Republic of the Philippines
Department of Education
Cordillera Administrative Region

September 1, 2020

REGIONAL MEMORANDUM
NO. 266 , 2020

To: OIC-Assistant Regional Director
Regional Office Division Chiefs
Schools Division Superintendents
Public & Private Elementary & Secondary School Heads
All Others Concerned

2020 MATHEMATICAL INVESTIGATION COMPETITION

1. The DepEd CAR, through the Curriculum and Learning Management Division, will be conducting the 2020 Mathematical Investigation Competition with the theme, ***"Providing Quality, Accessible, Relevant, and Liberating Mathematics Education for All in the New Normal."***

2. The activity intends to:
   a. facilitate the integration of learning outcomes in Mathematics and across curriculum areas within the Basic Education K-to-12 curriculum.
   b. provide learners with the opportunity to discover the practical applications of Mathematics.
   c. develop Mathematics learner research and communication skills.
   d. support independent and collaborative learning.

3. The following are the activities and important dates relative to the competition:

Activities	Dates
Conduct of Mathematical Investigation Activities	September 1, 2020 to October 15, 2020
Online Orientation of SDO Education Program Supervisors for Mathematics	September 4, 2020
Online Training of Grade 4-6 Teachers on Mathematical Investigations	September 8-10, 2020
Due date of online submission of entries at the Division Office	October 16, 2020
Division Judging of MI	October 19-23, 2020
Due date of online submission of entries at the Regional Office	October 30, 2020
Regional Judging of MI	November 2-6, 2020
Virtual Awards Ceremony	November 13, 2020

4. The competition is open to all grades 4 to 12 learners from both public and private schools in DepEd CAR. There are two entry categories for the competition per key stage: Individual and Group (with 2 or 3 members). For group category, members are encouraged to collaborate through online.
5. The following are the number of entries for submission at the regional office per key stage.

Key Stage	Category	
	Individual	Group
Key Stage 2: Grades 4 to 6	1 entry per SDO	1 entry per SDO
Key Stage 3: Grades 7 to 10	1 entry per SDO	1 entry per SDO
Key Stage 4: Grades 11 to 12	1 entry per SDO	1 entry per SDO

6. The SDOs shall conduct their own competition for mathematical investigation per key stage. Only the first-place winner in each category per key stage at the SDO level shall advance to the regional level.

7. For the guidelines in the conduct of mathematical investigation, please read enclosure 1 *(Mathematical Investigation Activity Guidelines).* All entries not conforming with the guidelines shall be automatically eliminated from the competition.

8. The submission of entries at the regional office shall be done online. All entries shall be sent through email: depedcar.matheducation@gmail.com. The manuscript shall be in PDF format with the following filename format: MI_Key Stage_Division_Surname of student for individual or Surname of one of the students, et al. (for group).

   Ex: MI_2_Abra_Dela Cruz (Individual Category)
   MI_2_Abra_Santa Cruz, et al. (Group Category)

9. There will be three regional winners in each category per key stage: first place, second place, and third place. The winning entries will be receiving certificates of recognition and medals.

10. Expenses relative to the conduct of the activity shall be charged against Regional Office/ Division/ School MOOE and/ or other local sources subject to the usual budgeting, procurement, accounting and auditing rules and regulations.

11. For inquiries, please contact Curriculum and Learning Management Division (CLMD), attention: Mr. Bryan A. Hidalgo at CP No.: 0920-223-2514 or landline No.: (074) 422-7096.

12. Immediate dissemination of and strict compliance with this Memorandum is directed.

MAY B. ECLAR, PhD, CESO V
Regional Director

CLMD/CFM/bah

Enclosure 1

MATHEMATICAL INVESTIGATION ACTIVITY GUIDELINES

I. Introduction

Doing mathematical investigation project is a very relevant task that must be required among students of mathematics at any level. It could be used as an authentic assessment. It provides opportunity for students to extend what they have learned to different mathematical contexts.

In doing mathematical investigations, students are expected to demonstrate at a certain degree the skills that are necessary when conducting the investigation. These skills are the bases in assessing mathematical investigation manuscripts. These skills are using appropriate notation and terminology, organizing and presenting information in tabular or graphical forms, recognizing patterns and structures in different mathematical situations, making conjectures or generalizations, demonstrating an understanding and appropriate use of mathematical models, recognizing and demonstrating an understanding of practical applications of mathematics, and using appropriate mathematical tools (International Baccalaureate Organization, 2004).

There are significant reasons why teachers need to use mathematical investigation in their mathematics classrooms. When students are involved in mathematical investigation, they become more imaginative and inquisitive (Flewelling & Higginson, 2005, as cited in Hidalgo, 2018). Grouws and Cebulla (2000), as cited in Hidalgo (2018), state that when students are given time to do mathematical investigation and to discover mathematical concepts and make their own procedures, they have better understanding of mathematical concepts and the relationships of these concepts. Also, Diezmann (2005), as cited in Hidalgo (2018), asserts that rich learning opportunities are rooted in the engagement of students in challenging task.

II. Stages of Mathematical Investigation

When conducting investigation, some processes must be considered to ensure that the investigation proceeds in a logical manner. **Figure 1** presents the different stages that a student should go through to start an investigation.

Stage 1: Attaining familiarity with the mathematical situation

In this stage, the student examines the mathematical situation to identify areas that are not yet investigated by reading related literatures. The focus of the investigation should be on the areas that are not yet investigated because the main purpose of conducting investigation is to add up to the existing body of knowledge about the mathematical situation.

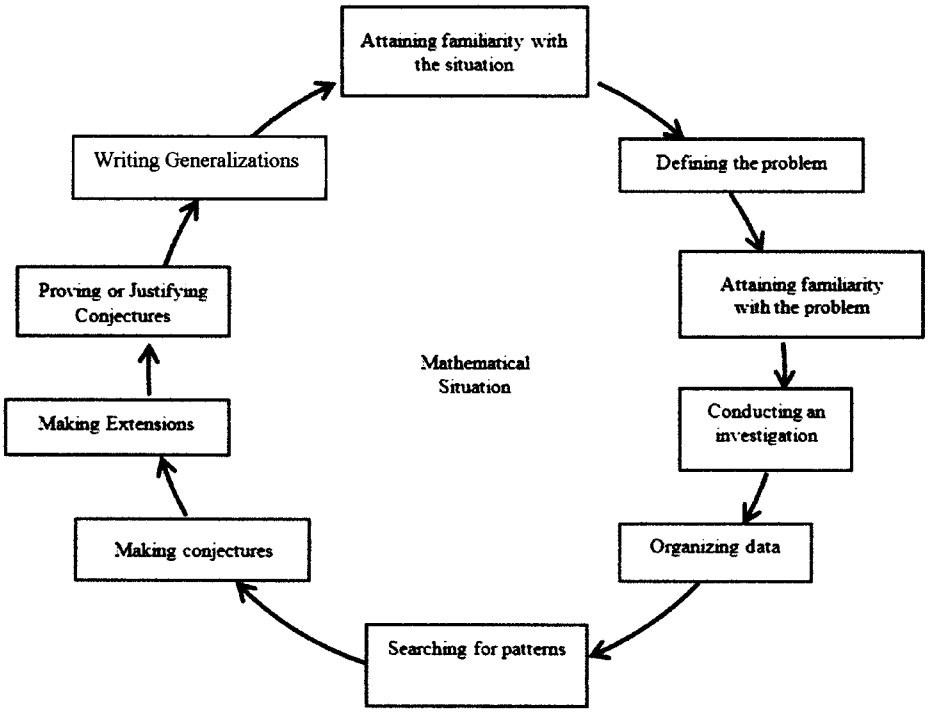

Figure 1

Stage 2: Defining the problem

After identifying the focus of investigation, the student should identify the purpose of the investigation. Again, reading the literatures helps the student to trim down the topics for investigation. Once the purpose of the investigation is identified, the student should express this purpose into specific problems that serve as the focus of investigation.

A clear statement of the problem guides the student in choosing later the approach to take in conducting the investigation.

Stage 3: Attaining familiarity with the problem

To attain familiarity with the problem, the student gathers relevant information about it. In this stage, the student is required to scan the literature to establish a better understanding of the problem. Mathematical concepts related to the topics are reviewed. All aspects of the topic should be known to the student. Talking to experts is another way of familiarizing one's self about the problem. This is a critical stage because the student cannot proceed to the next stage of investigation unless he has a full grasp of the problem. The success of the investigation depends on how he understands, and processes gathered information about the topic.

Stage 4: Conducting the investigation

To conduct the investigation, the student needs to identify the approach he should use. The student should be clear of the end goal of the investigation. Several approaches or paths should be considered to exhaust all possible outcomes and relevant data about the problem.

Simulation and conducting experiments are important strategies in investigation. They provide the necessary experiences that the student needs in order to understand the area of the mathematical situation being investigated.

Stage 5: Organizing the data

To understand the data, they should be organized through visual representations like graphs or tables. The data should be organized to allow the student to make correct interpretations, establish connections among data and concepts, and search for patterns.

Stage 6: Searching for patterns

After the data are organized into tables or visual representations, the student needs to search for patterns. A pattern is a consistent or recurring characteristic of the data that is observed after presenting them in tables or using visual representations. The pattern is used as an indicator or model for predicting future behavior of the phenomenon or problem. Thus, the student should be keen enough to observe a pattern.

Stage 7: Making conjectures

Based on the patterns observed, the student should be able to write generalizations. This can be done by trying several cases or continuing the process using the pattern observed to check if the pattern holds true for other cases. Because these generalizations are results of observations and their validity is not yet known, then they are called conjectures.

Stage 8: Making extensions

Under this step, the conjecture is being tested with other cases to determine if the observation is consistent with these cases. The student must be able to identify the cases which the conjecture holds true and not true. The purpose of making extension is to determine a more generalizing statement that captures all outcomes in a broader context.

Stage 9: Proving or Justifying the conjectures

After making conjectures, there is a need to proving these conjectures. A proof is a logical argument that establishes the validity of a statement to convince a doubtful reader that a given statement is true. When proving the validity of a conjecture, the student must be able to identify the most appropriate method of proof.

Stage 10: Writing Generalizations

The last step is to summarize the results of the investigation. In stating the results, the variables used in the statement should be defined properly. This allows the reader to have the same understanding of the variables used in the theorems.

III. Assessing Mathematical Investigation Outputs

The following criteria will be used to assess the mathematical investigation manuscript. These criteria were adapted from the National MTQ Rubric 2020.

Achievement Levels	Descriptors
4	Exceeds expectations of student's learning level
3	Meets expectations of student's learning level
2	Approaches expectations of student's learning level
1	Does not meet expectations of student's learning level
0	Not evident

Criteria	Indicators	Achievement Level
Mathematical Concept and Understanding	1. Investigates detailed mathematical content and concepts that are thought-provoking and challenge the student.	
	2. Completes a mathematical investigation that thoroughly examines all aspects of the subject.	
	3. Recognizes and makes relevant high-level mathematical connections with everyday experiences in and out of school.	
	4. Uses correct mathematical language, symbols and terminology.	

Mathematical Process	5. Uses correct and efficient strategies to achieve a solution. Monitors strategies and progress and/or considers alternative strategies as needed.	
	6. Consistently uses accurate mathematics and systematic reasoning to make decisions and reach conclusions.	
Presentation and Originality	7. A highly original investigation that displays evidence of student's personal ideas as well as other relevant information and resources.	
	8. A range of references together with acknowledgement of support (including the internet, teachers, parents, etc).	
Coherence	9. The investigation has explicit aims, a thorough plan and clearly stated generalizations.	
	10. Explanations are very clear and effectively detailed. Analyzes how and why solutions or generalizations are reached.	
	11. Presentation is very well-organized and captures the reader's interest.	
	Total Score (Maximum of 44 points)	

IV. Mathematical Investigation Manuscript

A. Elements

The following shall be the main parts of the mathematical investigation manuscript.

I. Endorsement from the SDO

II. Entry Form *(See attached document)*

III. Declaration of Anti-Plagiarism *(See attached document)*

IV. Title Page

V. Table of Contents

VI. Mathematical Situation
- Attaining familiarity with the mathematical situation

VII. Statement of the Problem
- Defining the problem
- Attaining familiarity with the problem

VIII. Investigation Proper
- Conducting the investigation
- Organizing the data

- Searching for patterns

IX. Statement and Justification of Conjectures
- Making conjectures
- Proving or justifying conjectures
- Making extensions

X. Summary of Results
- Writing generalizations

XI. References
- APA format

XII. Appendices

B. Typography

Font Style: Arial
Font size (text and headings): 12 pt. (key stage 2)/11 pt. (key stages 3-4)
Text alignment: Left
Paper size: A4
Margin: 1 inch in all sides
Spacing between lines of text: 1.0
Spacing between paragraphs and headings: 2.0
Page numbering: Right bottom of page

V. References

Hidalgo, B. (2018). *A simplified Guide in Doing Mathematical Investigation.* Manila, Philippines: Aklat at Dunong Publishing, Inc.

International Baccalaureate Organization (2004). *Teacher training workshop guide for Mathematics HL.*

Maths Talent Quest (2020). National MTQ Rubric 2020. Retrieved from https://www.mansw.nsw.edu.au/documents/item/393.

Republic of the Philippines

Department of Education

CORDILLERA ADMINISTRATIVE REGION

2020 Mathematical Investigation Activity – Entry Form

School Name: _____

Division: _____

Key Stage: ☐ Gr. 4-6 (KS-2) ☐ Gr. 7-10 (KS-3) ☐ Gr. 11-12 (KS-4)

Entry Category: ☐ Individual ☐ Group

MI Title: _____

_____

_____

Individual or Group Entry: (For group entry, 2 or 3 members only)

Surname, Given Name, MI	Contact No.	Email Address

Coach Information: (One coach per entry)

Surname, Given Name, MI	Contact No.	Email Address

Note: Please ensure that the spelling of student and coach names are correct so that certificates are error free.

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DECLARATION OF ANTI-PLAGIARISM

1. I/We, Name of Proponent/s, understand that plagiarism is the act of taking and using another's ideas and works and passing them off as one's own. This includes explicitly copying the whole work of another person and/or using some parts of their work without proper acknowledgment and referencing.

2. I/We hereby attest to the originality of this mathematical investigation manuscript and have cited properly all the references used. I/We shall use appropriate citations in referencing other works from various sources.

3. I/We understand that violation from this declaration and commitment shall be subject to consequences (disqualification from the competition, etc.) and shall be dealt with accordingly by the Department of Education Cordillera Administrative Region.

_____
Proponent Name and Signature

DATE: _____

_____
Proponent Name and Signature

DATE: _____

_____
Proponent Name and Signature

DATE: _____