NRICH

Magic Matrix

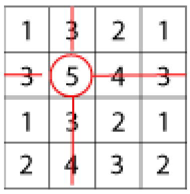
Age 7 to 11

Here is a "magic" matrix:

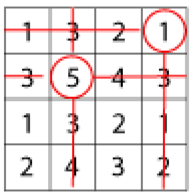
1	3	2	1
3	5	4	3
1	3	2	1
2	4	3	2

It doesn't look very magical does it?
This is how you find out the "magic" in the matrix:

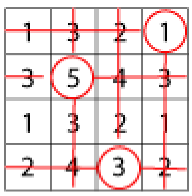
Circle any number in the matrix, for example, 5. Draw a line through all the squares that lie in the same row and column as your selected number:



Then circle another number that has not got a line through it, for example, the 1 in the top right hand corner, and again cross out all squares in the same row and column:



Repeat for a third time, for example:



Then circle only the remaining number that has no line through it:

1	3	2	1
3	5	4	3
1	3	2	1
2	4	3	2

Add all the circled numbers together and note your answer.
Try again with a different starting number. What do you notice?

Try the same thing with these two slightly harder matrices:

1·9	3·4	2·7	4·1	$1\frac{1}{6}$	$2\frac{1}{4}$	$2\frac{11}{12}$	$1\frac{1}{12}$
0·5	2	1·3	2·7	$1\frac{1}{4}$	$2\frac{1}{3}$	3	$1\frac{1}{6}$
0·3	1·8	1·1	2·5	3	$4\frac{1}{12}$	$4\frac{3}{4}$	$2\frac{11}{12}$
2·8	4·3	3·6	5	$1\frac{5}{6}$	$2\frac{11}{12}$	$3\frac{7}{12}$	$1\frac{3}{4}$

This problem was made to celebrate NRICH's tenth birthday - perhaps you can see the connection!

Let's try a different one with larger numbers.

18	17	25	34
6	5	13	22
29	28	36	45
25	24	32	41

What is the magic total this time?

I will show you how this kind of matrix works. You can then invent one to try on your friends!

First you need to choose your 'magic total'. As you know, I chose 100 for the matrix above.
I have chosen: $1, 16, 9, 23, 18, 4, 2$ and 27. [You can check that together they add to 100.]

Now make an addition table like this:

You can download a sheet of them [here /content/id/5517/Magic%20Matrix%20Empty.pdf](/content/id/5517/Magic%20Matrix%20Empty.pdf) .
Put your numbers in the cells on the outside and add them to make the matrix:

	2	1	9	18
16				
4				
27				
23				

	2	1	9	18
16	18	17	25	34
4	6	5	13	22
27	29	28	36	45
23	25	24	32	41

Finally, copy the square without the numbered outside cells:

18	17	25	34
6	5	13	22
29	28	36	45
25	24	32	41

Now you know how the matrix works, you are ready for the real problem.

Can you work out what numbers were used to make any of the original three matrices?