FUKIEN SECONDARY SCHOOL S4 First Term Uniform Test (2021-2022) Mathematics Extended Part Module 2 (1 hour 15 minutes)

Date: 12th November 2021 Time: 8:30a.m. - 9:45a.m.

Instructions to students:

- 1. This paper consists of TWO sections, A and B.
- 2. Attempt ALL questions in Section A and Section B.
- 3. Write your answers in the spaces provided.
- 4. Unless otherwise specified, show your workings clearly.
- 5. Unless otherwise specified, numerical answers must be exact.
- 6. The diagrams in this paper are not necessarily drawn to scale.

Section A (27 marks)

1. Solve the equation $C_2^n - C_1^n + C_0^n = C_2^7$, where *n* is a positive integer.

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(4 marks)

2. Expand $(x-3)^5$. Hence, find the constant term in the expansion of $(x-3)^5 \left(x+\frac{2}{x}\right)^3$.

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(5 marks)
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3.	Let $(1 + ax)^n = \sum_{k=0}^n \lambda_k x^k$, where <i>n</i> is a positive integer and <i>a</i> is a constant. It is given	en that $\lambda_1 = -4$
	and $\lambda_2 = -14a$.	
	(a) Find the values of <i>a</i> and <i>n</i> .	
	(b) Find the coefficient of x^3 .	
		(7 marks)

4. Using mathematical induction, prove that

$$2 + \frac{1}{1 \times 4} + \frac{1}{4 \times 7} + \frac{1}{7 \times 10} + \dots + \frac{1}{(3n-2)(3n+1)} = \frac{7n+2}{3n+1}$$
 for all positive integers *n*.

(4 marks)

5. (a) Using mathematical induction, prove that

(b) Using (a), evaluate
$$\sum_{k=4}^{n} (-1)^{k} k = \frac{(-1)^{n} (2n+1)-1}{4}$$
 for all positive integers *n*.
(b) Using (a), evaluate
$$\sum_{k=4}^{555} (-1)^{k+1} k.$$
 (7 marks)

Section B (17 marks)

6. (a) Prove by mathematical induction that

$$2 \times 8 + 3 \times 9 + 4 \times 10 + \dots + (n+1)(n+7) = \frac{(n+1)(n+2)(2n+21)}{6} - 7$$

for all positive integers n.

(b) Hence, evaluate $12 \times 48 + 18 \times 54 + 24 \times 60 + ... + 84 \times 120$.

(8 marks)

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7. (a) Show that

$$(1+ax-2ax^{2})^{n} = 1+anx+\frac{na}{2}[a(n-1)-4]x^{2} + \frac{n(n-1)a^{2}}{6}[a(n-2)-12]x^{3} + \cdots$$

- (b) If the coefficient of x^3 in the expansion of $(1 x + 2x^2)^n$ and $(1 + 2x 4x^2)^n$ are the same,
 - (i) given that n > 1, find n,
 - (ii) find the ratio of the coefficients of x^2 in these two expansions.

(9 marks)