LIMPOPO
PROVINCIAL GOVERNMENT
REPUBLIC OF SOUTH AFRICA

DEPARTMENT OF EDUCATION

CAPRICORN SOUTH DISTRICT

MATHEMATICS

GRADE 12

MATHEMATICS: INVESTIGATION
Distribution to Learners: 12/02/2024
Administration Date: 14/02/24

MARKS: 80

INSTRUCTIONS AND INFORMATION

Read the following instructions carefully before answering the questions.

1. This Investigation consists of 5 parts.

2. Answer ALL the questions.

3. Clearly show ALL calculations, diagrams, and etcetera that you have used in determining your answers.

4. ANSWER ONLY will not necessarily be awarded full marks.

5. You may use an approved scientific calculator (non-programmable and non-graphic), unless stated otherwise.

6. Round off to TWO decimal places unless stated otherwise.

7. Number the answers correctly according to the numbering system in this question paper.

8. Write legibly and present your work neatly

INVESTIGATION #1

A sequence is defined by $T_1 = 3$ and $T_{k+1} = T_k + 3$ for $k \geq 1$

   a) Determine the first five terms of the sequence

---   (4)

   b) Show that the difference between any two successive terms is a constant.

---   (4)

   c) Prove that $T_{k+1} - T_k$ is the common difference if $k \in N$

---   (4)

   d) What can you conclude?

---   (2)

INVESTIGATION #2

Consider the arithmetic series $2 + 5 + 8 + 11 + 14 + 20 + \ \dots\dots$ and answer the questions that follows. In this series, we defined $T_1 = S_1 = 2$

1.1)   Determine the values of:

a) T_2 in terms of S_2 and S_1

-- (3)

b) T_3 in terms of S_3 and S_2

-- (3)

c) T_4 in terms of S_4 and S_3

-- (3)

d)   What can you conclude?

-- (2)

1.2)   Identify a relationship between T_n , S_n and S_{n-1} where $n > 1$ and $n \in N$.

-- (4)

INVESTIGATION #3

The sum of the first nth terms of a certain sequence is $S_n = n^2 + 2n$

a) Determine the values of S_1 , S_2 and S_3

---　　(3)

b) Determine the values of T_1 , T_2 and T_3 (the first three terms of the sequence).

---　　(3)

c) Is the sequence arithmetic or Geometric?

---　　(2)

d) Prove your answer in (c).

---　　(2)

INVESTIGATION #4

The sum of the first nth terms of a certain sequence is $S_n = 2^n - 1$

a) Determine the sum of the first five terms.

---   (2)

b) Determine the first five terms.

---   (5)

c) Is the sequence arithmetic or Geometric?

---   (2)

d) Prove your answer in (c).

---   (4)

INVESTIGATION #5

1. The common difference of an arithmetic sequence is 4.

    Prove that $\sqrt{S2n - 2Sn} = 2n$

    -- (6)

2. The sum to n terms of an arithmetic series is:

    $$S_n = \frac{n}{2}(7n + 15)$$

    (a) How many terms of the series must be added to give the sum of 425?

        --- (5)

(b)   Determine the six term of the series.

--- (5)

3. The sum of the first n terms of an arithmetic sequence is given by:

$$S_n = \frac{5}{2}n^2 + \frac{7}{2}n$$

Determine:

(a) T_1 and T_2

--- (6)

(b) The common difference

--- (2)