A Proof of how the Magic Sum is found

Die 1	Die 2	Die 3	Die 4	Die 5
545	756	766	874	881
644	855	865	676	584
743	459	667	577	287
347	657	964	775	188
446	558	469	478	386
248	954	865	973	485

The middle number (tens digit) is the same for each 3 digit number on all 6 faces of any single die. Die 1 has a 4 in the 10's places for all of the numbers on the die , Die 2 has a 5 as the 10's digit, Die 3 has a 6 as the 10's digit, Die 4 has a 7 as the 10's digit and Die 5 has an 8 as the 10's digit.

No mater what 5 numbers you chose, 1 from each die, **the 5 numbers in the 10's column will be 4 5, 6, 7 and 8 and total 30. This is critical to the way the die works.**

Lets start the trick. Select 1 number from each of the 5 die. The value of the 1's and 100's digits vary so we use variables to express their values.

I select one number from **Die 1**. The 10's digit must be a 4 but I do not know what the 100's and 1's digits will be so I use a variable for each digit. Lets call it F 4 A

I select one number from **Die 1** and call it F 4 A
I select one number from **Die 2** and call it G 5 B
I select one number from **Die 3** and call it H 6 C
I select one number from **Die 4** and call it J 7 D
I select one number from **Die 4** and call it K 8 E

You start the trick by adding the digits in the ones place. You will get a 2 digit number. You write the ones digit of that total below the ones column and carry the 10's digit.

Step 1: Add the 1's digits. You get a 2 digit number <u>x y</u> Write the y in the ones place and carry the x digit to the top of the tens column.

carry the x

$$\begin{array}{rl} F\ 4\ A & \text{from die 1} \\ G\ 5\ B & \text{from die 2} \\ H\ 6\ C & \text{from die 3} \\ J\ 7\ D & \text{from die 4} \\ +\ K\ 8\ E & \text{from die 5} \\ \hline y & \end{array}$$

The sum of A + B + C + D + E = the two digit number <u>x y</u>

you write the ones digit (y) under the ones colum and carry the x

Step 2: Add the 10's digits. You selected the numbers in the 10's place so the the 10's digits on the die add to 30. You add the x that was carried and get a two digit number 3 x. Write the x in the 10's place of the answer and carry the 3 above the 100's column.

carry the 3

	F 4 *A*	from die 1
	G 5 *B*	from die 2
	H 6 *C*	from die 3
	J 7 *D*	from die 4
+	*K* 8 *E*	from die 5
	x y	

The sum of the 10's digits WILL ALWAYS TOTAL 30.
This means that the sum of the 10's digits will be the two digit number 3 x

4 +5 +6 +7 +8 = the two digit numebr 3 x
you write the digit x under the tens column and carry the 3

Step 3: Add the 100's digits to get F + G + H + J + K plus the 3 that was carried. If that sum is called w z then this two digit number is written next to the 2 digit number x y already listed under the addition line.

carry the 3

	F 4 *A*	from die 1
	G 5 *B*	from die 2
	H 6 *C*	from die 3
	J 7 *D*	from die 4
+	*K* 8 *E*	from die 5
	w z x y	

The sum of the 100's digits is F +G +H + J +K +the 3 that was carried
Lets say the sum of the 100's digits will be the two digit number w z

F +G +H +J +K +the 3 = the two digit number w z
You write the w z number under the 100's colum and
the final answer is the four digit number w z x y

The answer to the total of the 5 numbers from the five dice is the 4 digit number w z x y

x y is found by adding the numbers in the 1's column.

The second part of the trick states that the last 2 digits of the answer **w z** are found by subtracting the total of the ones digits **x y** from 60. **w z = 60 – x y**

How can we explain that fact?

Proving that **w z** is found by subtracting the sum of the ones digits **x y** from 60.

w z = 60 – x y

The 1's and 100's digits add to the same number on each face of any single die. The 1's and 100's digits add to 10 for each number on die 1. The 1's and 100's digits add to 13 for each number on die 2. The 1's and 100's digits add to 13 for each number on die 3. The 1's and 100's digits add to 12 for each number on die 4. The 1's and 100's digits add to 9 for each number on die 5.

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The faces for the die are written below with the 1's and 100's digits written as variables.

Die 1 has all the The 1's and 100's digits total 10. You cannot tell what combination of digits will be selected but no matter what pair of numbers from die 1 are selected the total of the 100's and 1's digits for die 1 will be F + A and total 10

Die 2 will have one pair of 100's and 1's digits selected. The total of the 100's and 1's digits for die 2 will be G + B and total 13

Die 3 will have one pair of 100's and 1's digits selected. The total of the 100's and 1's digits for die 3 will be H + C and total 13

Die 4 will have one pair of 100's and 1's digits selected. The total of the 100's and 1's digits for die 4 will be J + D and total 13

Die 5 will have one pair of 100's and 1's digits selected. The total of the 100's and 1's digits for die 5 will be K + E and total 9

Die 1	Die 2	Die 3	Die 4	Die 5
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E

Die 1	Die 2	Die 3	Die 4	Die 5
F + A = 10	G + B = 13	H +C = 13	J + D = 12	K + E = 9

Die 1	Die 2	Die 3	Die 4	Die 5
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E
F4A	G5B	H6C	J7D	K8E

Die 1	Die 2	Die 3	Die 4	Die 5
F + A = 10	G + B = 13	H +C = 13	J + D = 12	K + E = 9

The six numbers, 1 from each die are shown below with variables in place of the unknown values for the digits.

carry the 3

$$\begin{array}{rl} & F\ 4\ A \quad \text{from die 1} \\ & G\ 5\ B \quad \text{from die 2} \\ & H\ 6\ C \quad \text{from die 3} \\ & J\ 7\ D \quad \text{from die 4} \\ + & K\ 8\ E \quad \text{from die 5} \\ \hline & w\ z\ x\ y \end{array}$$

the 100's digits total = **w z** The 1's digits total = **x y**

F + G + H + J + K + 3 = **w z** and A + B + C + D + E = **x y** and

Add the left and right sides together

F + G + H + J + K + 3 + A + B + C + D + E = **w z** + **x y**

rearrange the addition to create the 100's and 1' pairs

F + A + G +B + H +C + J +D + K +E + 3 = **w z** + **x y**

Die 1	Die 2	Die 3	Die 4	Die 5
F + A = 10	G + B = 13	H +C = 13	J + D = 12	K + E = 9

substitute in the values for the variables

10 + 13 + 13 + 12 + 9 + 3 = **w z** + **x y**

60 = **w z** + **x y**

w z = 60 – **x y**

Conclusion:

If the first 2 digits of the answer are **x y** then the last 2 digits are 60 – **x y**