

Calculator Patterns

Use your calculator to solve the following questions.

Squaring and Multiplying

1 Choose 3 consecutive 2-digit numbers (e.g. 69, 70, 71).

(a) Multiply the first and third numbers.

Answer: _____

(b) Square the middle number.

Answer: _____

(c) What do you notice?

(d) Try some other 2-digit numbers.

(e) Try some 3-digit numbers and 4-digit numbers.

(f) Describe the pattern. Why does this happen?

Cubing, Squaring and Multiplying

2 Choose a 2-digit number (e.g. 47).

- (a) Make a new number by finding the difference between the cube of the tens digit and the cube of the ones digit.

Answer: _____

- (b) Make another new number by adding the square of the tens digit, the square of the ones digit and the product of the tens and ones digits.

Answer: _____

- (c) Divide the first new number by the second new number.

Answer: _____

- (d) Try some other 2-digit numbers.

- (e) What do you notice?

- (f) Investigate what happens if you split a 3-digit number into two parts (there will be two different ways).

- (g) Describe the pattern. Can you explain why this happens?

Calculator Patterns

- 1 (a) 4899
 (b) 4900
 (c) Difference of 1
 (d) Numbers will vary, but difference will always be 1.
 (e) Numbers will vary, but difference will always be 1.
 (f) For consecutive numbers, the product of the number before and the number after is 1 less than the number squared, number^2 .
 The number before is $(\text{number} - 1)$, the number after is $(\text{number} + 1)$.
 $(\text{number} - 1) \times (\text{number} + 1)$
 $= \text{number} \times \text{number} + \text{number} \times 1 - 1 \times \text{number} - 1 \times 1$
 $= \text{number}^2 + \text{number} - \text{number} - 1$
 $= \text{number}^2 - 1$
 No matter what number is chosen, there will always be a difference of 1.
- 2 (a) 279
 (b) 93
 (c) 3
 (d) Try 83
 Difference between 8^3 and 3^3 is 485.
 $8^2 + 3^2 + (8 \times 3) = 97$
 $485 \div 97 = 5$
 (e) Answer is always the difference between the tens and ones digits.
 (f) e.g. 346 is 34 and 6 or 3 and 46.
 Difference is 28 or 43.
 (g) When a 3-digit number is split into two parts, the difference of the cubes of the parts divided by the sum of the squares and the product of the two parts is the same as the difference between the two parts.
 This result is a consequence of the algebraic relationship (that students will learn at secondary level): $a^3 - b^3 = (a - b) \times (a^2 + ab + b^2)$.
 Showing students and asking them to substitute numbers for a and b will allow them to see that it always works – this is what the questions have asked them to do in words.
 Some students may be able to multiply out the brackets part by part in a similar way as the example above:
 $(a - b) \times (a^2 + ab + b^2)$
 $= (a \times a^2) + (a \times ab) + (a \times b^2) - (b \times a^2) - (b \times ab) - (b \times b^2)$
 $= a^3 + a^2b + ab^2 - a^2b - ab^2 - b^3$
 $= a^3 - b^3$