

APRIL 2021  
EMA 402SW  
TEACHING PROBLEM SOLVING IN  
MATHEMATICS  
2 HOURS

Candidate's Index Number
IE/MAT/KBI/15/0324
Signature:

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

FIVE-SEMESTER BACHELOR OF EDUCATION (SANDWICH) PROGRAMME  
SECOND YEAR, END-OF-THIRD SEMESTER EXAMINATION, APRIL 2021

APRIL 29, 2021

TEACHING PROBLEM SOLVING IN  
MATHEMATICS

2:00 PM - 2:40 PM

This paper consists of two sections, A and B. Answer ALL the questions in Section A and TWO questions from Section B. Section A will be collected after the first 40 minutes.

SECTION A  
(40 marks)

Answer ALL the questions in this Section.

1. Identify two benefits students derive when they engage their teachers and mates in discussion in the mathematics classroom. [2 marks]
2. Explain two reasons why as a prospective mathematics educator you would advocate for mathematics to be taught *through problem solving*. [6 marks]
3. Distinguish between *heuristics* and *strategy* in problem solving. [4 marks]
4. When the famous German mathematician Carl Fredrich Gauss was a child, his teacher required the students to find sum of the first 100 natural numbers. The teacher expected this problem to keep the class occupied for some time. Gauss gave the answer almost immediately. Using Polya's model, explain how he went about solving the problem. [8 marks]
5. Outline the steps involved in the *Six-Step* problem solving model. [6 marks]
6. Outline two traits possessed by good problem solvers. [2 marks]
7. Explain two principles that would guide you as a prospective mathematics teacher to teach your students how to solve problems. [6 marks]
8. Arrange the numbers 1, 2, 3, 4, 5, 6, 7, 8 and 9 in a *three-by-three square* such that any row, column and diagonal have the same sum of 15. [6 marks]

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1 HOUR 20 MINUTES

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2:40 PM - 4:00 PM

SECTION B  
[60 MARKS]

Answer any THREE questions from this section. Each question carries 20 marks.

- 1.
- a. Prove by mathematical induction that the numbers of the form  $8^n + 6$  are divisible by 14 for all natural numbers  $n$ . [6 marks]
- b. One-fourth of a herd of camels was seen in the desert. Twice the square root of that herd had gone to the mountain slopes. After these 15 camels still remained at a riverbank located in the desert. What is the numerical measure of that herd of camels? [12 marks]
- c. An array of nine dots is arranged in a  $3 \times 3$  square, as shown in figure below. Join all the dots with exactly four straight lines if you are not allowed to pick up your pencil from the paper and not tracing over a line that has already been drawn. [2 Marks]



Figure 1

177

2. a. Write the numbers 1 through 7, one in each hexagon below, so that all three lines across the middle add up to a total of 12. [6 marks]



- b. A man put a pair of rabbits in a cage. During the first month the rabbits produced no offspring, but each month thereafter produced one new pair of rabbits. If each new pair thus produced reproduces in the same manner, how many pairs of rabbits will there be at the end of one year? [9 marks]
- c. A teenager's age is increased by 2 gives a perfect square. Her age decreased by 10 gives the square root of that perfect. She is 5 years older than the brother. How old is her brother? [5 marks]
3. a. Consider the series,  $(1) + (2 + 3) + (4 + 5 + 6) + (7 + 8 + 9 + 10) + (11 + 12 + 13 + 14 + 15) + \dots$ . Find an expression for the  $r^{\text{th}}$  term in the  $r^{\text{th}}$  bracket [10 marks]
- b. A cat chases a mouse, which has a 160-meter head start. For every 7 meters the mouse runs, the cat runs 9 meters. How far must the cat run to catch the mouse? [10 marks]

4. a. What is the main idea in *VDW*? [2 marks]
- b. i. Identify the phases of the *three-part lesson format* for teaching through problem solving as proposed by Van de Walle. [3 marks]
- ii. Provide **three** likely agendas for the mathematics teacher in each of these phases in b(i). [6 marks]
- iii. Explain what the teacher actions must be for the effective implementation of each of these agendas. [9 marks]

5. a. Use Mason's three phases of problem solving to solve the task below showing clearly all necessary actions taken in each of the stages:

*A census taker comes to the house of a mathematician and asks how many children he has and what their ages are. The mathematician replies that he has three children and the product of their ages is 72. The census taker replies that he has not been given enough information to determine their ages. The mathematician adds that the sum of their ages is the same as his gate number. The census taker leaves to check the gate number but returns shortly to say that he still does not have enough information. The mathematician thinks and says the oldest one*



likes chocolate ice cream. The census taker replies that he now has enough information and leaves. What are the ages of the three children?

- i. What are the ages of the three children?
- ii. State the strategy you used.

[8 Marks]

[2 Marks]

- b. Use Polya's four phases of problem solving to solve the task below showing clearly all necessary actions taken in each of the stages:

*Mary has a special package for large groups to attend their amusement park: an admission fee of GH¢20.00 per group and an additional fee of GH¢6.00 per person. Using George Polya's four principles of problem solving, if a club has GH¢100.00 to spend at the park, determine:*

- i. *the maximum number of people who can attend.*
- ii. *problem solving strategy you employed in arriving at your answer in i above?*

[8 Marks]

[2 marks]