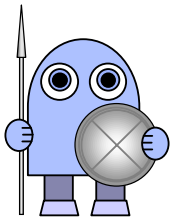
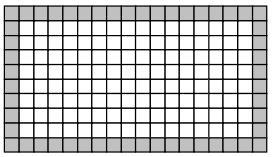


MATHS CHALLENGE CARDS SET B

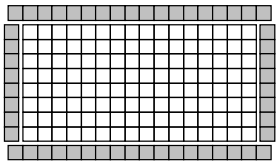
ANSWER BOOK

four winds maths

1 To make things simpler, just think of the jigsaw as 180 squares arranged in 10 rows of 18 :



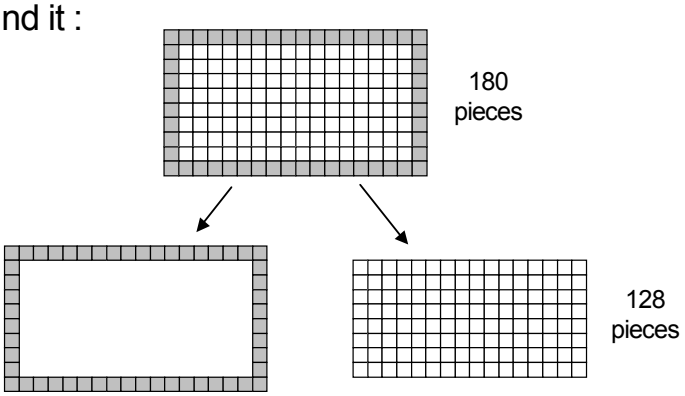
The edge pieces have been shaded grey and you can think of the four edges as two sets of 18 plus two sets of 8 . . .



. . . which gives you a total of 52. So that's your answer : the puzzle has 52 edge pieces.

** If you got 56 for your answer, because you just added two sets of 18 and two sets of 10, think again! You've counted the corner pieces twice!*

A different way of getting to the answer is to think of the 18 x 10 puzzle as a 16 x 8 rectangle (like a smaller puzzle) with a border of edge pieces all round it :



The border must have 180 – 128 pieces, which again gives 52.

2 There are many different ways of doing these. This table shows you two ways for each of the numbers :

8	2 + 3 + 4 - 1	(24 ÷ 3) x 1
9	12 x 3 ÷ 4	23 - 14

10	1 + 2 + 3 + 4	(2 x 4) + 3 - 1
11	42 - 31	(1 x 2 x 4) + 3
12	(2 x 4) + 1 + 3	(4 + 2) x (3 – 1)

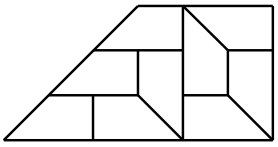
3 Kate is 8 years old, Tom is 7, Ben is 5 and Sally is 4.

4 First set of numbers : 7 is the only prime number (or 7 is the only single-digit number), 15 is the only multiple of 3 (or 15 is the only multiple of 5), 28 is the only even number (or 28 is the only 'perfect number'), 49 is the only square number.

Second set : 3 is the only triangle number (or 3 is the only prime number), 8 is the only cube number, 25 is the only square number, 40 is the only multiple of 10.

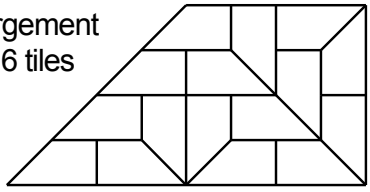
** a 'perfect number' is one which is the sum of all its factors (not counting the number itself); 6 is another 'perfect number'.*

5 These are not difficult – and there are many different ways of doing them. Here are examples of a 3 x enlargement and of a 4 x enlargement :



3 x enlargement
– uses 9 tiles

4 x enlargement
– uses 16 tiles



The important thing to notice is how many tiles you're using for these. If the 2 x enlargement uses 4 tiles, the 3 x version uses 9 tiles and the 4 x version uses 16 tiles, it's pretty obvious that the 10 x enlargement is going to use 100 tiles.

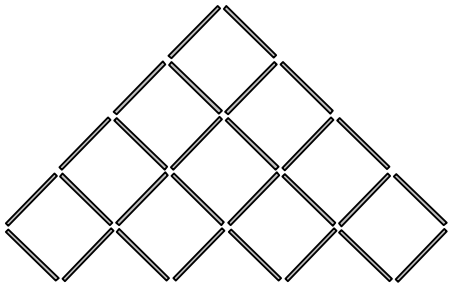
6 You'll get the largest product by using 50 and 50 as your two numbers; multiplying 50 by 50 gives 2500. If you preferred to use two different numbers (though the question doesn't say the numbers have to be different from each other), then 49 and 51 would be your best bet; 51 x 49 = 2499 as you can easily work out.

The second question, about the rectangular pen for a goat, uses what you've found out in the first question . . . Obviously, if you've got 28 metres of fencing, adjacent pairs of sides must add up to 14 – and the two numbers adding up to 14 which have the largest product are 7 and 7. So the goat could have an enclosure of 49 m^2.

* *Don't even think of saying that a square's not a rectangle !*

7 **a** Pattern 3 has 18 matchsticks.

b Here's pattern 4 which, as you can see, uses 28 matchsticks :



There's a pattern in these results and it's not too hard to find. If we set the results out in a table like this, the pattern is easier to see :

shape	number of matchsticks	
1	4	= 1 x 4
2	10	= 2 x 5
3	18	= 3 x 6
4	28	= 4 x 7

So for shape 20, we're going to need 20 x 23 matches, and that's a total of 460 matches !

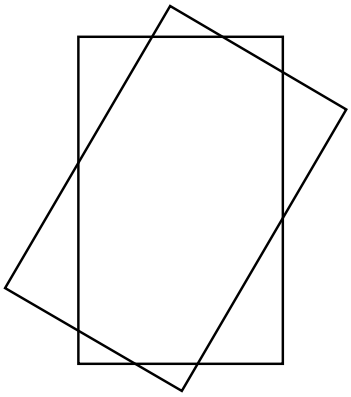
8 **a** 36 **b** 45 **c** 63

9 **a** 137, 138, 139 or 102, 103, 104, 105

b 257, 258 or 101, 102, 103, 104, 105

c Yes (but not easy to work out) : 85, 86, 87, 88, 89, 90, 91

10 9 is the largest number of regions you can get, like this :



11 This one's not easy but the first stage is to find what each of the children weighs. The answers here are :

Amy 20kg, Bill 40kg, Chris 15kg, Debbie 35kg

You can make the sea-saw balance if you have Amy and Debbie on one side with Bill and Chris on the other side.

12 Simon is 20, his father is 40 and his grandfather is 60.

13 **a** There are different possibilities here. The two numbers could be 5 and 20 (100 = 4 x 25), or they could be 6 and 12 (72 = 4 x 18), or they could be 8 and 8 (64 = 4 x 16).

b 4, 5, 6

14

14	21	8	15	2
1	13	20	7	19
18	0		24	6
5	17	4	11	23
22	9	16	3	10

15 **a** You can easily see that each year they use 1500 kg of potatoes for every 100 children at the school. At this rate they would need 4 times as much to feed 400 children – and that's 6000 kg.

b On average, each seal-cub eats 4.8 kg of fish per day, which means that 9 seal-cubs would eat 43.2 kg of fish per day.

c With each child getting through 0.5 kg of shoe-leather per year on average, you'd expect three similar children to use 1.5 kg.

d This one's a bit harder. Notice that the first wall has an area of $55m^2$ and the second wall has an area of 66 m^2. We can now work things out like this :

$$10 \text{ days} \rightarrow 55 \text{ m}^2$$

$$2 \text{ days} \rightarrow 11 \text{ m}^2$$

$$12 \text{ days} \rightarrow 66 \text{ m}^2$$

– so the answer's 12 days.

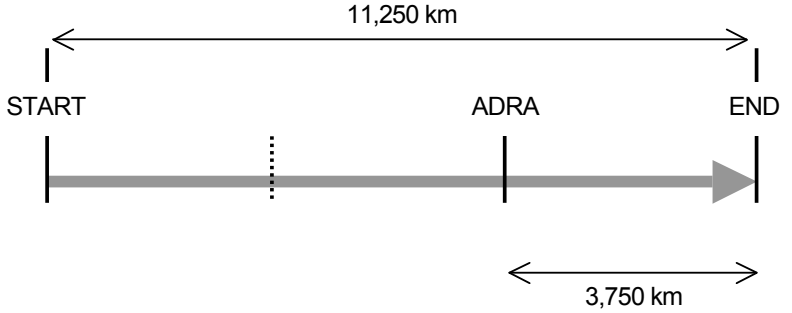
16 **a** $5 * 9 = 45 - 14 = 31$

b $10 * 10 = 100 - 20 = 80$

c Either 0 or 3 will work here, since $0^2 - 0 = 0$ and $3^2 - 3 = 3$.

17 A diagram helps here. If the distance covered is twice the distance still to go, you're best dividing the whole journey into three equal parts :

Dividing 11, 250 km by 3 gives 3,750 km, and that's the distance still to be covered :



18 **a** 3 ○ 5 = 1 **b** 3 ○ 6 = 0 **c** 9 ○ 9 = 9

d 7 ○ 2 = 12 **e** 9 ○ 7 = 11 **f** 15 ○ 15 = 15

19 Here you just need to be systematic (and careful !) . . .

One way is to think first of all the numbers ending in 3 and then of all the numbers beginning with 3 :

3 / 13 / 23 / 33 . . . 93 (10 altogether)

30 / 31 / 32 // 34 . . . 39 (9 altogether)

Notice we were careful not to count 33 twice ! With our total here of 19 cards having a 3 on them somewhere, we know that there must be 81 cards (that's 100 – 19) which don't have a 3 on them.

20 Total kilometres of tyre wear = 4 x 1200 = 4800 km. This total distance is shared among 5 tyres, so each tyre must travel 960 km (that's 4800 ÷ 5).

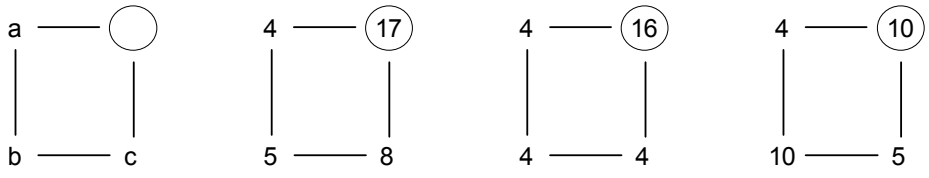
21 Here are two ways of making 100 from five 5s :

$(5 \times 5 \times 5) - (5 \times 5) = 100$ and $5 \times 5 \times (5 - \frac{5}{5}) = 100$

3 and 6 are two numbers whose product (18) is exactly twice as big as their sum (9). You could also have had 4 and 4, since 16 = 2 x 8.

22 There are 6 mice, 12 goldfish and 8 parrots. What a party !

23 Here are the answers – and to explain how each one works, we've used a, b, c to stand for the three numbers you're given :



answer = a + b + c

answer = a + c + 2b

answer = ac - b

24 Before the grandfather arrives, there are 3 people in the house. Sam must have worked out their average age (32) by dividing the total of their ages by 3, so this total must have been 3 x 32 = 96.

Once the grandfather has arrived, there are 4 people in the house. If the average age of these 4 people is 42, the total of their ages must be 4 x 42, which is 168.

Of course, it's grandfather who has increased the age total in the house from 96 to 168, so he must be 72 !

25 This isn't a hard question, but you do need to be careful . . .

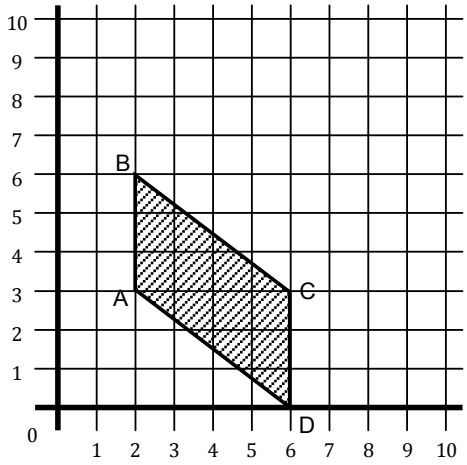
ZEROS TO 200

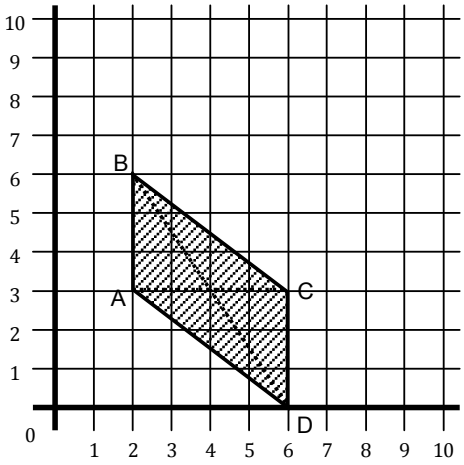
	how many
10, 20 . . . 90	9
100 and 101	3
110 . . . 190	9
200	2
total =	23

So Tom must order 23 brass 0s. Would the answer be the same for each of the other numerals he needs? Who can say?

26 There are 10 silver phones, 15 black phones and 20 grey phones.

27





- ABCD is a parallelogram.
- No, ABCD doesn't have a line of symmetry. The only parallelograms which have bilateral symmetry are rhombuses and rectangles.
- The diagonals cross at the point (4,3).
- You can easily see that ABCD has the same area as a 4 x 3 rectangle ie 12 squares.

28 It's easier if you write all the ages in months. So, Ralph is 37 mths, Millie is 53 mths, Ian is 42 mths and Naomi is 48 mths. Add all these together and you get 180 months. Divide this by 4 to get the mean and your answer is 45 months, or 3 yrs 9 mths.

29 (**a**) parallelogram (**b**) rhombus (**c**) right-angled isosceles triangle (**d**) hexagon (**e**) regular tetrahedron (**f**) rhombus

30 You can tell straight away that they're going to meet, because at each chime they get 7 stones nearer together – and 63 (the number of stones between them at the start) is a number which divides by 7. In fact, $63 \div 7 = 9$, and it's on the 9^{th} chime that they meet up – on stone number 30.

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31 1 : Ben, 2 : Peter, 3 : Sue, 4 : Alfred, 5 : Jane, 6 : Kate

---

32 **a.** $11^2 - 9^2 = 10 \times 4 = 40$ and $13^2 - 11^2 = 12 \times 4 = 48$

b. $51^2 - 49^2 = 50 \times 4 = 200$

c. $101^2 - 99^2 = 100 \times 4 = 400$

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33 ○ Three friends start off with £8 each; so they must have £24 in all. Robin joins them and now there are four friends with £6 each – that's still only £24 in all. So Robin has contributed nothing !

○ When Sally joins the group, the average sum in their pockets goes back up to £8. Five friends with £8 each comes to £40, so Sally must have put in £16.

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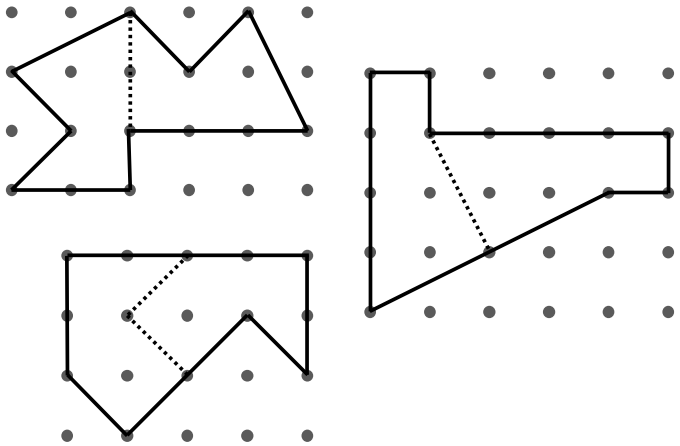
34 ○ There are 12 matchboxes per carton.

○ The surface area of the original carton is 288 cm^2 and the surface area of the new carton is 264cm^2 – so the new carton saves on packaging !

35

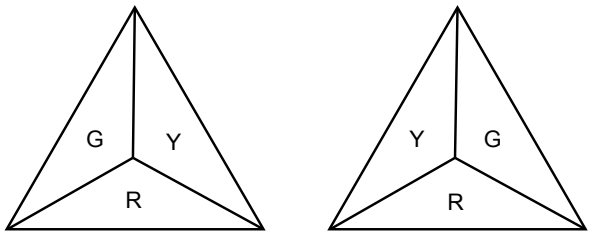


36
- The first 9 cabins will use 1 digit each, so that's 9 so far.
- The cabins from 10 to 20 will use 22 digits, so by now we will have used 31 digits.
- The cabins from 21 to 30 will use 20 digits, which brings our total up to 51.
- In the same way, each set of ten cabins up to 90 (ie 31 to 40, 41 to 50, 51 to 60, 61 to 70, 71 to 80, 81 to 90)will use 20 digits. That's 6 lots of 20, or another 120 digits, bringing our running total to 171, the number we're after. So the cabins must go up to number 90.

37 (**a**) 24, 30, 40 (**b**) 36 (**c**) 48

38 (**a**) 3, 5, 8 (**b**) 2, 3, 4, 7 (**c**) 2, 5, 5, 9

39 Suppose you colour the base blue. Then we can consider the choices for the other faces by looking at the tetrahedron from above. As you can see, there are only two different options :



40 Mr G bought 7 single albums at £10 each and 2 double albums at £15 each.

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41 **a.** John's two numbers are 63 and 84.

b. No, it's not possible : there are no 2-digit numbers which will work.

c. Yes, 81 is 9 times the sum of its digits.

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42 **a.** Set both timers running. As soon as the 7-minute timer runs out, start your cooking : the 11-minute timer has just 4 minutes left to go.

b. Start both timers. When the 7-minute timer runs out, turn it over and let it carry on running; when the 11-minute timer runs out, do the same for it. As soon as the 7-minute timer runs out for the second time, start your cooking : the 11-minute timer still has exactly 8 minutes left to run.

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43 ○ Looking at the dimensions of the tile used here, we can see that 3 x the length is the same as 5 x the width. So let's suppose for now that the tiles are all 5cm x 3cm. This would give a perimeter for the whole shape of 52cm. But we know that the perimeter of the whole shape is actually 104cm, ie twice as much. So the tiles must each measure 10cm x 6cm.

○ The tiles we know have side lengths of 10cm and 6cm and the hexagon must have a side length of 10cm, so the perimeter of this whole shape is also 104cm !

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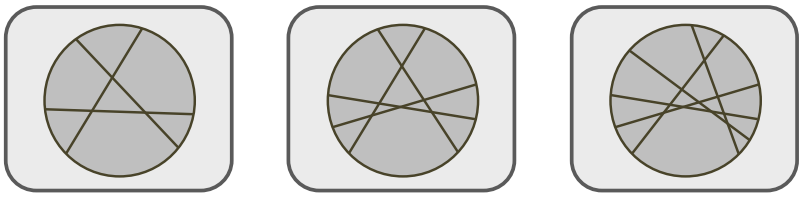
44 **a.** With 3 straight cuts you can get 7 pieces.

b. With 4 cuts you can get 11 pieces.

c. As you go from 1 cut to 2 cuts to 3 cuts to 4 cuts, the number of pieces you produce goes 2 → 4 → 7→ 11, or in other words, it's add 2, add 3, add 4 . . . So, we would expect to add 5 for the next step, giving 16 as the maximum number of pieces you can get with 5 straight cuts.



** To get the maximum number of pieces from your cuts, it's essential that no two cuts are parallel and that no more than two cuts cross at any one point.*

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45 **a.** 3, 8, 23, 68, 203, **608**, **1823** . . . (to go from one term to the next, multiply by 3 and take 1 away)

b. **6**, 3, 9, 12, **21**, 33, 54 . . . (Fibonacci)

c. 2, 3, **5**, 7, **11**, 13, 17, 19 . . . (prime numbers)

d. 4, 5, 7, 11, 19, 36, **69**, **135** . . . (to go from one term to the next, double and take away 3)

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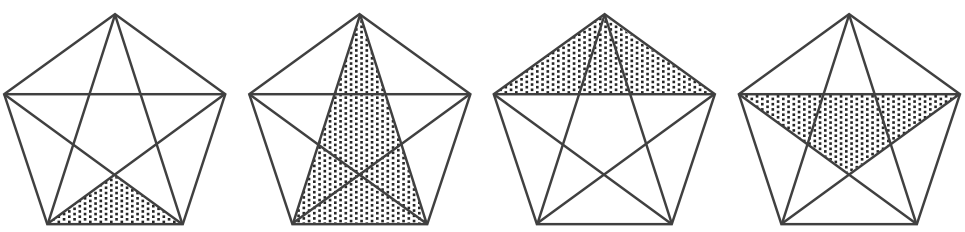
46 Each of these four isosceles triangles can be drawn in five different positions, giving a total of 20 isosceles triangles in all :



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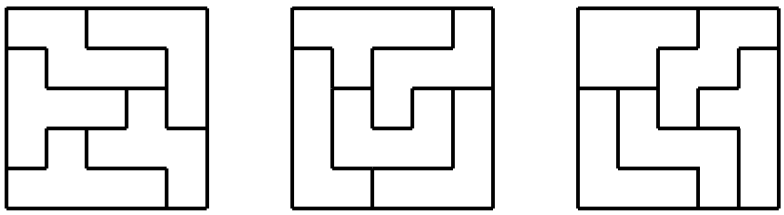
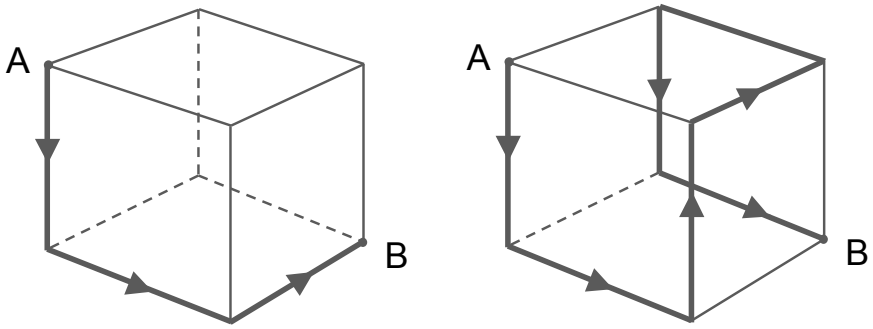
47 There are many ways of doing this; here are just three :



48
- Simon is 6, his mother is 36, his father is 42 and his grandfather is 72.
- In 6 years' time Simon will be 12 and his father will be 48.

49
- Starting at point A, Lewis has three edges to choose from to take him to the next corner. At any one of these corners he will have just two alternatives if he's taking the shortest route to B. At the next corner, there's no choice. So, the total number of possible ways is 3 x 2 x 1 = 6. The distance covered will be 30cm, as in the example on the left :



- The longest possible route without going through any point twice is 70cm, as in the example on the right.

50 There are 168 spots in a complete set of dominoes. So if John can count only 135 spots, his missing three dominoes must total 33 spots in all. They can only be the 6 – 6, the 6 – 5 and the 5 – 5.