Primary Mathematics Challenge – November 2012

Answers and Notes

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

P1 D (18) P2 D (20)

1	**A**	circle	All the other shapes are also in the picture of a bird.
2	**C**	£53	5300 pence equals £53.
3	**E**	32	The complete patio will be 8 × 4 and will have 32 slabs.
4	**C**	£1	The increase is 10p a journey, twice a day. So the total increase is £1.
5	**D**	6	Pupils can draw and list all the possibilities. Or consider that you can use three colours in the first section, leaving two for the next and one colour for the final. This gives 6 possibilities.
6	**D**		The polecat has been rotated 90° clockwise and then reflected in a vertical axis.
7	**A**	1	The first and third patterns have no line of symmetry (look carefully at the third). The second and fifth have one. The fourth has six. The symbols: humanism, Christianity, Islam, Judaism and Sikhism.
8	**D**	9.1	The arrow points midway between 9.0 and 9.2 and so to 9.1
9	**D**	triangle	The shape with the smallest number of sides will have sides of the largest length. So the triangle has sides of the longest length (20cm).
10	**C**	40p	Dolores starts with £1, spends £1.30. So she then has -30p. She finds 70p and now has 40p.
11	**B**	17	The final cuboid will have 4 × 3 × 5 = 60 cubes. He has used 43 and will need 17 more.
12	**C**	14 313	The sum is 13 000 + 1300 + 13 = 14 313.
13	**B**	very unlikely	We have no evidence that a music teacher has been hit by bird poo, but it is not impossible.
14	**C**	15	50 = 2 × 5 × 5. 3 is not in the list of factors so 15 cannot be a factor.
15	**D**	39	Marcus goes to the school on Tuesdays, Wednesdays and Thursdays; so there are 3 × 13 = 39 days in the term.
16	**A**	245	The journey takes 90 min to midday and 170 after midday which is a total of 260 min. It stops for 15 min and so it is moving for 245 min.
17	**C**	10	Pupils can work through the responses until they get one that works! Or use inverses: 8 → 16 → 20 → 10.
18	**D**	40%	24 out of 60 boys choose pink for girls. That is 4 out of 10 and is 40%.
19	**B**	16cm^2	The length of SQ is 2cm and the length of PS is 6cm. So triangle PRS has area 12 cm^2 and triangle QRS 4cm^2. Therefore the area of triangle PQR is 16 cm^2.
20	**E**	2017	2013 is divisible by 3. 2014 and 2016 are divisible by 2 and 2015 is divisible by 5. So 2017 must be the prime number.
21	135º		Three angles meet at the point with the angle x. One is 90° and the other two are interior angles of the octagons and are equal. Now 360º – 90° = 270° so x = 135°.
22	8		The digits of the number must add up to a multiple of 9 if the number is divisible by 9. 6 + 4 + 1 = 11. The next multiple of 9 above 11 is 18, but ☺ + ☺, being equal, would be 3½ each – no good. If the sum of the digits is 27, then ☺ + ☺ =16 and ☺ = 8.
23	20		This looks very difficult, but pupils might notice that the second bracket (on the top) equals 992, and can cancel down with the 992 on the bottom, leaving 3 + 7 + 10 = 20. [This is a problem quoted in *Lewis Carroll in Numberland* by Robin Wilson, Penguin (2009)]
24	black and orange (or orange and black)		There is no scale on the vertical axis, but the frequencies of the colours are multiples of: red 3, orange 6, black 2, green 1 and yellow 4. The total is 16. The two colours which are the favourites of 50% of the class must add up to 8 and are black and orange.
25	5		The sum of 4 children's ages is 42, so pupils could think that they will be about 10 years old each, as a start to solving the problem. So, with two years apart for the boys and the girls, a first estimate could be 14, 12, 8, 6 which totals 40. An adjustment to this would give us 16, 14, 7, 5 which totals 42 and meets the criteria that the younger boy's age is twice the older girl's age.

Some possibilities for further problems

P2 Pupils could make up really silly problems such as: If I can eat one hard boiled egg in one minute, how many can I eat in one hour?

Q1 Pupils can design other animals and objects with mathematical shapes.

Q5 How many different badges could be made if a badge used four colours, or more? There is a pattern here. If the number of colours used in making a badge is n, then the numbers of badges that can be made is $n \times (n-1) \times (n-2) \times ... \times 1$.

Q10 It would seem that our world does not allow children to have a negative amount of money (unless you include loans). But mathematics has often used seemingly impossible ideas and then they turn out to be most useful. An example is the use of the symbol √2 to represent the infinite decimal which is impossible to write down without something like √. Or the number i to represent √-1.
Here is another 'silly' sum: I have only one hour before bedtime. How much spare time will I have if I do homework (35min), text my girlfriend (10 min), and then send some emails when having a bath (27min)?

Q13 Can pupils make up examples of problems which have the different probability outcomes used in this question?

Q14 The prime factors of 50 are shown by 2 × 5 × 5. The factors of 50 can be made by combining these (2, 5, 10, 25, 50). 1 is also a factor. Pupils could explore other numbers to find their prime factors and their complete set of factors.

Q17 Pupils might be able to design problems like this which always end up with the same number. Here is one: Think of a number; multiply by 4; add 8; halve the answer; and take away twice the original number. The answer is always four.

Q18 The numbers used in this problem are not from an actual survey but have been made up. But do your pupils think that young girls' bicycles must be pink? Or that their hobbies and interests must be very different to those of boys? How about a serious survey on this? The website *www.pinkstinks.org.uk* has some thoughts on the subject.

The PMC is organised by The Mathematical Association.