

# Wonderful numbers

Number Day

Friday 7<sup>th</sup> Feb 2020

# Starter

What is the ONLY number, when spelt out in English whose letters are in alphabetical order?

Answer

FORTY

# First course

## “Perfect numbers”

A number is perfect if the sum of all of its proper factors (ie factors excluding itself) is equal to the number itself

The smallest perfect number is 6.

Its proper factors are 1, 2 and 3

$$1 + 2 + 3 = 6$$

# First question

- There is another perfect number between 20 and 30 – can you find it?

# Answer

$$28 = 1 + 2 + 4 + 7 + 14$$

(the next two perfect numbers are 496 and 8128)

# Amuse-bouche between courses

Perfect numbers are bit antisocial – since when you add up their factors you get back to where you started...

Look at this pair:

220 – its factors are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110 – they add to 284

284 – its factors are 1, 2, 4, 71 and 142 – they add up to 220

Pairs of numbers like this (whose proper factors add up to the other one) are called AMICABLE numbers

And you can even get SOCIABLE numbers....

The proper factors of 1264460 add up to 1547860

The proper factors of 1547860 add up to 1727636

The proper factors of 1727636 add up to 1305184

The proper factors of 1305184 add up to 1264460

...and the cycle repeats...

So those 4 numbers form a group of 4 sociable numbers

# Second Course

## Abundant numbers

Numbers whose proper factors add up to MORE than the original number are called ABUNDANT numbers

For example, proper factors of 12 are 1, 2, 3, 4 and 6 and these add up to 16 (which is more than 12).

# Second Question

- Can you find the three other abundant numbers LESS than 25...

# Answer

**18**

$$1 + 2 + 3 + 6 + 9 = 21$$

**20**

$$1 + 2 + 4 + 5 + 10 = 22$$

**24**

$$1 + 2 + 3 + 4 + 6 + 8 + 12 = 36$$

The number of factors of a number can be quite important since if a number has a lot of factors it can be quite useful (and easy to work with).

That's one of the reasons why we have 60 minutes in an hour (60 has 12 different factors) and 360 degrees in a full turn (360 has 24 factors)

# Dessert

What is the smallest number that when you spell it out in English contains the letter “a”?

# Answer

One Hundred and One

## 2<sup>nd</sup> Dessert

What is the smallest number that when you spell it out in English contains the letter “b”?

Answer

One Billion