

Solutions

1 Four-pin bowling

Score 5 by knocking down 1 and 4, or 2 and 3.

Score 6 by knocking down 2 and 4, or 1, 2 and 3.

Score 7 by knocking down 3 and 4, or 1, 2 and 4.

2 Gob-stopper

Five different ways to pay 6p:

$5p + 1p$
 $2p + 2p + 2p$
 $2p + 2p + 1p + 1p$
 $2p + 1p + 1p + 1p + 1p$
 $1p + 1p + 1p + 1p + 1p + 1p$

Six different ways to pay 7p:

$5p + 2p$
 $5p + 1p + 1p$
 $2p + 2p + 2p + 1p$
 $2p + 2p + 1p + 1p + 1p$
 $2p + 1p + 1p + 1p + 1p + 1p$
 $1p + 1p + 1p + 1p + 1p + 1p + 1p$

3 Pick a pair

There are six different sums and six different (positive) differences.

- | | |
|----------------|----------------|
| 1. $1 + 2 = 3$ | 2. $2 - 1 = 1$ |
| $1 + 4 = 5$ | $4 - 2 = 2$ |
| $2 + 4 = 6$ | $4 - 1 = 3$ |
| $1 + 8 = 9$ | $8 - 4 = 4$ |
| $2 + 8 = 10$ | $8 - 2 = 6$ |
| $4 + 8 = 12$ | $8 - 1 = 7$ |

Adapt the puzzle by using larger numbers.

4 Snakes and ladders

Watching out for snakes, there are four different ways to get to 16 in two throws:

1 then 6; 3 then 4; 4 then 3; 5 then 2.

5 Bean-bag buckets

- The highest score is 12 (3 bags in 4).
- Score 6 in three ways:
1 bag in 4 and 2 bags in 1, or
1 bag in 1, 1 bag in 2 and 1 bag in 3, or
3 bags in 2.
- Score 9 in three ways:
1 bag in 1 and 2 bags in 4, or
1 bag in 2, 1 bag in 3, 1 bag in 4, or
3 bags in 3.
- Besides 6, 9 and 12, other possible scores are:
3: 3 bags in 1
4: 2 bags in 1, 1 bag in 2
5: 2 bags in 1, 1 bag in 3, or
1 bag in 1, 2 bags in 2
7: 1 bag in 1, 2 bags in 3, or
2 bags in 2, 1 bag in 3, or
1 bag in 1, 1 bag in 2, 1 bag in 4
8: 2 bags in 2, 1 bag in 4, or
1 bag in 2, 2 bags in 3, or
1 bag in 1, 1 bag in 3, 1 bag in 4
10: 1 bag in 2, 2 bags in 4

Adapt this puzzle by using larger numbers.

6 Crossword

¹ T	W	² O		³ S	I	X
		N		E		
⁴ T	W	E	L	V	E	
E				E		
N		⁵ N	I	N	E	

7 Gold bars

Move two bars from pile 1 to pile 3.
Move one bar from pile 4 to pile 2.

8 Ride at the fair

The amounts up to 20p that **cannot** be made from exactly three coins are:

1p, 2p, 10p, 18p, 19p.

Lucy could have given her Mum:

$$3p = 1p + 1p + 1p$$

$$4p = 2p + 1p + 1p$$

$$5p = 2p + 2p + 1p$$

$$6p = 2p + 2p + 2p$$

$$7p = 5p + 1p + 1p$$

$$8p = 5p + 2p + 1p$$

$$9p = 5p + 2p + 2p$$

$$11p = 5p + 5p + 1p$$

$$12p = 5p + 5p + 2p$$

$$13p = 10p + 2p + 1p$$

$$14p = 10p + 2p + 2p$$

$$15p = 5p + 5p + 5p$$

$$16p = 10p + 5p + 1p$$

$$17p = 10p + 5p + 2p$$

9 Sum up

If each number can be used only once:

$$9 = 2 + 3 + 4$$

$$10 = 2 + 8$$

$$11 = 3 + 8$$

$$12 = 4 + 8$$

$$13 = 2 + 3 + 8$$

$$14 = 2 + 4 + 8$$

$$15 = 3 + 4 + 8$$

Other solutions are possible if numbers can be repeated.

Other totals:

$$5 = 2 + 3$$

$$6 = 2 + 4$$

$$7 = 3 + 4$$

$$17 = 2 + 3 + 4 + 8$$

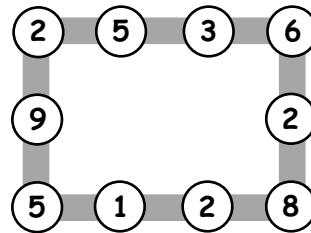
10 Birds' eggs

There are 10 possibilities:

1, 1, 17	1, 7, 11	3, 3, 13	5, 5, 9
1, 3, 15	1, 9, 9	3, 5, 11	5, 7, 7
1, 5, 13		3, 7, 9	

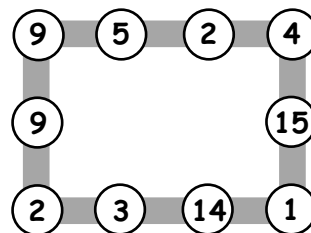
11 Number lines

1. For example:

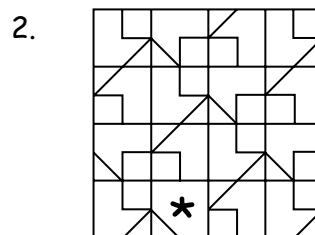
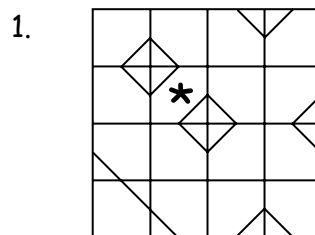


Other solutions are possible.

2. For example:



12 Odd one out



13 Line of symmetry

There are five other ways for Gopal to arrange the squares:

red, green, blue, blue, green, red
 green, red, blue, blue, red, green
 green, blue, red, red, blue, green
 blue, red, green, green, red, blue
 blue, green, red, red, green, blue

What if Gopal has eight squares: two red, two blue, two green and two yellow? How many different symmetrical lines can he make now? (24)

14 Card sharp

- There are 10 different ways to choose three cards with a total of 12:
 0, 3, 9 1, 2, 9 2, 3, 7 3, 4, 5
 0, 4, 8 1, 3, 8 2, 4, 6
 0, 5, 7 1, 4, 7
 1, 5, 6
- There are 9 different ways to choose four cards with a total of 12:
 0, 1, 2, 9 0, 2, 3, 7 1, 2, 3, 6
 0, 1, 3, 8 0, 2, 4, 6 1, 2, 4, 5
 0, 1, 4, 7 0, 3, 4, 5
 0, 1, 5, 6
- No.

Adapt the puzzle by changing the total.

15 Jack and the beanstalk

Jack can climb the beanstalk like this:

left, left, right, right
 left, right, left, right (as shown)
 left, right, right, left
 right, left, right, left
 right, left, left, right
 right, right, left, left

16 Monster

Alesha can use these coins to pay 45p:

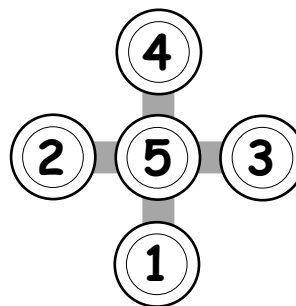
two 20p and one 5p
 one 20p, two 10p and one 5p
 one 20p, one 10p and three 5p
 one 20p and five 5p
 four 10p and one 5p
 three 10p and three 5p
 two 10p and five 5p
 one 10p and seven 5p
 nine 5p

There are 13 different ways to pay 50p using only silver coins. First add 5p to each of the ways for 45p. The other four possibilities are:

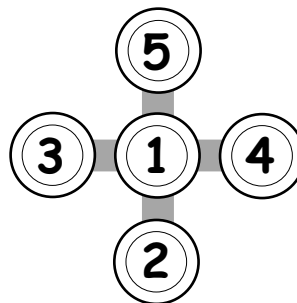
two 20p and one 10p
 one 20p and two 10p
 five 10p
 one 50p

17 Cross-road

Each line adds up to 10.



Each line adds up to 8.



18 Fireworks

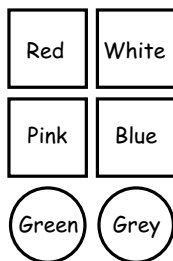
For 19 stars:

- 5 fireworks made 3 stars and 1 made 4 stars, or
- 1 firework made 3 stars and 4 made 4 stars

For 25 stars:

- 3 fireworks made 3 stars and 4 fireworks made 4 stars, or
- 7 fireworks made 3 stars and 1 firework made 4 stars

19 Coloured shapes



20 Ones and twos

Some higher scores:

$$\begin{array}{ll}
 2 \times 2 \times 2 = 8 & 2 + 1 = 3 \\
 1 + 1 + 1 = 3 & 2 + 1 = 3 \\
 8 \times 3 = 24 & 2 + 1 = 3 \\
 & 3 \times 3 \times 3 = 27
 \end{array}$$

21 Birthdays

Answer: Paul is 15.

Most pupils will guess then try to improve.

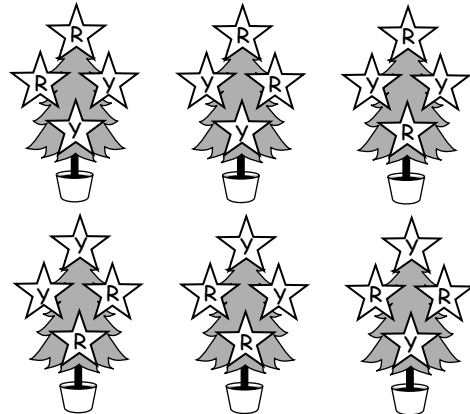
For example, try 10:

$$10 \times 2 = 20 \quad 20 + 5 = 25 \quad \text{too small}$$

22 Christmas tree

There are 16 different ways:

- 1 way for 4 red;
- 1 way for 4 yellow;
- 4 ways for 3 red and 1 yellow;
- 4 ways for 1 red and 3 yellow;
- 6 ways for 2 red and 2 yellow (shown below).



23 At the toyshop

There are 9 tricycles and 2 go-carts, or 4 tricycles and 5 go-carts.

24 Ben's numbers

There are 16 different numbers in Ben's list:

5, 14, 23, 32, 41, 113, 122, 131, 212, 221, 311, 1112, 1121, 1211, 2111, 11111.

What if the digits add up to 4, or if they add up to 6? How many different numbers are there now?

25 Spot the shapes 1

1. There are 9 triangles.
2. There are 18 rectangles.

26 Rows of coins

- 5p, 2p, 20p, 1p, 10p
- 2p, 5p, 1p, 2p, 1p, 5p, or its reverse
When two 10p coins are also used:
2p, 5p, 10p, 2p, 1p, 5p, 1p, 10p, or its reverse

27 Roly poly

- The total number of dots on the dice is 21. Of these dots 17 are showing, so the face with 4 dots is face down.
- The total number of dots on two dice is 42, so 12 dots are hidden. The two hidden faces must each have 6 dots.

28 Dan the detective

- 48
- 63

29 Spaceship

3 Tripods (9 legs) and 7 Bipods (14 legs), or 5 Tripods (15 legs) and 4 Bipods (8 legs).

What if Tripods with 3 legs and Quadrapods with 4 legs are on the spaceship?

Find two different ways to make 23 legs.

30 Susie the snake

Susie has 19 eggs.

You could make up similar problems with, say, 21 eggs.

If you counted them in fours, there would be 1 left over.

If you counted them in fives, there would be 1 left over.

31 Three monkeys

There are 10 possibilities:

1, 3, 21	3, 5, 17
1, 5, 19	3, 7, 15
1, 7, 17	3, 9, 13
1, 9, 15	5, 7, 13
1, 11, 13	5, 9, 11

What if the monkeys ate 24 nuts, with each of them eating a different even number of nuts?

The possible answers are:

2, 4, 18	4, 6, 14
2, 6, 16	4, 8, 12
2, 8, 14	6, 8, 10
2, 10, 12	

32 Card tricks

Systematic working helps to make sure that all possibilities have been considered.

Four different cards with a total of 20 are:

1, 4, 7, 8	2, 3, 7, 8	3, 4, 5, 8
1, 5, 6, 8	2, 4, 6, 8	3, 4, 6, 7
	2, 5, 6, 7	

Three different cards with a total of 16 are:

1, 7, 8	2, 6, 8	3, 5, 8	4, 5, 7
		3, 6, 7	

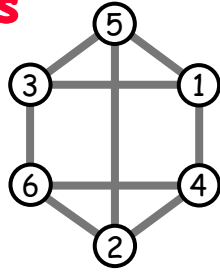
You could try other totals. For example, four cards with a total of 18 are:

1, 2, 7, 8	2, 3, 6, 7	3, 4, 5, 6
1, 3, 6, 8	2, 4, 5, 7	
1, 4, 5, 8		
1, 4, 6, 7		

Explore the different totals that can be made with four cards. (It is possible to make any total from 10 to 26.)

33 Neighbours

Here is one possible solution.



Can you find others?

34 Queen Esmeralda's coins

There were 7, 3, 4 and 6 coins in each pile. The problem can be solved by trial and error.

35 Duck ponds

1. (2) (2) (5) (5)
2. (2) (4) (8)
3. (5) (4) (3) (2)

You could try similar problems with other numbers. For example, using 15 ducks and 5 ponds make each hold 1 more than the one before (1, 2, 3, 4, 5)
 4 ponds make each hold twice as many as the one before (1, 2, 4, 8)
 3 ponds make each hold 4 more than the one before (1, 5, 9)
 3 ponds make each hold 2 less than the one before (7, 5, 3)

36 Treasure hunt

Jed	(R)	(D)	(E)	(R) (D)	(R) (E)	(E) (D)	(R) (E) (D)	
Jake	(D) (E)	(R) (E)	(R) (D)	(E)	(D)	(R)		(E) (D) (R)

37 Stamps

Tilly stuck three 10p stamps and five 5p stamps on her parcel.

No. of 5p stamps	No. of 10p stamps	Total value
8	0	40p
7	1	45p
6	2	50p
5	3	55p
4	4	60p
3	5	65p
2	6	70p
1	7	75p
0	8	80p

To adapt the problem, change the cost of the parcel, or use different stamps.

38 Maisie the mouse

Maisie had 46 breadcrumbs.

The problem can be solved by experiment.

Alternatively, list all the multiples of 4. Add 2 to each number in the list.

Now list all the multiples of 5. Add 1 to each number in the list.

Now look for a number lying between 30 and 50 that is common to both lists.

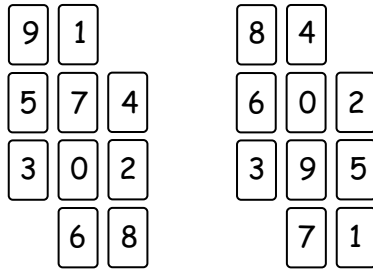
To adapt the problem, group the breadcrumbs in 5s and 6s, or 7s and 9s.

39 Kieron's cats

Kieron's cats weigh 5 kg, 2 kg and 6 kg.

40 Next door numbers

For example:



41 Nick-names

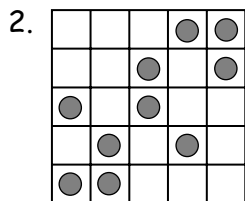
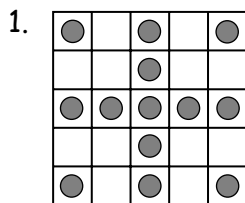
Dawn is Ace.
Mark is Curly.
Josh is Fudgy.
Tina is Spider.

42 Stickers

There are 8 stickers in a full sheet.

43 Odds and evens

Several solutions are possible. For example:



44 More stamps

Rosie bought four 20p stamps and twelve 10p stamps.

45 Sandcastles

Over the 5 days Lisa made 24, 20, 16, 12 and 8 sandcastles.

She made 84 sandcastles altogether.

46 Sail away

Two women cross the river together.
One woman stays there and one brings the boat back.

One man crosses the river.
One woman brings the boat back.

Two women cross the river together.
One woman stays there and one brings the boat back.

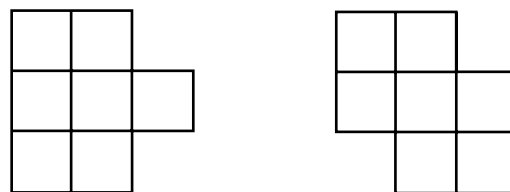
The second man crosses the river.
One woman brings the boat back.

Two women cross the river together.

47 Straw squares

You can make a maximum of 9 squares with 20 straws.

Here are two ways of doing it.



For older children, try 40 straws.

With these you can make a maximum of 30 squares.

48 King Arnold

Three knights can sit with King Arnold in 6 different ways.

Four knights can sit with King Arnold in 24 different ways.

49 Footsteps in the snow

Counting from zero in 2s, 3s and 5s will first match up at 30, when Little has taken 15 footsteps.

50 Ski lift

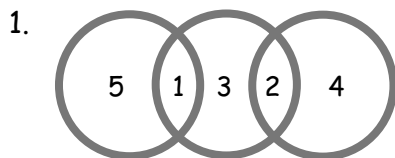
The ski lift has 180 chairs.

51 Lighthouses

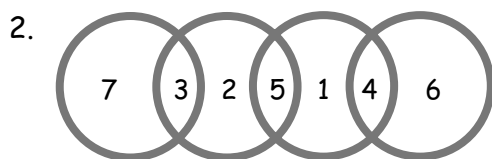
All three lights will be off after 5 seconds.

All three lights will next come on together after 120 seconds.

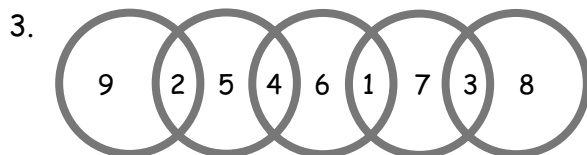
52 Circle sums



or its reverse



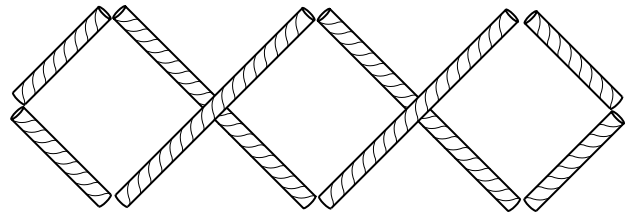
or its reverse



or its reverse

53 Square it up

For example:



54 Joins

Using four numbers:

the highest score is $19 + 15 + 17 + 18 = 69$,

the lowest score is $6 + 5 + 2 + 17 = 30$.

Using five numbers:

the highest is $20 + 18 + 13 + 17 + 18 = 86$,

the lowest is $6 + 18 + 2 + 5 + 6 = 37$.

Using five numbers and diagonal joins:

the highest is $19 + 17 + 14 + 15 + 18 = 83$,

the lowest is $13 + 6 + 20 + 2 + 6 = 47$.

55 Money bags

Ram put 1p, 2p, 4p and 8p in the four bags.

Any sum from 1p to 15p can be made with these amounts.

56 A perfect match

1. A matchbox tray fits into its outer cover in 4 different ways.
2. A cube will fit into a box with any one of its 6 faces uppermost.

Each face can be rotated into any one of 4 different positions.

So there are $6 \times 4 = 24$ ways of fitting the cube in the box.

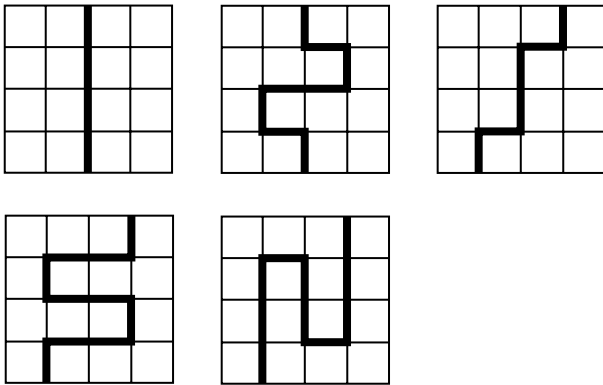
57 Presents

Gurmit paid £2, £4, £6, £1 and £8 for the five presents.

58 Spot the shapes 2

1. There are 11 triangles.
2. There are 17 squares.

59 Four by four



60 Three digits

You can make six different numbers.
In order, the numbers are:
799, 889, 898, 979, 988, 997.

61 Make five numbers

For example:

- a. 12, 39, 45, 60, 78.
- b. 7, 42, 63, 98, 105.
- c. 5, 23, 67, 89, 401.

There are other solutions.

62 Maze

There are two routes that total 100 exactly:

$$\begin{array}{r} + 6 \quad \times 7 \quad - 6 \quad \times 3 \quad - 8 \quad = 100 \\ + 9 \quad \times 7 \quad \div 3 \quad \times 5 \quad - 5 \quad = 100 \end{array}$$

The route giving the highest total is:

$$+ 9 \quad \times 7 \quad - 6 \quad \times 7 \quad - 8 \quad = 391$$

The route giving the lowest total is:

$$+ 6 \quad \times 7 \quad \div 3 \quad \times 3 \quad - 8 \quad = 34$$

63 Jack's book

The book has 221 pages.
42 of the digits are a 5.

64 Flash Harry

Flash Harry's bank balance looked like this.

April	- £100
May	+ £100
June	- £200
July	+ £200

So Harry made £200 overall.

65 Age old problems

1. I am 48 years old (or possibly 104).
2. I am now 26 years old. In 38 years' time, when I am 64, my age will be both a square number and a cube.
3. I am 9 years old now.

66 Zids and Zods

There are 3 Zids with 4 spots and 4 Zods with 9 spots.

If Zids have 5 spots and Zods have 7 spots, the possible ways of making 140 are:

- 28 Zids;
- 21 Zids and 5 Zods;
- 14 Zids and 10 Zods;
- 7 Zids and 15 Zods;
- 20 Zods.

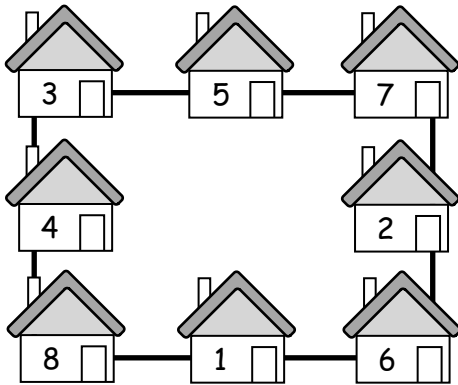
67 Franco's fast food

A curry costs £3.50, a pudding costs £1 and a tea costs 50p.

So the total cost of a curry, a pudding and a tea is £5.

68 Albert Square

For example:



69 Coins on the table

Anna put 12 coins on the table.

70 A bit fishy

Nasreen bought 4 angel fish and 8 goldfish.

71 Pet shop

1. Jim sold the dog and the cat for £72 and £48 respectively, a total of £120.
2. The dog cost £50 and the cat cost £75, a total of £125.
The cat and the dog were sold for a total of £120, so Jim made a loss of £5.

72 Shape puzzle

The circle has the value 5.
The triangle has the value 8.
The club has the value 6.

▲	♣	▲	○	27
♣	○	♣	▲	25
○	○	○	○	20
▲	♣	♣	▲	28
27	22	25	26	

73 Eggs

Mrs Choy bought:
10 large eggs at 50p each,
10 medium eggs at 10p each,
80 small eggs at 5p each.

74 Anyone for tennis?

Ali, Luke, Holly and Zoe play tennis.
Two boys can play.
Ben won't play if Luke plays.
So the two boys must be Ali and Ben,
or Ali and Luke.
Ali will play only if Holly plays.
Holly won't play with Ben.
So the two boys are Ali and Luke.
Luke will play only if Zoe plays.
So the two girls are Holly and Zoe.

75 Bus routes

There are six different routes from A back to A:

A B C D E F A
A B D C E F A
A B D E C F A

and the three reversals of these.

The cheapest routes are A B D E C F A and its reversal, which each cost £21.

76 Slick Jim

Jim won £540 000.

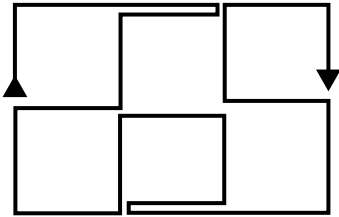
77 All square

For example:

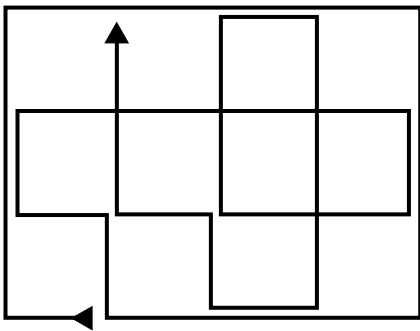
○		○	○
○	○		○
	○		
○	○	○	

78 Sleigh ride

With 3 rows of 4 igloos, the shortest route is 190 metres. For example:



With 4 rows of 5 igloos, the shortest route is 350 metres. For example:



79 Spendthrift

Anil bought 13 choc bars and 9 fruit bars, or 4 choc bars and 22 fruit bars.

80 Cola in the bath

A bath 1.5 metres long by 60 cm wide would have a floor area of approximately 9000 cm^2 . If there was 10 cm of cola in the bath, the volume of liquid would be about $90\,000 \text{ cm}^3$ or 90 000 ml. This would require roughly 270 cans of cola.

81 Millennium

- a. 00:33:20 1 January 2000
- b. 09:20:00 2 January 2000
- c. 08:00 23 March 2000
- d. 00:00 23 June 2005
- e. 00:00 1 May 2038

82 People in the crowd

There is no precise answer, but pupils can compare their estimates and discuss how they arrived at them.

83 Make 200

There are 22 different solutions. Eleven of the solutions are as follows:

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

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

6	1	6	2	7	1
5	7	4	7	3	8

Eleven more solutions are formed by changing over the two digits in the top right and bottom left boxes.