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ST BENEDICT'S

SUBJECT	Mathematics	PAPER	Sequences and Series
GRADE	12	DATE	8 June 2020
EXAMINER	M.Brown	MARKS	60
NAME		MODERATOR	M.Povall, A.Balzer, C.Botha
TEACHER		DURATION	75 minutes
			RELEASED – ±16:50 (Reading time) START WRITING – 17:00 STOP WRITING – 18:15 SUBMISSIONS CLOSED – 18:45

QUESTION NO	DESCRIPTION	MAXIMUM MARK	ACTUAL MARK
	Section A		
1	Basic Sequences	5	
2	Arithmetic Sequences	5	
3	Geometric Sequences	15	
4	Quadratic Sequences	9	
	<u>Total of Section A</u>	<u>34</u>	
	Section B		
5	Arithmetic and Geometric Sequence combination	13	
6	Geometric Series	13	
	<u>Total of Section B</u>	<u>26</u>	
TOTAL		60	

INSTRUCTIONS:

1. This paper consists of 6 questions and 6 pages.
2. Read the questions carefully.
3. Answer all questions.
4. Number your answers clearly and use the same numbering as in the question paper.
5. You **may use** an approved non-programmable and non-graphical calculator, unless otherwise stated.
6. Round off your answers to two decimal digits, where necessary.
7. All necessary working details must be shown. Answers only, without the relevant calculations will not be given marks. Equations may not be solved solely with a calculator.
8. It is in your interest to write legibly and present your work neatly.

Formulas you may need:

$$T_n = a + (n-1)d$$

$$S_n = \frac{n}{2}[2a + (n-1)d]$$

$$T_n = ar^{n-1}$$

$$S_n = \frac{a(r^n - 1)}{r - 1} ; r \neq 1$$

$$S_\infty = \frac{a}{1 - r} ;$$

QUESTION 1

5 MARKS

- (a) Expand and calculate:

(2)

$$\sum_{n=7}^{11} (3n + 2)$$

- (b) Write down the next two terms of the sequence and the general term.

$$\frac{4}{5} ; \frac{8}{9} ; \frac{12}{13} ; \frac{16}{17} ; \dots$$

(3)

QUESTION 2

5 MARKS

Given the Arithmetic Series: $-7 - 3 + 1 + \dots + 173$

- (a) Determine the number of terms in the series.

(3)

- (b) Hence, rewrite the given series in sigma notation.

(2)

QUESTION 3

15 MARKS

- (a) The first term of a Geometric Sequence is 15, and the second term is 10.

Calculate the tenth term, without the use of a calculator.

(3)

- (b) Determine the value of P, correct to one decimal digit, if:

(4)

$$P = \sum_{n=1}^{13} 3^{n-5}$$

(c) Consider the following geometric sequence: $81p ; 27p^2 ; 9p^3 ; 3p^4 ; \dots$

- (1) Determine the common ratio of the sequence in terms of p . (2)
- (2) For which values of p will the sequence converge? (3)
- (3) Calculate S_{∞} if $p = 2$. (3)

QUESTION 4

9 MARKS

Consider the following sequence:

$41 ; 43 ; 47 ; 53 ; 61 ; 71 ; 83 ; 97 ; 113 ; 131 ; 151 ; 173 ; 197 ; \dots$

This sequence has a constant second difference.

- (a) Determine a formula to represent the n^{th} term. (4)
- (b) An interesting property of this sequence is that the first forty terms are all prime numbers.
Using your formula, calculate T_{41} and show that it is **not** prime. (3)
- (c) Determine the **units**-digit of the $49\,999\,998^{\text{th}}$ term of the sequence. (2)

QUESTION 5

13 MARKS

The following sequence is a combination of an Arithmetic Sequence and a Geometric Sequence:

$$3 ; 3 ; 9 ; 6 ; 15 ; 12 ; \dots$$

- (a) Write down the next two terms. (2)
- (b) Calculate $T_{52} - T_{51}$. (4)
- (c) Calculate S_{24} . (4)
- (d) Prove that ALL the terms of this infinite sequence will be divisible by 3. (3)

QUESTION 6

13 MARKS

- (a) Given: $S_n = 2n^2 + 3n$
Determine the value of the 15th term. (3)
- (b) The first term of a geometric series is $\sqrt{3}$ and the second term is $\sqrt{3} - 1$.
Without the use of a calculator:
- (1) write down, in simplified surd form, the 3rd term of the series.
Show all your working. (3)
- (2) calculate, in its simplest form, the sum to infinity of the series,
showing all working. (3)

- (c) A little frog is 5 metres away from the pond. His first jump is 1,2m and each jump thereafter is three quarters of the distance of the previous jump.



Will he reach the pond or not?

Show all working to motivate your answer.

(4)