## SIX IS THE SUM

What do the digits in the number 15 add up to?

How many other numbers have digits with the same total if we only include numbers without zeros?

## SOLUTION

There are 31 solutions below and 32 solutions if you include the number 6.

Two-digit numbers:
15; 24; 33; 42; 51

Three-digit numbers:
114; 123; 132; 141; 213; 222; 231; 312; 321; 411

Four-digit numbers:
1113; 1122; 1131; 1212; 1221; 1311; 2112; 2121; 2211; 3111 ***One thousand one hundred and thirteen etc.***

Five-digit numbers:
11112; 11121; 11211; 12111; 21111 ***Eleven thousand one hundred and twelve etc.***

Six-digit numbers:
111111 ***One hundred and eleven thousand one hundred and eleven.***

# NOTES FOR TEACHERS

## Why do this activity?

This activity allows learners to explore numbers in a new and unusual way. It encourages them to work systematically, and to use different approaches which can then be discussed as a class.

## Intended Learning Objectives (Grade 4)

To develop number sense and problem solving skills. To practice ordering, comparing and representing numbers up to 6 digits and recognizing the place value of digits.

## Possible approach

You could introduce this challenge simply by asking learners to write down a number whose digits add to six, perhaps on a mini-whiteboard. Tell them to keep their number hidden from everyone else and then ask them to consider whether there might be any other numbers whose digits add to six. Give them time to think and write down any others that come to mind.

You can then set up the task and start by inviting learners to compare their numbers with a neighbour. At this stage you may need to clarify whether numbers with a zero can be included or not. Encourage the learners themselves to justify why we should leave out numbers with a zero. Pairs could then work together to find other numbers.

After some time, stop the group and ask how they will know when they have found all the possibilities. Draw on suggestions that focus on finding numbers in a particular order or by using a particular system, and then give more time for paired work. Learners should say the numbers correctly to emphasise place value, for example 111111 is ***One hundred and eleven thousand one hundred and eleven.***
The use of 'twenty seventeen' for the year 2017, though widely accepted, is mathematically incorrect. You could ask learners "What would be the mathematically correct way to say 2017?"

You could encourage pairs to record each number they find on a strip of paper. Then, in the plenary you could attach strips to the board, each displaying a different number. By ordering the numbers the class can then work out whether any are missing. Different learners will have different ways of doing this ordering, so encourage pairs to explain their own way rather than only focusing on one approach.

## Key questions

What numbers have you found?
How did you find these answers?
How do you know that you have found all the numbers?
Can you sort your numbers out into different sets?

## Possible extension

Learners could use a similar systematic approach to try other numbers whose digits have a different sum.

## Possible support

By writing each number on a different piece of paper, learners are not expected to be systematic straight away. Having digit cards might help some learners.

## Reference:

http://nrich.maths.org/230