

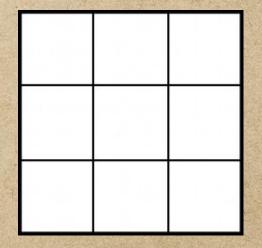
MAGIC SQUARES

come (aquale crestificity affices described and

mustale (three breezes me & placement) also passe

a regim he gint hime con is con

gramme interfections of



FILL IN THE SQUARE USING THE NUMBERS 1-9 (ONLY ONCE), SUCH THAT THE SUM OF EACH ROW, COLUMN, AND MAJOR DIAGONAL IS THE SAME.

MAGIC CONSTANTS

THE SUM OF EACH ROW, COLUMN, AND MAJOR DIAGONAL FOR AN NXN MAGIC SQUARE IS CALLED THE MAGIC CONSTANT.

What is the magic constant for the 3 x 3 magic square?

What is the magic constant for the 4 x 4 magic square?

What is the magic constant for the 5 x 5 magic square?

MAGIC CONSTANTS

WHAT IS THE MAGIC CONSTANT FOR THE NX N MAGIC SQUARE?

MAGIC CONSTANTS - PROOF

The sum of the first *n* integers is given by the formula

N(N+1)/2

SINCE THE *NTH* MAGIC SQUARE CONTAINS THE FIRST N^2 INTEGERS, THE SUM OF ALL THE NUMBERS IN THE *NTH* MAGIC SQUARE IS

 $N^2(N^2+1)/2$

MAGIC CONSTANTS - PROOF

This sum is split into *n* different rows (or columns), so the sum of each row is

 $N^2(N^2+1)/2N$

OR

 $N(N^2+1)/2$

SEQUENCE OF SEQUENCES

MAGIC CONSTANTS

1, 5, 15, 34, 65, 111, 175, 260, 369, 505, 671, 870, 1105,...

LAZY CATERER

What is the maximum number of pieces a pizza can be cut into with one straight cut?

What is the maximum number of pieces a pizza can be cut into with two straight cuts?

WHAT IS THE MAXIMUM NUMBER OF PIECES A PIZZA CAN BE CUT INTO WITH THREE STRAIGHT CUTS?

LAZY CATERER

com (a quali crestorine affer a brown delan

pregala library for me bladenga

What is the maximum number of pieces a pizza can be cut into with *n* straight cuts?

PROOF #1:

SEQUENCE = 1, 2, 4, 7, 11,

FIRST DIFFERENCE = 1, 2, 3, 4, ...

SECOND DIFFERENCE = 1, 1, 1, 1, ...

Thus, we know the formula is a 2nd degree equation.

must seen also must depend must be assembly sometiment of the first of the several all the record

 $F(N)=AN^2+BN+C$

$$F(0) = A(0)^2 + B(0) + C = 1$$
 SO, $C = 1$

NOW, $F(1) = A(1)^2 + B(1) + 1 = 2$

contino of amost amost the account

enterest property and evidence

AND

$$F(2) = A(2)^2 + B(2) + 1 = 4$$

margines and with a committee of the second of the second

granus of the option pass on

and the state of t

L'estaport trafaport onil

PROGRAMAS OF SED ON

WE GET THE SYSTEM,

AR A TOO THE STATE OF MAIN A STREET ON CHESTER AS TO SHOELD

$$A + B = 1$$
$$4A + 2B = 3$$

ground after extension on the contract of the

on way in the see all interference amailed and

to har with beinglich in mines

SOLVING THE SYSTEM GIVES US $A = \frac{1}{2} \text{ AND } B = \frac{1}{2}$

THUS,

$$F(N) = \frac{1}{2} N^2 + \frac{1}{2} N + 1$$

OR

$$F(N) = (N^2 + N + 2)/2$$

PROOF #2:

THE NTH LINE MUST CROSS EACH PREVIOUS LINE, CUTTING THE NTH LINE INTO N SEGMENTS.

EACH OF THE *N* SEGMENT'S DIVIDES AN EXISTING REGION INTO TWO REGIONS. THIS ADDS *N* NEW REGIONS TO THE PREVIOUS SOLUTION.

THIS GIVES US: F(N) = N + F(N-1)

We can work backwards using this recursive formula getting

$$F(N) = N + N-1 + N-2 + N-3 + + 1 + F(0)$$

THIS CAN BE REWRITTEN AS

$$F(N) = (1 + 2 + 3 + ... + N) + 1$$

$$=(N^2+N)/2=1$$

$$=(N^2+N+2)/2$$

SEQUENCE OF SEQUENCES

MAGIC CONSTANTS

1, 5, 15, 34, 65, 111, 175, 260, 369, 505, 671, 870, 1105,...

LAZY CATERER

1, 2, 4, 7, 11, 16, 22, 29, 37, 46, 56, 67, 79, 92, 106, ...

LAZY CATERER II

What is the maximum number of pieces a donut can be cut with one straight vertical cut?

WHAT IS THE MAXIMUM NUMBER OF PIECES A DONUT CAN BE CUT WITH TWO STRAIGHT VERTICAL CUTS?

WHAT IS THE MAXIMUM NUMBER OF PIECES A DONUT CAN BE CUT WITH THREE STRAIGHT VERTICAL CUTS?

LAZY CATERER II

pregala library for me bladenga

WHAT IS THE MAXIMUM NUMBER OF PIECES A DONUT CAN BE CUT WITH N STRAIGHT VERTICAL CUTS?

SEQUENCE: 2, 5, 9, 14, ...

FIRST DIFFERENCE: 3, 4, 5, ...

SECOND DIFFERENCE: 1, 1, 1, ...

Thus, we know the formula is a 2nd degree polynomial.

and the and also and delan mind by among them one your day of the way of the same

 $F(N) = AN^2 + BN + C$

graphe district from a

and organized of the same to the same of t

margings and right and property and spragger on a remain or

יותם מפני און לימונים ביותר ביותר

SOLVE THE SYSTEM OF EQUATIONS:

$$F(1) = A(1)^{2} + B(1) + C = 2$$

$$F(2) = A(2)^2 + B(2) + C = 5$$

$$F(3) = A(3)^2 + B(3) + C = 9$$

SOLUTION

MA A TO THE STATE OF MAIN A STREET OF THE STATE OF THE ST

area antique of the antique of the property of the state of the state

contra of sample and the one

$$F(N) = N(N+3)/2$$

SEQUENCE OF SEQUENCES

MAGIC CONSTANTS

1, 5, 15, 34, 65, 111, 175, 260, 369, 505, 671, 870, 1105,...

LAZY CATERER

1, 2, 4, 7, 11, 16, 22, 29, 37, 46, 56, 67, 79, 92, 106, ...

LAZY CATERER II

2, 5, 9, 14, 20, 27, 35, 44, 54, 56, 77, 90, 104...

TRIANGLES!!!

A winds not probles from langual file and first

preparation of the property and for the content

מ מבקומן את בייול אניישור ביבין וב

gradua of the spire of the

WHAT ARE THE TRIANGLE NUMBERS?

1, 3, 6, 10, 15, 21,

WHAT IS THE NTH TRIANGLE NUMBER?

TRIANGLES!!! - PROOF

EACH TRIANGLE CAN BE DOUBLED AND PAIRED WITH ITSELF TO FORM A N BY N+1 RECTANGLE.

There are *n(n+1)* objects in each rectangle.
Therefore, each triangle contains *n(n+1)/2* objects.

F(N)=N(N+1)/2

SEQUENCE OF SEQUENCES

MAGIC CONSTANTS

1, 5, 15, 34, 65, 111, 175, 260, 369, 505, 671, 870, 1105,...

LAZY CATERER

1, 2, 4, 7, 11, 16, 22, 29, 37, 46, 56, 67, 79, 92, 106, ...

LAZY CATERER II

2, 5, 9, 14, 20, 27, 35, 44, 54, 56, 77, 90, 104...

TRIANGLE NUMBERS

0, 1, 3, 6, 10, 15, 21, 28, 36, 45, 55, 66, 78, 91, 105,

FLOYD'S TRIANGLE

1								
2	3							
4	5	6						
7	8	9	10					
11	12	13	14	15				
16	17	18	19	20	21			
22	23	24	25	26	27	28		
29	30	31	32	33	34	35	36	
37	38	39	40	41	42	43	44	45