

Investigating Digits

You need: a classmate

ACTIVITY ONE

Kirsty claimed that you can reverse any two-digit number and use subtraction to end up with a difference of 9.

She followed these steps:

- i. Choose any two-digit number where the digits are different, for example, 83.
(Don't choose a number ending in 0.)
- ii. Reverse the digits. (38)
- iii. Subtract the smaller number from the larger number.

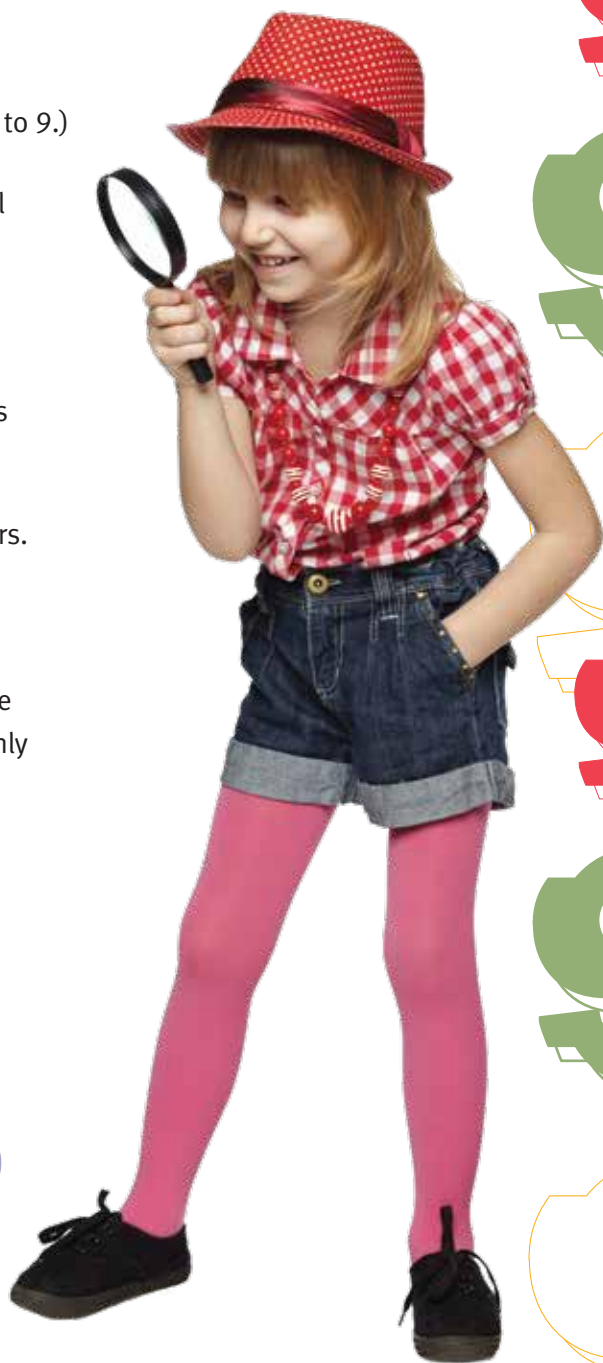
$$83 - 38 = 45$$

- iv. Repeat steps i–iii with your result until you get to 9.

$$54 - 45 = 9$$

(83 takes two subtractions to get to 9.)

1. Try 51. Keep repeating the steps until you get 9 as your result.
How many subtractions did it take?
2. 21 and 12 are a one-subtraction pair.
How many more one-subtraction pairs can you find?
3. Kirsty found seven two-subtraction pairs.
Can you find them all?
4. Kirsty extended her investigation to three-digit numbers. She followed the same steps except that she reversed only the first and last digits.
(For example, with 318, step iii was $813 - 318$.)
What should Kirsty always get after repeating steps i–iii?



$$813 - 318$$

$$874 - 478$$

ACTIVITY TWO

George decided to see what would happen with three-digit numbers if all three digits were rearranged so that the smallest possible number was subtracted from the largest possible number.

Like Kirsty, he did not use any zeros and he did not repeat any digits within a number. Here are his first two tries:

Number: 712

$$721 - 127 = 594$$

$$954 - 459 = 495$$

Number: 869

$$986 - 689 = 297$$

$$972 - 279 = 693$$

$$963 - 369 = 594$$

$$954 - 459 = 495$$

1. George tried these steps with other three-digit numbers and found that he always ended up with 495. He also realised that 495 would always end up as 495 because it would always be rearranged as $954 - 459 = 495$.

Number: 495

$$954 - 459 = 495$$

How many steps are needed for the following numbers?

- a. 123
 - b. 792
 - c. 981
2. With a classmate, find four more five-step numbers. Can you see a pattern?

INVESTIGATION

- a. With your classmate, investigate four-digit numbers (without using zeros or more than one of the same digit in your first number).
- b. What is the four-digit number that will produce itself as the result?



$$973 - 379$$

$$954 - 459$$