

## 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:

1	3	2	1
<del>3</del>	5	<del>4</del>	<del>3</del>
1	3	2	1
2	<del>4</del>	3	2

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:

1	<del>3</del>	2	1
<del>3</del>	5	<del>4</del>	<del>3</del>
1	3	2	1
2	<del>4</del>	3	2

Repeat for a third time, for example:

1	<del>3</del>	2	1
<del>3</del>	5	<del>4</del>	<del>3</del>
1	3	2	1
2	<del>4</del>	3	2

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?



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