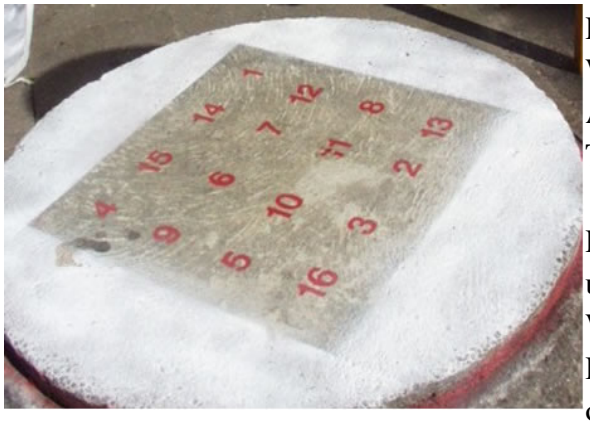
AIMSSEC

AFRICAN INSTITUTE FOR MATHEMATICAL SCIENCES
SCHOOLS ENRICHMENT CENTRE
TEACHER NETWORK

PICTURE PUZZLER



Look carefully at the numbers.
What do you notice?
Add up the rows. Add up the columns. Add up the diagonals.
The square is magic.

Look carefully at the patterns when you find numbers adding up to 17.
What do you notice about the numbers in the four quadrants?
Find out what Albrecht Dürer had to do with this arrangement of numbers.

23	6	19	2	15
10		1		22
	5			9
4	12		8	
11		7		

Can you finish off this 5 by 5 magic square?

Remember that each of the numbers 1 to 25 is used once and only once.

Photograph by Lyndon Baker of a seat in the playground of a Danish school.

Solution

In the 4 by 4 magic square in the photo each row, column and diagonal adds up to 34, the magic total.

We can find the magic total by adding the numbers $1 + 2 + 3 + \ldots + 16 = 136$ and dividing by 4.

The numbers in the four quadrants and also in the 4 central positions all add up to 34.

Each pair of numbers that add up to 17 (half the magic total) are symmetrically placed in the magic square.

23	6	19	2	15
10	18	1	14	22
17	5	13	21	9
4	12	25	8	16
11	24	7	20	3

See https://en.wikipedia.org/wiki/Melencolia_I for some information about Albrect Durer's magic square.

The diagram shows the solution for the 5 by 5 magic square. The top row gives the magic sum of 65.

First find the number missing in the first column.

The remaining numbers to be filled in are:

3, 7, 13, 14, 16, 18, 20, 21 and 25.

To fill in the table look for pairs of numbers that give the missing totals and use trial and improvement.

Notes for teachers

Learning Objective: To investigate numeric and geometric patterns looking for relationships between numbers, including patterns. To develop the skill of finding information online.

Why do this activity?

This activity is an investigation that involves looking for numeric and geometric patterns and using mathematical thinking to solve a puzzle. Magic squares have been studied and played with for 5000 years in many cultures and in many parts of the world. If you have access to the internet then your class could do some research about magic squares.

Possible approach

Give the learners a copy of Durer's 4 x 4 Magic Square and ask them what they notice. Give them time to study it then the class should share their ideas.

Then copy the 5 by 5 partially completed magic square on the board. Ask the learners to work in pairs or small groups to fill it in.

If the learners do not have access to the internet find out a little about the history of magic squares yourself and to tell the class.

Key questions

Can you find the magic sum?
What is the total of all the numbers in the square? Can you use this total to find the magic sum?
What total you need to complete that row? Column?
Do the diagonals give the same total?

Possible extension

Make up your own 3 by 3 magic square using the numbers 1 to 9.

Possible support

Ask:
"What does the total of the top row tell you?"
"Can you find the missing number in the first column?"
"Can you make a list of the numbers that remain to be filled in?"