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MATHEMATICAL SCIENCE: MMSC4

LESSON 16

TOPIC: Using general rules to form patterns

UNIT STANDARD: 7448
SPECIFIC OUTCOME: 05

By the end of the lesson, you should be able to:

- Substitute in general rule (formula)
- Describe and generate patterns

INTRODUCTION
In the previous lessons we have learned about:
- Identifying and recognizing patterns and
- devising processes to finding general rule for each pattern,

So, in this lesson we are going to use the general rule to form patterns

Example 1
Using tables and rules to extend patterns

A rule is usually written as a formula.

For example: $y = 2x - 5 \text{ or } Tn = -3n + 4$

This rule or formula can then be used to complete a table in which values are given.
These values are substituted to find the numbers that form the pattern.

For example: Use the rule $y = 2x + 3$ to complete the table:

x	1	2	3	4	5
y					

$y = 2x + 3$ $\qquad\qquad\qquad\qquad y = 2x + 3$
$y = 2x + 3$
$\quad = 2(1) + 3 \qquad\qquad\qquad\quad = 2(2) + 3$
$= 2(3) + 3$
$\quad = 9 \qquad\qquad\qquad\qquad\qquad\quad = 7$

$y = 2x + 3 \qquad\qquad\qquad\qquad\quad y = 2x + 3$
$\quad = 2(4) + 3 \qquad\qquad\qquad\qquad\quad = 2(5) + 3$
$\quad = 11 \qquad\qquad\qquad\qquad\qquad\quad = 13$

x	1	2	3	4	5
y	5	7	9	11	13

OR

$$T_n = -3n + 4$$

So to generate the pattern using the above general rule we have the following,

$$T_1 = -3(1) + 4 = 1$$
$$T_2 = -3(2) + 4 = -2$$
$$T_3 = -3(3) + 4 = -5$$
$$T_4 = -3(4) + 4 = -8$$
$$T_5 = -3(5) + 4 = -11$$

Hence the pattern is as follows:

$$1, -2, -5, -8, -11, \ldots$$

ACTIVITY 1

1.1 The terms in a sequence are given by the rule $T_n = n^2 + 1$, where n is the number of terms in the sequence. Determine the first 3 terms in this pattern by substituting

n = 1, 2 and 3 respectively.

1.2 Give the rule to describe the relationship between the numbers in the sequences below. Use the   rule to give the next three numbers in the sequence:
    (a) 3; 7; 11; 15; _____; _____; _____
    (b) 120; 115; 110; 105; _____; _____
    (c) 2; 4; 8; 16; _____; _____; _____
    (d) 1; 2; 4; 7; 11; 17; _____; _____; _____

1.3 Provide a rule to describe the relationship between the numbers in the sequence below. Use the rule to find the 20th term in this sequence.
                4; 7; 10; 13; ___; ___; ___

1.4 The general rule for a pattern is given by $Tn = 2n + 4$.
    1.4.1 Calculate the value of the 5th term, T5.
    1.4.2 Which term will be equal to 18?

1.5 Write down the first THREE terms of the pattern described by the following words:

   Start with the first prime number and multiply by 6 each time.

ACTIVITY 2

2.1 As before, you and 3 friends are studying for Maths and are sitting together at a square table. A few minutes later 2 other friends arrive so you move another table next to yours. Now 6 people can sit at the table. Another 2 friends also join your group, so you take a third table and add it to the existing tables. Now 8 people can sit together as shown below

2.1.1 Find an expression for the number of people seated at n tables.

2.1.2 Use the general formula to determine how many people can sit around 12 tables.

2.1.3 How many tables are needed to seat 20 people?

2.2 Raymond subscribes to a limited data plan from Vodacell. The limited data plans cost R120 for 1 gigabyte (GB) per month, R135 for 2 GB per month and R150 for 3 GB per month. Assume this pattern continues indefinitely.

2.2.1 Use a table to set up the pattern of the cost of the data plans.

2.2.2 Find the general formula for the sequence.

2.2.3 Use the general formula to determine the cost for a 30 GB data plan.

2.2.4 The cost of an unlimited data plan is R520 per month. Determine the amount of data Raymond would have to use for it to be cheaper for him to sign up for the unlimited plan.

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