

Magic Squares 6

Prime reciprocal magic squares

Take the prime number 7.

The reciprocal of 7 is $\frac{1}{7}$.

Convert this into a decimal with 6 decimal places $\frac{1}{7} = 0.142875$

(do not use any rounding)

If you examine the multiples of $\frac{1}{7}$, you can see that each is a cyclic permutation of these six digits:-

| | | |
|--------------------------|-----------------------|-----------------|
| $\frac{1}{7} = 0.142857$ | You complete these... | $\frac{4}{7} =$ |
| $\frac{2}{7} = 0.285714$ | | $\frac{5}{7} =$ |
| $\frac{3}{7} = 0.428571$ | | $\frac{6}{7} =$ |

Complete the square below using the digits above....

| | | | | | | |
|-------------------------|---|---|---|---|---|---|
| $\frac{1}{7} = 0 \cdot$ | 1 | 4 | 2 | 8 | 5 | 7 |
| $\frac{2}{7} = 0 \cdot$ | 2 | 8 | 5 | 7 | 1 | 4 |
| $\frac{3}{7} = 0 \cdot$ | 4 | 2 | 8 | 5 | 7 | 1 |
| | | | | | | |
| | | | | | | |
| | | | | | | |

Is this a magic square?

It is fairly obvious that the rows all total 27 but less obvious that each column will also do so, and consequently we have a magic square. However, neither diagonal sums to 27.

Not all Prime numbers form magic squares in this way. Try finding the reciprocals of 3 or 5 or 11 and you'll soon see the problem.

But 19 is worth investigating!

