

Jo has been experimenting with pairs of two-digit numbers. She has been looking at the difference of their squares.

Jo has collected together some answers which she found quite surprising:

$$55^2 - 45^2 = 1000$$

$$105^2 - 95^2 = 2000$$

$$85^2 - 65^2 = 3000$$

Can you find other pairs which give multiples of 1000? Do you notice anything special about these pairs of numbers?

Jo was also surprised to get these answers:

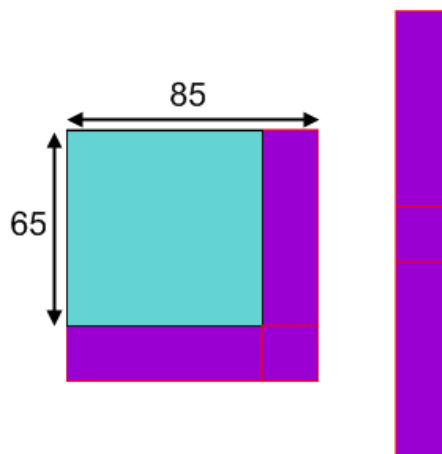
$$89^2 - 12^2 = 7777$$

$$78^2 - 23^2 = 5555$$

$$85^2 - 65^2 = 3000$$

Can you find any other pairs which give repeated digits? Do you notice anything special about these pairs of numbers?

Jo wanted to explain why she was getting these surprising results. She drew some diagrams to help her. Here is the diagram she used to work out $85^2 - 65^2$:



What is the connection between Jo's diagram and the calculation $85^2 - 65^2$? How could Jo work out the area of the long purple rectangle (without a calculator)? Can you draw similar diagrams for Jo's other calculations (or for your own examples)?

How can these diagrams help Jo to develop a quick method for evaluating $a^2 - b^2$ for any values of a and b ?