

A Number Puzzle



By Mike Ollerton

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INTRODUCTION

This puzzle is appropriate for a range of ages of students ... it just depends how far anybody is able to develop it. The puzzle can be an interesting piece of arithmetic or developed algebraically to explain/prove why certain outcomes occur.

MATHEMATICAL CONTENT

- Place value
- Algebra

APPLICABILITY

KS2 – KS5

- Step 1 Write down any three different digits.
- Make all the possible 2-digit number using combinations of these three digits.
 - Sum these 2-digit numbers.
 - Divide your answer by 2.
 - Write down your answer.

- Step 2 Now return to the original three digits that you wrote down at the start. Add these three digits together.

Q1a What do you notice ?

Q1b Why does it happen ?

As students begin see what happens the following extension questions could be posed:

- Q2a Why does this result occur ?
- Q2b Can you prove why it always happens ?
- Q2c Suppose we started with four different digits and repeated steps 1a) and 1b) as before but changed step 1c) what happens now? Again can you explain and prove why it happens?
- Q2d What about using 2-digit values from 5 numbers ?
- Q2e Suppose we started with four different digits and this time made all possible 3-digit numbers and proceeded as before, how will you need to change step 1c) to make the puzzle 'work' ?
- Q2f What about using n -digit values from m digits ?

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Students writing about the work they have done

For homework, ask student to write about this puzzle, in terms of what they did, what they found out and how far they developed it. Their 'audience' to whom they need to explain what they have done could be their teacher, a parent, a younger student or an inspector. The idea of providing them with a sense of audience is so they carefully record and explain what they have been doing. As a learning device the act of writing about mathematics serves to deepen students' understanding.

Assessment of skills which cannot easily be 'tested'

Students' write-ups can form the beginning of a journal or a portfolio of evidence which, over time, can be used to demonstrate how they: i) solve problems, ii) make conjectures, iii) seek generalities, iv) engage with proof and v) how they communicate these broader process skills.