21		180 cm ²	Referring to the width and length of the triangles as x and y respectively, as shown in the diagram, we can see that <i>y</i> is half of the short side of the rectangle, ie. 12 cm. Thus the longer side of the rectangle is 2×12 cm + <i>x</i> from which we can conclude that $x = 5$ cm. The area of the six triangles, in cm ² , is $6 \times \frac{1}{2} \times 12 \times 5 = 180$.								
22		2 years	This year Gareth's age is a multiple of 10, but last year Gareth's age was a multiple of 13. The only age less than 120 that satisfies these conditions is 40. Therefore this year Gareth is 40 and Herbie is 4. In 2 years' time, Gareth will be 42, and Herbie 6.								



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 *m*æth, 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?!