

Republic of the Philippines
 Department of Education
NATIONAL CAPITAL REGION
 Misamis Street, Bago-Bantay, Quezon City

UNIFIED SUPPLEMENTARY LEARNING MATERIALS GRADE 8 - MATHEMATICS



MATHEMATICS

Development & Editorial Team

Writer and Illustrator:	Joenelle J. Sandagon
Layout Artists:	Joel J. Estudillo
Content Editors:	Editha B. Cajilig, Dominador J. Villafria, Olive R. Lomibao, Melody F. Grimaldo, Lorna M. Elemento, and Marites M. Bendoy
Language Editors:	Jose B. Ballovar
Management Team:	Dr. Malcom S. Garma, Regional Director - NCR Dr. Sheryll T. Gayola, SDS SDO-Marikina City Dr. Genia V. Santos, CLMD Chief - NCR Dr. Elisa O. Cerveza, CID Chief SDO-Marikina City Dennis M. Mendoza, LR EPS - NCR SDO EPS, Dominador J. Villafria Ivy Coney A. Gamatero, LR EPS SDO-Marikina City Nancy C. Mabunga, Librarian - NCR Menere R. Nasiad, PDO SDO-Marikina City Catherine C. Paningbatan, Librarian SDO-Marikina City

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Expectation

In this module, Grade 8 learners are expected to:

- illustrate and define a mathematical system; **M8GE-IIIa-40.1**
- discuss parts of mathematical system. **M8GE-IIIa-40.2**
- illustrate the need for an axiomatic structure of a mathematical system in general, postulates; and theorems. **M8GE-IIIa-c1**

The students have understood the lesson if they can demonstrate the following needed skills to:

1. illustrate and define a mathematical system;
2. differentiate the four components of a mathematical system;
3. identify and differentiate postulates and theorems;
4. create statements that illustrate or describe the four components of a mathematical system.

Pre-Test

Encircle the letter of the correct answer.

1. Which system or structure consists of both defined and undefined terms, axioms or postulates, and theorems?
A. mathematical system C. scientific system
B. organized system D. systematical system
2. Which of the following does **not** belong to the group?
A. defined terms B. diagrams C. postulates D. undefined terms
3. What component of a mathematical system consists of a point, a line, and a plane?
A. defined terms B. postulates C. theorems D. undefined terms
4. What component of a mathematical system includes a category or has definition such as a ray and an angle?
A. defined terms B. postulates C. theorems D. undefined terms
5. Which of the terms are assumed to be true without proof?
A. defined terms B. postulates C. theorems D. undefined terms
6. Which of the terms is proven from definitions, postulates, or using operations and facts that were already known?
A. defined terms B. postulates C. theorems D. undefined terms
7. Which of the following does not illustrate an undefined term?
A. stars in the sky C. like the edge of a blackboard
B. flat surface of a table D. office chair

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For items 8 – 10, read the text below and answer the following questions.

Marikina is known as the Shoe Capital of the Philippines since 1956 because of its notable shoe industry and by virtue of R.A. 650 better known as Import Control Law. Currently, Marikinaians also struggle from COVID-19. At the beginning of the year, some said that the virus would not spread with warm weather. Almost 80 percent of Marikina's shoe enterprises have ceased operations due to COVID-19. Nevertheless, Marikina remains hopefully strong and consistently confident in running its shoe industry for the remaining 20 percent through digital platforms like online selling. Source: <http://www.artesdelasfilipinas.com/archives/160/the-history-of-marikina-s-shoe-industry>

8. Which of the following statements illustrates a postulate?
- A. Marikina is known as the Shoe Capital of the Philippines since 1956 because of its notable shoe industry and by virtue of R.A. 650 better known as Import Control Law.
 - B. Almost 80 percent of Marikina's shoe enterprises have ceased operations due to COVID – 19.
 - C. Some said that the virus would not spread with warm weather.
 - D. Currently, people also struggle from and fight against COVID-19.
9. Which of the following statements illustrate a theorem?
- A. Marikina is known as the Shoe Capital of the Philippines since 1956 because of its notable shoe industry and by virtue of R.A. 650 better known as Import Control Law.
 - B. Marikina remains hopefully strong and consistently confident in running its shoe industry for the remaining 20 percent through digital platforms like online selling.
 - C. Some said that the virus would not spread through warm weather.
 - D. Currently, people struggle against COVID-19.
10. Which of the following statements illustrates a defined term(s)?
- A. Marikina is known as the Shoe Capital of the Philippines since 1956 because of its notable shoe industry and by virtue of R.A. 650 better known as Import Control Law.
 - B. Marikina remains hopefully strong and consistently confident in running its shoe industry for the remaining 20 percent through digital platforms like online selling.
 - C. Some said that the virus would not spread with warm weather.
 - D. Currently, people also struggle from and fight against COVID-19.
11. What property is illustrated in: "If $x = y$, then $y = x$ ".
- A. distributive
 - B. reflexive
 - C. symmetric
 - D. transitive
12. Which of the following statements is true?
- A. If $\angle x$ has a measure of 60° , then $\angle x$ is right.
 - B. If $\angle x$ has a measure of 90° , then $\angle x$ is acute.
 - C. If $\angle x$ has a measure of 120° , then $\angle x$ is obtuse.
 - D. If $\angle x$ has a measure of 190° , then $\angle x$ is obtuse.
13. What property justifies the given conclusion?
- Given: $x = y$, $y = z$
Conclusion: $x = z$
- A. addition property
 - B. division property
 - C. reflexive
 - D. transitive
14. What will be the result when the distributive property is applied in $5(x - y)$?
- A. $5x - y$
 - B. $5x - 5y$
 - C. $x - 5y$
 - D. $5 - x - y$

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15. Which of the following is not a postulate?

- A. A line contains at least two points.
- B. Through any two points, there is exactly one line.
- C. A plane contains at least three points that are non collinear.
- D. If two lines intersect, then their intersection is exactly one point.

Looking Back

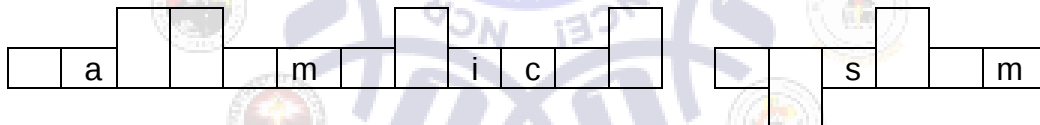
A. Fill in **each** blank with the correct word to make **each** statement meaningfully correct. Choose the appropriate word from the given box.

recognized	angles	stars	myth	sides
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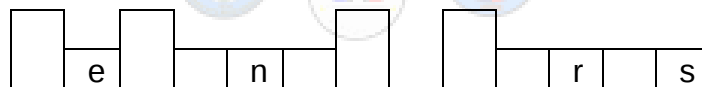
- The _____ at the night sky are like dots as seen by our naked eye.
- A square is a rectangle that has four right _____.
- There's a _____ that says "Marikina" was first named as "*Marikit ka na*" because of a story about a lovely maiden whose name is Marikit.
- Jesús de la Peña Chapel is the oldest church in Marikina wherein the first Catholic Mass was held on April 16, 1630. This historical event was _____ by the National Historical Commission of the Philippines.

B. Fill in the boxes with the correct letters to decode the words/phrase being described.

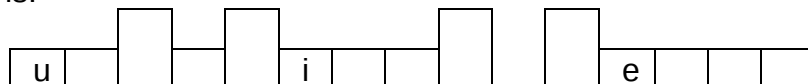
- It is a system or structure that consists of defined and undefined terms, axioms or postulates, and theorems.



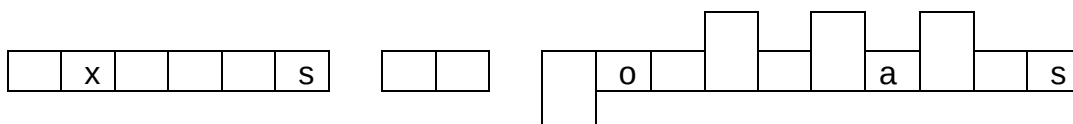
- These are terms that includes a category or formed using other defined words or terms.



- These are terms that can only be explained using representations and/or descriptions.



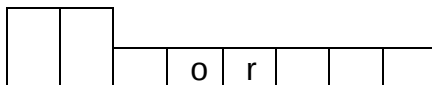
- These are statements that assumed or accepted to be true without proof.



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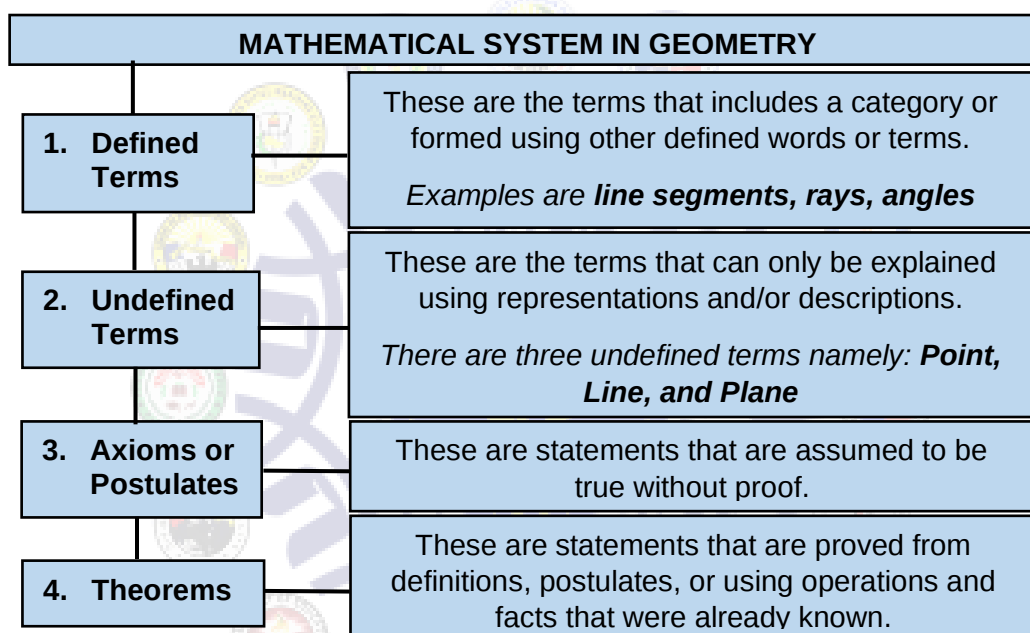
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5. These are statements that were proven to be true using other definitions, postulates, using operations or facts that were already known.



Brief Introduction

A **mathematical system** is a structure that consists of defined and undefined terms, axioms or postulates, and theorems. There are four components of a mathematical system. Study the chart below.



Mathematical system can be illustrated in different ways in which we somehow experienced or could also be applied to our daily lives. Below are some examples for each of the components of the mathematical system.

A. Defined Terms - statements, group of words, or phrases that formed using other defined words or terms. Here are some examples:

1. A square is a rectangle with four equal sides.
2. Never give up. There is always a ray of hope that exists, you just need to start from where you are right now and move forward to your success.

B. Undefined Terms – statements, group of words, or phrases that illustrates, describes or suggests a point, a line, or a plane. Here are some examples:

1. The stars at the night sky are like dots as seen by our naked eye.
2. At train stations, people need to obey rules such as no standing beyond the yellow lines while waiting for the train to come for safety purposes.

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C. Axioms or Postulates - statements, group of words, or phrases that suggest opinions or personal point of view without any proof or evidence that they were true. Here are some examples:

1. There's a myth or a saying that says "Marikina" was first named as "Marikit ka na" because of a story about a lovely maiden whose name is Marikit.
2. The clouds are a little bit dark; I think it will rain soon.

Postulates are automatically accepted as true and valid as most of the time they state the obvious. Most often used postulates in Geometry are the axioms or properties of equality.

Distributive Property

$$(a)(b + c) = (a)(b) + (a)(c)$$

Addition Property of Equality

$$\text{If } a = b \text{ and } c = d, \text{ then } a + c = b + d$$

Reflexive Property

$$a = a, \text{ anything is equal to itself}$$

Subtraction Property of Equality

$$\text{If } a = b \text{ and } c = d, \text{ then } a - c = b - d$$

Symmetric Property

$$\text{If } a = b, \text{ then } b = a$$

Multiplication Property of Equality

$$\text{If } a = b, \text{ then } (a)(c) = (b)(c)$$

Transitive Property

$$\text{If } a = b \text{ and } b = c, \text{ then } a = c$$

Division Property of Equality

$$\text{If } a = b \text{ and } c \neq 0, \text{ then } a/c = b/c$$

Substitution Property of Equality

$$\text{If } a = b, \text{ then } (a) \text{ may be replaced by } (b)$$

D. Theorems - statements, group of words, or phrases proved to be true through facts that were already known. It required proof to be accepted. Here are some examples:

1. Jesús de la Peña Chapel is the oldest church in Marikina wherein the first Catholic Mass was held on April 16, 1630. This historical event was acknowledged by the National Historical Commission of the Philippines.
2. Typhoon Ondoy is one of the most disastrous typhoons ever recorded in the Philippines especially in Marikina. It generated a total of 455 mm of rain over a 24-hour period based on the measurement of PAGASA Science Garden in Quezon City.

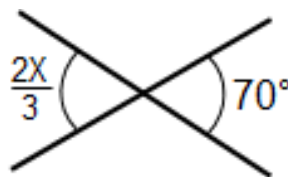
In Geometry, theorems are used to prove other theorems and applied in solving different problems.

Example: Using the Vertical Angles Theorem

Find the value of X in the diagram
Using the **Vertical Angles Theorem**

We can write down, $\frac{2x}{3} = 70^\circ$

$$\begin{aligned} \text{Solving:} \quad & \frac{3(2x)}{3} = \frac{(70)3}{3} \\ & \frac{2x}{2} = \frac{210}{2} \\ & x = 105 \end{aligned}$$



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In later modules you will learn about and also prove theorems such as the AAS Congruence Theorem and other Triangle Congruence Theorems.

Proof is a logical argument in which each statement is supported or justified by given information, definitions, axioms, postulates, theorems and previously proven statements. Proofs can be written in different ways; a commonly used form is the two-column form.

Two - Column Proof – listing down proof in two columns of Statements and Reasons

Example:

Given: $4(2x + 3) + 4 = 8$

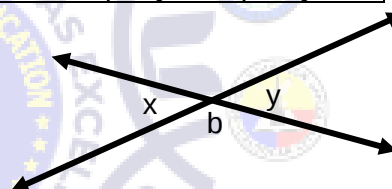
Prove: $x = -1$

Statement	Reason
$4(2x + 3) + 4 = 8$	Given
$8x + 12 + 4 = 8$	Distributive Property
$8x + 16 = 8$	Combine similar terms
$8x + 16 + -16 = 8 + -16$	Addition Property of Equality
$8x + 0 = -8$	Additive Inverse Property
$8x = -8$	Subtraction Property of Equality
$x = -1$	Multiplication Property of Equality

Two - Column Proof – Vertical Angles Theorem

Given: $\angle x$ and $\angle y$ are vertical angles.

Prove: $\angle x \cong \angle y$



Statement	Reason
1. $\angle x$ and $\angle y$ are vertical angles	Given
2. $\angle x$ and $\angle b$ are supplementary $\angle y$ and $\angle b$ are supplementary	Definition of a Linear Pair
3. $m\angle x + m\angle b = 180^\circ$ $m\angle y + m\angle b = 180^\circ$	Definition of Supplementary Angles
4. $m\angle x + m\angle b = m\angle y + m\angle b$	Transitive Property
5. $m\angle x = m\angle y$	Subtraction Property of Equality
6. $\angle x \cong \angle y$	Definition of Congruent Angles

Activities

Activity 1

- A. Underline the statement, group of words, or phrases that talk about or describe a component of a mathematical system.
- In my opinion, COVID-19 virus will have vanished by the end of this year.
 - In every establishment, you need to follow the line as the mark or measure to practice social distancing.
 - Doctors keep reminding individuals that proper and frequent handwashing is one of the best ways to protect yourself and your family from getting sick or ill.

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4. The movement of the hands of a clock shows different measurements of different angles.
 5. Eating more vegetables and fruits may improve mental health in two weeks, according to study.
- B. Based on your answers above, identify which component is being illustrated or described as undefined term, axiom or postulate.
1. _____
 2. _____
 3. _____
 4. _____
 5. _____

Activity 2

Write the property applied in each statement on the space provided.

1. If $a + b = 7$, then $a + b - 7 = 0$.

2. If $\angle a = \angle a$, then $\angle a$ is equal to $\angle a$.

3. If $2 = x$ and $x = y + 3$, then $2 = y + 3$.

4. If $x + y = z$ and $z + 3 = m$, then $(x + y) + 3 = m$.

5. If $4xy = 12x$, then, $y = 3$.

Remember

Fill in each blank with the appropriate word or phrase to make each given statement meaningfully correct.

1. A _____ is a structure that consists of defined and undefined terms, axioms or postulates, and theorems.
2. Statements that are assumed to be true without proof are called _____.
3. Statements that are proved from definitions, postulates, or using operations and facts that were already known are called _____.
4. Terms that include a category or formed using other defined words or terms are called _____.
5. Terms that can only be explained using representations and/or descriptions are called _____.

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Checking Your Understanding

Create two statements that illustrate or describe the four components of a mathematical system.

1. Defined terms

- a. _____
- b. _____

2. Undefined terms

- a. _____
- b. _____

3. Axioms or Postulates

- a. _____
- b. _____

4. Theorems

- a. _____
- b. _____

RUBRIC FOR THE ACTIVITY

Score	Description
10	All statements were correct.
8	Six to seven statements were correct.
6	Four to five statements were correct.
4	Two to three statements were correct.
2	At least one statement was correct.
0	Learner did not attempt to answer the activity.

Post-Test

Encircle the letter that corresponds to your answer.

- Which system or structure that consists of defined and undefined terms, axioms or postulates, and theorems?
A. mathematical system
B. organized system
C. scientific system
D. systematical system
- What component of a mathematical system consists of a point, a line, and/or a plane?
A. defined terms
B. postulates
C. theorems
D. undefined terms
- Ray and angle are examples of what component of mathematical system?
A. defined terms
B. postulates
C. theorems
D. undefined terms
- Which of the following mathematical systems are assumed to be true without proof?
A. defined terms
B. postulates
C. theorems
D. undefined terms

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5. Which of the following mathematical system is proved using definitions, postulates, or other theorems that were already known?
- A. defined terms B. postulates C. theorems D. undefined terms
6. Based on research of UP Diliman Institute of Biology, mangroves are better than dolomite for Manila Bay rehabilitation. What mathematical system is used in the given situation?
- A. defined terms B. postulates C. theorems D. undefined terms
7. Using google map, you need to follow the line to reach your destination. What mathematical system is used in the given situation?
- A. defined terms B. postulates C. theorems D. undefined terms
8. Some people said that at the end of the year, COVID-19 virus will vanish and everything would go back to normal. What mathematical system is used in the given situation?
- A. defined terms B. postulates C. theorems D. undefined terms
9. As an architect, you need to design buildings that are functional and safe. Correct angle measurement is one of the factors that need to be considered. What mathematical system is used in the given situation?
- A. defined terms B. postulates C. theorems D. undefined terms
10. According to PAGASA, rainfall forecast from October 2020 to March 2021 suggests that most parts of the country will likely receive near to above normal rainfall conditions due to the effect of La Niña. What mathematical system is used in the given situation?
- A. defined terms B. postulates C. theorems D. undefined terms
11. What property states that any number is equal to itself?
- A. distributive B. reflexive C. symmetric D. transitive
12. Which of the following statements is true?
- A. If $\angle a$ has a measure of 60° , then $\angle a$ is right.
B. If $\angle b$ has a measure of 90° , then $\angle b$ is obtuse.
C. If $\angle c$ has a measure of 120° , then $\angle c$ is acute.
D. If $\angle d$ has a measure of 190° , then $\angle d$ is reflex.
13. Which of the following is considered true without proof or justification?
- A. conjecture B. defined term C. postulate D. theorem
14. Which of the following is true if $\angle x$ and $\angle y$ are complementary?
- A. $m\angle x = m\angle y$ C. $m\angle x + m\angle y = 90^\circ$
B. $m\angle x \neq m\angle y$ D. $m\angle x + m\angle y = 180^\circ$
15. Which will be the result when the distributive property is applied in $-2(x - y)$?
- A. $2x - 2y$ B. $-2x - 2y$ C. $2x + y$ D. $-2x + y$