

SEPTEMBER 2022
EMA 111SW
DEVELOPING ALGEBRAIC THINKING
1 HOUR 20 MINUTES

Candidate's Index Number
Signature: <i>Hipniff</i>

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
SCHOOL OF EDUCATIONAL DEVELOPMENT AND OUTREACH
INSTITUTE OF EDUCATION

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME
LEVEL 300, END-OF-FIRST SEMESTER EXAMINATION, SEPTEMBER 2022

9TH SEPTEMBER 2022 DEVELOPING ALGEBRAIC THINKING 2:40 PM - 4:00 PM

SECTION B
(60 Marks)

Answer any THREE questions from this section.

- 1.
- a. Define the following and give one example in each case.
- i. Singleton set [3 marks]
 - ii. Power set [3 marks]
 - iii. Cardinality of a set [3 marks]
- b. Express each of the following as set notation and represent your answer on a number line:
- i. $(-\infty, -1] \cup [1, \infty)$ [4 marks]
 - ii. $(-4, 9] \cap [-2, 11]$ [4 marks]
 - iii. $(-3, 5) \cap (-1, 9)$ [3 marks]
- 2.
- a. The function f and g are defined on the set R , of real numbers by
 $f(x) = x^2 + 1$ and $g(x) = 5 - 3x$.
Find:
- i. $g^{-1}(x)$ [4 marks]
 - ii. the value of x for which $g^{-1}(x) = f(x)$ [5 marks]
- b. If $f(x) = \frac{2x-3}{(x^2-1)(x+2)}$,
- i. find the domain of $f(x)$ [3 marks]
 - ii. express $f(x)$ in partial fractions. [8 marks]

3.

a. The sum of the first and the last terms of a linear sequence (AP) is 42. If the sum of all the terms of the sequence is 420 and the second term is 4, find the

i. number of terms [6 marks]

ii. common difference of the sequence [5 marks]

b. Given that $f \circ g(x) = 2x^2 + 16x + 29$ and $f(x) = 2x^2 - 3$.

i. Determine the function $g(x)$. [6 marks]

ii. Find $g(x - 1)$ [3 marks]

4.

a. Prove by mathematical induction that $1^2 + 2^2 + 3^2 + 4^2 + \dots + n^2 = \frac{1}{6}n(n+1)(2n+1)$, for all natural numbers. [12 marks]

b. Solve $|5 - \frac{x}{3}| < 11$ and illustrate your answer on the number line. [8 marks]

5.

a. The terms of an exponential sequence are $\frac{1}{3}, \frac{1}{12}, \frac{1}{48}, \dots$

Show that the

i. n th term of this sequence is $\frac{1}{3}(4^{1-n})$ [6 marks]

ii. sum of the first n terms this sequence is $\frac{4}{9}\{1 - (\frac{1}{4})^n\}$ [6 marks]

b. Find the sum of each of the following sequences

a) $\sum_{k=1}^5 (3k)$ [3 marks]

b) $\sum_{k=6}^{20} (4k^2)$ [5 marks]