

Mixed methods

Prerequisite knowledge

- Mental arithmetic that enables pupils to undertake simple addition and subtraction
- Understanding of place value

Why do this problem?

This gives pupils experience of finding all possibilities, but in addition requires them to be systematic in the sense of observing patterns and therefore narrowing the range of possible solutions. It consolidates understanding of place value in a motivating context.

Time

One lesson

Resources

CD-ROM: problem sheet, resource sheet of blank grids

NRICH website (optional):
www.nrich.maths.org, September 2002,
 'Reach 100'

It might be appropriate to have calculators available for pupils to check their calculations, and digit cards (optional).

Reach 100

Mixed methods

Here is a 2×2 grid:

Choose four different digits from 1 to 9 and put one in each box. For example:

5	2
1	9

This gives four 2-digit numbers:

52 (reading along the 1st row)

19 (reading along the 2nd row)

51 (reading down the left-hand column)

29 (reading down the right-hand column)

In this case their sum is 151.

Your challenge is to find four different digits that give four 2-digit numbers which total 100.
 How many ways can you find of doing it?

Maths Trails: Working Systematically | Problem and resource sheets | © Cambridge University Press 2006

Introducing the problem

Draw a 2×2 grid on the board and fill it with the numbers 1, 2, 5 and 9 as shown on the problem sheets. Explain the problem to the pupils, showing them how the four two-digit numbers are made from the grid (52, 19, 51 and 29), and ask them to find the sum of these numbers.

In order to develop their understanding of the problem's structure, challenge pairs of pupils to:

- rearrange the digits to make a larger total;
- rearrange the digits to make a smaller total.

Main part of the lesson

After a suitable time, draw the group back together and talk about the totals they have

made. The following questions and prompts might be useful:

- How did you go about finding a solution?
- What is the lowest total you have made?
- Is this the lowest possible from these numbers?
- How can you convince yourselves this is the case?
- What is the highest total that can be achieved?
- How do you know?

In discussing these points, pupils may have drawn on knowledge of how the tens and units digits of each two-digit number contribute to the sum of all four numbers. Bring this to their attention if it does not come up automatically by asking:

- Which digits contribute to the units digit of the total? (all but the top left)
- Which digit contributes least to the total? (bottom right)
- Which digits contribute to the tens? (all but bottom right)
- What does the top left digit contribute? (it is only used for tens)

Introduce the boxed problem on the sheet, emphasising that there may be more than one solution and pupils will need to convince you that they have found them all. Having gained insight from the particular case above, challenge pupils to work in pairs to address the problem itself, that is placing four *different* digits in the grid to make a total of 100.

After five minutes share results and ideas so far in order to encourage those who might be making less progress, and to reiterate and identify key points.

- What solutions have you found already?

- What strategies are you using?
- Are you being systematic? How will you know that you have all the solutions?
- At a glance, what is the largest number that can go in the top left? (4 because 5 would take you over 100 with any one of the other digits)
- What other digits could go in the top left?
- What possibilities have you tried for all the other digits in each case?

Plenary

The main point to bring out in the plenary is the strategies used to solve the problem, such as:

- working systematically to find all solutions;
- being helped by getting a feel for the mathematics by observing patterns relating to the structure of the problem;
- using trial and improvement to home in on all possible solutions.

Solution notes

There are two pairs of solutions.

1	2
4	7

1	4
2	7

2	3
1	8

2	1
3	8