



Republic of the Philippines
OFFICE OF THE PRESIDENT
COMMISSION ON HIGHER EDUCATION

MATHEMATICS IN THE MODERN WORLD Preliminaries

Course Title : **Mathematics in the Modern World**

No. of Units : **3 units**

Course Description:

This course deals with nature of mathematics, appreciation of its practical, intellectual, and aesthetic dimensions, and application of mathematical tools in daily life.

The course begins with an introduction to the nature of mathematics as an exploration of patterns (in nature and the environment) and as an application of inductive and deductive reasoning. By exploring these topics, students are encouraged to go beyond the typical understanding of mathematics as merely a set of formulas but as a source of aesthetics in patterns of nature, for example, and a rich language in itself (and of science) governed by logic and reasoning.

The course then proceeds to survey ways in which mathematics provides a tool for understanding and dealing with various aspects of present-day living, such as managing personal finances, making social choices, appreciating geometric designs, understanding codes used in data transmission and security, and dividing limited resources fairly. These aspects will provide opportunities for actually doing mathematics in a broad range of exercises that bring out the various dimensions of mathematics as a way of knowing, and test the students' understanding and capacity. (CMO No. 20, series of 2013)

Learning Outcomes

At the end of the course, the students would be able to:

Knowledge

1. Discuss and argue about the nature of mathematics, what it is, how it is expressed, represented, and used.
2. Use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts.
3. Discuss the language and symbols of mathematics.

Skills

4. Use a variety of statistical tools to process and manage numerical data;
5. Analyze codes and coding schemes used for identification, privacy, and security purposes;
6. Use mathematics in other areas such as finance, voting, health and medicine, business, environment, arts and design, and recreation.

Values

1. Appreciate the nature and uses of mathematics in everyday life.
2. Affirm honesty and integrity in the application of mathematics to various human endeavors

COURSE OUTLINE

Section 1. The Nature of Mathematics

I. Mathematics in our World

Core Idea: Mathematics is a useful way to think about nature and our world

II. Mathematical Language and Symbols

Core Idea: Like any language, mathematics has its own symbols, syntax and rules

III. Problem Solving and Reasoning

Core Idea: Mathematics is not just about numbers; much of it is problem solving and reasoning

Section 2. Mathematics as a Tool

I. Data Management

Core Idea: Statistical tools derived from mathematics are useful in processing and managing numerical data in order to describe a phenomenon and predict values

II. Part Two

1. Geometric Designs

Core Idea: Geometry can help enhance one's artistic prowess as well as enrich one's own culture

2. Codes

Core Idea: The utility of mathematics goes beyond the mundane. Mathematics enables the development of codes and ciphers that are useful to individuals and to society

3. Linear Programming

4. The Mathematics of Finance

5. Apportionment and Voting

6. Logic

7. The Mathematics of Graphs

8. Mathematical Systems

Number of Hours: 3 hours every week for 18 weeks or 54 hours in a semester

MATHEMATICS IN THE MODERN WORLD Learning Plan

Note: Topics that have been shaded indicate the areas or opportunities for interdisciplinarity.

Learning Outcome	Topic	Methodology	Resources	Assessment
1. Identify patterns in nature and regularities in the world (K)	Section 1. The Nature of Mathematics	<u>Activities to do.</u> (i) video-watching (ii) pair-sharing or small group sharing (iii) journal writing (iv) whole class discussion	<u>Required:</u> (1) <i>Nature's Numbers</i> by Ian Stewart or <i>Mathematics in Nature: Modeling Patterns in the Natural World</i> by John A. Adam or <i>A Mathematical Nature Walk</i> by John A. Adam, or any book of the same level, intent and approach	<u>Evaluation Requirements.</u> (i) short-response/essay writing at the end of class to one question. Examples of these questions are: what new ideas about mathematics did you learn?; what is it about mathematics that might have changed your thoughts about it?; and; what is most useful about mathematics for humankind? (ii) Two- to three-page synthesis paper focusing on one of the following aspects of mathematics: (a) Mathematics helps organize patterns and regularities in the world. (b) Mathematics helps predict the behavior of
2. Articulate the importance of mathematics in one's life (V)	I. Mathematics in our World Schedule. Weeks 1-2 Number of hours. 4 hours	<u>Questions to Pose.</u> (i) What is mathematics? (ii) Where is mathematics? (iii) What role does mathematics play in your world?	(2) https://vimeo.com/9953368	
3. Argue about the nature of mathematics, what it is, how it is expressed, represented, and used (K)	<u>Core Idea.</u> Mathematics is a useful way to think about nature and our world.	<u>Some ideas to elicit and encourage.</u> (i) Many patterns and occurrences exist in nature, in our world, in our life. Mathematics helps makes sense of these patterns and occurrences. (ii) Mathematics is a tool to quantify, organize, and control our world,	<u>Recommended:</u> (1) <i>A Day's Adventure in Math Wonderland</i> by Akiyama & Ruiz; (2) <i>The Number Devil</i> by Enzensberger	
4. Express appreciation for mathematics as a human endeavor (V)	<ul style="list-style-type: none"> Patterns and Numbers in Nature and the World: the snowflake and honeycomb, tiger's stripes and hyena's spots, the sunflower, the snail's shell, flower petals, the world's population; 			

Learning Outcome	Topic	Methodology	Resources	Assessment
	<p>the weather, etc.</p> <ul style="list-style-type: none"> • The Fibonacci Sequence • Mathematics helps organize patterns and regularities in the world. • Mathematics helps predict the behavior of nature and phenomena in the world. • Mathematics helps control nature and occurrences in the world for our own ends. • Mathematics has numerous applications in the world making it indispensable. <p><u>Caution.</u> (i) This is not a Philosophy of Mathematics course;</p>	<p>predict phenomena, and make life easier for us.</p> <p><u>Some ideas to discourage or debunk or disprove.</u> (i) Mathematics is just for the books, confined in the classroom. (ii) Mathematics has no place in my life.</p>		<p>nature and phenomena in the world. (c) Mathematics helps control nature and occurrences in the world for our own ends.</p> <p><u>Standards/Basis for Grading to Use.</u> 0 point – The student is unable to elicit the ideas and concepts from the readings and video indicating that s/he has not read the prescribed reading or watched the video. 1 point – The student is able to elicit the ideas and concepts from the readings and video but shows erroneous understanding of these. 2 points – The student is able to elicit the ideas and concepts from the readings and video and shows correct</p>

Learning Outcome	Topic	Methodology	Resources	Assessment
	<p>therefore, refrain from discussing at the level of Eaves or the like. (ii) This is not simply a math appreciation course; therefore, refrain from merely showing or telling the “beauty” or usefulness of mathematics alone.</p>			<p>understanding of these. 3 points – The student not only elicits the correct ideas from the readings and video but also shows evidence of internalizing these. 4 points – The student elicits the correct ideas from the readings and video, shows evidence of internalizing these, and consistently contributes additional thoughts to the Core Idea.</p>
5. Discuss the language, symbols, and conventions of mathematics (K)	<p>Section 1. The Nature of Mathematics II. Mathematical Language and Symbols</p>	<p><u>Activities to do.</u> (i) Individual or small group exercises including games (see exercises in The Language of Mathematics (from <i>One Mathematical Cat, Please!</i> by Carol Burns Fisher) (ii) Whole class discussions of the</p>	<p><u>Required for Instructors:</u> Jamison, R. E. (2000). Learning the language of mathematics. <i>Language and Learning across the Disciplines</i>, 4(1), 45-54. (attached) <u>Required for Students:</u> (i) The Language of Mathematics (from <i>One</i></p>	<p><u>Evaluation Requirements.</u> (i) Writing exercise sets (ii) Quiz <u>Standards/Basis for Grading to Use.</u> Use numerical scores.</p>
6. Explain the nature of mathematics as a language (K)	<p>Schedule Weeks 2-3 Number of hours: 3</p>			
7. Perform operations on mathematical	<p><u>Core Idea.</u> Like any language, mathematics has its own symbols,</p>			

Learning Outcome	Topic	Methodology	Resources	Assessment
expressions correctly (S)	syntax and rules.	comparisons between the English language and Mathematical language (iii)	<i>Mathematical Cat, Please!</i> by Carol Burns Fisher) (ii) The Language and Grammar of Mathematics (both attached)	
8. Acknowledge that mathematics is a useful language (V)	<ul style="list-style-type: none"> • Characteristics of mathematical language: precise, concise, powerful • Expressions vs. sentences • Conventions in the mathematical language • Four basic concepts: sets, functions, relations, binary operations • Elementary logic: connectives, quantifiers, negation, variables • Formality <p><u>Note.</u> This part of the course is intended to be light and easy. The intention is to expose the students to the world</p>	<p>Compilation of mathematical symbols and notations and their meanings</p> <p><u>Some ideas to elicit and encourage.</u> (i) Mathematics is a language in itself. Hence, it is useful in communicating important ideas. (ii) Mathematics as a language is clear and objective. (iii) Language conventions are necessary in mathematics for it to be understood by all.</p> <p><u>Some ideas to discourage or debunk or disprove.</u> (i) Mathematics is not a language but a useless</p>		

Learning Outcome	Topic	Methodology	Resources	Assessment
	of mathematics as a language in order that they may be able to read and write mathematics texts and communicate ideas with precision and conciseness.	set of formal rules and alien symbols. (ii) Mathematics confuses the communication of concepts and ideas. (iii) Mathematics is full of unnecessary symbols, rules, and conventions.		
9. Use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts (K)	Section 1. The Nature of Mathematics III. Problem Solving and Reasoning Schedule Weeks 3-4 Number of hours 5	<u>Activities to do.</u> (i) reading and writing proofs (ii) small-group problem solving (iii) whole class discussions of key problems and solutions	<u>Required:</u> <i>Mathematical Excursions</i> (Ch. 1) by R. Aufmann et al.; <i>What is Mathematics Really?</i> (Ch. 4 & 5) by R. Hersh; <u>Recommended:</u> <i>Mathematical Excursions</i> (Ch. 2) by R. Aufmann et al.; <i>Mathematics, A Practical Odyssey</i> (Ch. 1) by Johnson & Mowry; <i>The Number Devil</i> by Enzensberger, <i>Professor Stewart's Cabinet of Mathematical Curiosities</i> by Ian Stewart; <i>Problem</i>	<u>Evaluation Requirements.</u> (i) one take-home problem set (ii) quiz on proving using deductive or inductive reasoning <u>Standards/Basis for Grading to Use.</u> 0 point – The students did not make any attempt to solve any of the problems in the problem set or prove any of the statements in the quiz. 1 point – The student attempted to solve 50% of the problems in the problem set or displayed
10. Write clear and logical proofs (K)	<u>Core Idea.</u> Mathematics is not just about numbers; much of it is problem solving and reasoning.	<u>Some ideas to elicit and encourage.</u> (i) Mathematics requires not only facility with numbers but also the ability to critically think through situations, to reason and argue logically and to creatively solve problems. (ii)		
11. Solve problems involving patterns and recreational problems following Polya's four steps (S)	<ul style="list-style-type: none"> Inductive and Deductive Reasoning 			
12. Organize one's methods and	<ul style="list-style-type: none"> Intuition, proof, and 			

Learning Outcome	Topic	Methodology	Resources	Assessment
<p>approaches for proving and solving problems (V)</p>	<p>certainty</p> <ul style="list-style-type: none"> • Polya's 4-steps in Problem Solving • Problem solving strategies • Mathematical Problems involving Patterns • Recreational Problems using mathematics <p><u>Caution.</u> (i) This is not a full-fledged problem-solving course; therefore, refrain from giving problems that are beyond the students' abilities. (ii) While it seems more important to be able to think through and attempt to solve problems, there is a higher value in actually completing solutions to problems.</p>	<p>Mathematics is an active human endeavor. We can create the mathematics we need to solve problems. (iii) Mathematics is for everyone and anyone who cares to learn it. (iv) Mathematical problem solving takes time. Solutions are not always apparent to the solver. (v) There may be more than one approach in solving mathematical problems.</p> <p><u>Some ideas to discourage or debunk or disprove.</u> (i) One only needs to learn numbers and fractions to be mathematically proficient (ii) Mathematics is a spectator sport. Mathematics is just out there to be discovered</p>	<p><i>Solving Through Recreational Mathematics</i> by Averbach and Chein.</p>	<p>logical reasoning 50% of the time in attempting to prove the statement/s in the quiz. 2 points - The student attempted to solve all the problems in the problem set or displayed logical reasoning 75% of the time in attempting to prove the statement/s in the quiz. 3 points – The student is able to completely solve 50% of the problems in the problems set or completed 75% of the proof/s in the quiz. 4 points – The student is able to completely solve 75% of the problems in the problem set or completed all the proof/s in the quiz.</p>

Learning Outcome	Topic	Methodology	Resources	Assessment
	Hence, dissuade students from merely attempting to solve and encourage them instead to complete their solutions. (iii) Avoid giving problems that do not have known solutions. Such problems are not for this course.	and appreciated. (iii) Mathematics is only for the gifted. (iv) One is dumb if s/he cannot solve a mathematical problem right away. (v) There is only one way to solve a mathematical problem.		
13. Use a variety of statistical tools to process and manage numerical data (S)	Section 2. Mathematics as a Tool (Part 1) <u>Data Management</u> Schedule Weeks 5-8 Number of hours: 10	<u>Activities to do.</u> (i) lectures (ii) work with appropriate computer statistical software (iii) class discussions (iv) pseudo-proposal defense	<u>Required:</u> <i>Mathematical excursions, 3rd Edition</i> (International Edition) by Aufmann et al. (Ch. 13)	<u>Evaluation requirements.</u> (i) 1 quiz (ii) 1 test (iii) 1 problem set (iv) 1 project proposal for a quantitative study to be orally proposed
14. Use the methods of linear regression and correlations to predict the value of a variable given certain conditions (S)	<u>Core Idea.</u> Statistical tools derived from mathematics are useful in processing and managing numerical data in order to describe a phenomenon and predict values.	<u>Examples of applications.</u> 1. A brisk walk at 6.4 km/hr burns an average of 300 calories per hour. If the standard deviation of the distribution is 8 calories, find the	<u>Recommended:</u> <i>Mathematics, A Practical Odyssey</i> by Johnson & Mowry (Ch. 4) <i>Math in Our World</i> by Sobekki, Bluman, & Schirck-Matthews	<u>Sample Project Proposal</u> You want the university to offer free shuttle rides for students, faculty, and staff from strategic points outside your university in order to
15. Advocate the use of statistical data in making important decisions (V)				

Learning Outcome	Topic	Methodology	Resources	Assessment
	<ul style="list-style-type: none"> • Data: Gathering and Organizing Data; Representing Data using graphs and charts; Interpreting organized data • Measures of Central Tendency: Mean, Median, Mode, Weighted Mean • Measures of Dispersion: Range, Standard Deviation and Variance • Measures of Relative Position: z-scores, Percentiles, Quartiles and Box-and-Whiskers Plots • Probabilities and Normal Distributions • Linear Regression and Correlation: Least-Squares Line, Linear Correlation 	<p>probability that a person who walks 1 hour at the rate of 6.4 km/hr will burn the given number of calories. Assume the variable is normally distributed. (a) More than 280 calories (b) Less than 293 calories (c) Between 285 and 320 calories (From: Sobecki et al., Math in Our World). Interpret the result for each number of calories.</p> <p>2. Does good health relate to education? Below are the figures for the Philippines:</p> <p>Immunization (measles, % of children ages 12-23 months) 2005... 92 2006... 92</p>		<p>improve traffic flow in your campus. The university chancellor asks your team to present hard data that will convince the administration. Prepare a proposal on how you will do this task.</p> <p><u>Standards/Basis for Grading to Use.</u> (i) Numerical scores for the quizzes, test and problem sets (ii) rubric for the project proposal</p> <p><u>Caution.</u> (i) Define the bounds of the project proposal to ensure that the work required is commensurate to the hours allotted for this section of the course. (ii) The oral proposal is not to be graded</p>

Learning Outcome	Topic	Methodology	Resources	Assessment
	<p>Coefficient</p> <p><u>Note.</u> (i) Although the concepts and skills appear to be the same as the Statistics taught at Junior and Senior High School, they are not. Hence, the intention is to build on the concepts and skills learned prior to university/college, deepen what have been learned and highlight skills in interpreting statistical results. (ii) Exert efforts to use technology that are available to students.</p>	<p>2007... 92 2008... 92 2009... 88 2010... 80</p> <p>Primary completion rate (total, % of relevant age group) 2005... 94 2006... 91 2007... 91 2008... 92 2009... 91 2010... no data</p> <p>Can you predict the primary completion rate for 2010?</p>		
<p>Choose two or three topics for this section. The sections on Geometric Designs and Codes have been developed as samples.</p>				
<p>16. Apply geometric concepts, especially isometries in describing and creating designs (S)</p>	<p>Section 3. Mathematics as a Tool (Part 2)</p> <p>Time Allocation for Topic 1</p>	<p><u>Activities to do.</u> (i) small group or large class sharing of various indigenous designs</p>	<p><u>Required: Geometry: Shapes, Patterns and Designs</u> (A Chapter for the New Editions of the</p>	<p><u>Evaluation requirements.</u> (i) 1 problem set (ii) 1 long test (iii) class exhibit of</p>

Learning Outcome	Topic	Methodology	Resources	Assessment
<p>17. Contribute to the enrichment of the Filipino culture and arts using concepts in geometry (V);</p>	<p>Schedule Weeks 8-11 Number of Hours: 10 Time Allocation for Topic 2 Schedule Weeks 13-14 Number of Hours: 10 Time Allocation for Topic 3 Schedule Weeks 15-18 Number of hours: 12</p> <p><u>I. Geometric Designs</u></p> <p><u>Core Idea.</u> Geometry can help enhance one's artistic prowess as well as enrich one's own culture.</p> <ul style="list-style-type: none"> • Recognizing and analyzing geometric shapes • Transformations • Patterns and Diagrams • Designs, Arts, & 	<p>found in one's home community (ii) lectures (iii) written exercises</p>	<p>Math 12 Textbook for Ateneo de Manila University) by Vistro-Yu</p> <p><u>Recommended:</u> <i>Palaspas</i> by Nochesada</p>	<p>created or collected indigenous designs</p> <p><u>Standards/Basis for Grading to Use.</u> (i) numerical scores for problem set and long test (ii) rubric for the class exhibit (iii) peer evaluation for the class exhibit</p> <p><u>Caution.</u> The content material may prove to be a challenge to many students hence there should be few assessment activities.</p>

Learning Outcome	Topic	Methodology	Resources	Assessment
	Culture			
18. Use coding schemes to encode and decode different types of information for identification, privacy, and security purposes (S)	<p><u>II. Codes</u></p> <p><u>Core Idea.</u> The utility of mathematics goes beyond the mundane. Mathematics enables the development of codes and ciphers that are useful to individuals and to society</p> <ul style="list-style-type: none"> • Binary codes • Integers in computers • Logic and computer addition • Text data • Errors and error correction • Error detecting codes • Repetition and Hamming Codes 	<p><u>Activities to do.</u> (i) role playing (ii) lectures (iii) written exercises (iv) computer exercises</p>	<p>Required: (i) <i>For All Practical Purposes, Introduction to Contemporary Mathematics</i> (2nd Ed.) by COMAP, Inc. (ii) <i>A Student's Guide to Coding and Information Theory</i> by Moser and Chen</p> <p>Recommended: http://www.exploratorium.edu/ronh/secret/secret.html</p>	<p><u>Evaluation requirements.</u> (i) 3 quizzes (ii) 1 long test</p> <p><u>Standards/Basis for Grading to Use.</u> Numerical scores</p>
19. Exemplify honesty and integrity when using codes for security purposes (V)				

Learning Outcome	Topic	Methodology	Resources	Assessment
	<p><u>Caution.</u> It is easy to get lost in the “fun” that this section brings. Do not lose the mathematics.</p>			
<p>20. Use mathematical concepts and tools in other areas such as in finance, voting, logic, business, networks and systems (S)</p>	<p><u>III. Linear Programming</u></p> <ul style="list-style-type: none"> • Linear Inequalities • Geometry of Linear Programming • Simplex Method 	<p><u>Activities.</u> (i) lectures (ii) role playing (iii) written exercises</p>	<p>Johnson & Mowry, Ch. 12</p>	<p><u>Evaluation requirements.</u> (i) 1 problem set (ii) an integrating project</p> <p><u>Sample Integrating Project (by groups)</u></p> <p>Create a poster aimed at recruiting students to join a club that promotes mathematics as an important tool in everyday life.</p> <p><u>Standards/Basis for Grading to Use.</u> (i) Numerical scores for problem sets (ii) Rubrics for the project</p>
<p>21. Support the use of mathematics in various aspects and endeavors in life (V)</p>	<p><u>IV. The Mathematics of Finance</u></p> <ul style="list-style-type: none"> • Simple and Compound Interest • Credit Cards and Consumer Loans • Stocks, Bonds and Mutual Funds 		<p>Aufmann et al., Chapter 11</p>	

Learning Outcome	Topic	Methodology	Resources	Assessment
	<ul style="list-style-type: none"> • Home ownership 			
	<p><u>V. Apportionment and Voting</u></p> <ul style="list-style-type: none"> • Introduction to apportionment • Introduction to Voting • Weighted Voting Systems 		Aufmann et al., Chapter 4	
	<p><u>VI. Logic</u></p> <ul style="list-style-type: none"> • Logic statement and quantifiers • Truth tables and tautologies • Conditional, Biconditional and related statements • Symbolic Arguments • Arguments and Euler 		Aufmann et al., Chapter 3	

Learning Outcome	Topic	Methodology	Resources	Assessment
	diagrams			
	<u>VII. The Mathematics of Graphs</u> <ul style="list-style-type: none"> • Graphs and Euler circuits • Weighted graphs • Euler's formula • Graph coloring 		Aufmann et al., Chapter 5	
	<u>VIII. Mathematical Systems</u> <ul style="list-style-type: none"> • Modular Arithmetic • Applications • Group Theory 		Aufmann et al., Chapter 8	

MATHEMATICS IN THE MODERN WORLD Course Map

GE Learning Outcomes	Mathematics in the Modern World
Knowledge (Intellectual Competencies)	
1. Analyze “texts” (written, visual, oral, etc.) critically	O
2. Demonstrate proficient and effective communication (writing, speaking, and use of new technologies)	O
3. Use basic concepts across the domains of knowledge	L
4. Demonstrate critical, analytical, and creative thinking	L
5. Apply different analytical modes in problem solving	P
Values (Personal and Civic Responsibilities)	
1. Appreciate the complexity of the human condition	L
2. Interpret the human experience from various perspectives	O
3. Examine the contemporary world from both Philippine and global perspectives	O
4. Take responsibility for knowing and being Filipino	O
5. Reflect critically on shared concerns	O
6. Generate innovative practices and solutions guided by ethical standards	P
7. Make decisions based on moral norms and imperatives	O
8. Appreciate various art forms	O
9. Contribute to aesthetics	L

GE Learning Outcomes	Mathematics in the Modern World
10. Advocate respect for human rights	O
11. Contribute personally and meaningfully to the country's development	P
Skills (Practical Skills)	
1. Work effectively in a group	O
2. Apply computing tools to process information effectively	P
3. Use current technology to assist and facilitate learning and research	P
4. Negotiate the world of technology responsibly	P
5. Create solutions to problems in various fields	P
6. Manage one's knowledge, skills, and values for responsible and productive living	P
7. Organize one's self for lifelong learning	L

L = Learned

P= Practiced

O= Opportunity to learn

MATHEMATICS IN THE MODERN WORLD Additional Course Map

GE Learning Outcomes	Mathematics in the Modern World	Learning Outcomes Mathematics in the Modern World
Knowledge (Intellectual Competencies)		
6. Analyze “texts” (written, visual, oral, etc.) critically	O	
7. Demonstrate proficient and effective communication (writing, speaking, and use of new technologies)	O	
8. Use basic concepts across the domains of knowledge	L	<ul style="list-style-type: none"> • Discuss the language, symbols and conventions of mathematics
9. Demonstrate critical, analytical, and creative thinking	L	<ul style="list-style-type: none"> • Identify patterns in nature and regularities in the world • Argue about the nature of mathematics, what it is, how it is expressed, represented, and used • Explain the nature of mathematics as a language • Write clear and logical proofs
10. Apply different analytical modes in problem solving	P	<ul style="list-style-type: none"> • Use different types of reasoning to justify statements and arguments made about mathematics and mathematical concepts
Values (Personal and Civic Responsibilities)		
12. Appreciate the complexity of the human condition	L	<ul style="list-style-type: none"> • Articulate the importance of mathematics in one’s life • Express appreciation for mathematics as a human endeavor • Acknowledge that mathematics is a useful

GE Learning Outcomes	Mathematics in the Modern World	Learning Outcomes Mathematics in the Modern World
		language <ul style="list-style-type: none"> • Support the use of mathematics in various aspects and endeavors in life
13. Interpret the human experience from various perspectives	O	
14. Examine the contemporary world from both Philippine and global perspectives	O	
15. Take responsibility for knowing and being Filipino	O	
16. Reflect critically on shared concerns	O	
17. Generate innovative practices and solutions guided by ethical standards	P	<ul style="list-style-type: none"> • Organize one's methods and approaches for proving and solving problems • Exemplify honesty and integrity when using codes for security purposes
18. Make decisions based on moral norms and imperatives	O	
19. Appreciate various art forms	O	
20. Contribute to aesthetics	L	<ul style="list-style-type: none"> • Contribute to the enrichment of the Filipino culture and arts using concepts in geometry
21. Advocate respect for human rights	O	
22. Contribute personally and meaningfully to the country's development	P	<ul style="list-style-type: none"> • Advocate the use of statistical data in making important decisions
Skills (Practical Skills)		
8. Work effectively in a group	O	

GE Learning Outcomes	Mathematics in the Modern World	Learning Outcomes Mathematics in the Modern World
9. Apply computing tools to process information effectively	P	<ul style="list-style-type: none"> • Use a variety of statistical tools to process and manage numerical data • Use the methods of linear regression and correlations to predict the value of a variable given certain conditions
10. Use current technology to assist and facilitate learning and research	P	<ul style="list-style-type: none"> • Apply geometric concepts, especially isometries in describing and creating designs
11. Negotiate the world of technology responsibly	P	<ul style="list-style-type: none"> • Use coding schemes to encode and decode different types of information for identification, privacy and security purposes
12. Create solutions to problems in various fields	P	<ul style="list-style-type: none"> • Solve problems involving patterns and recreational problems following Polya's four steps
13. Manage one's knowledge, skills, and values for responsible and productive living	P	<ul style="list-style-type: none"> • Use mathematical concepts and tools in other areas such as in finance, voting, logic, business, networks and systems
14. Organize one's self for lifelong learning	L	<ul style="list-style-type: none"> • Perform operations on mathematical expressions correctly

L = Learned

P= Practiced

O= Opportunity to learn

MATHEMATICS IN THE MODERN WORLD Required Readings and Other Materials

Required for student

Adam, John A. *Mathematics in Nature: Modeling Patterns in the Natural World*

Adam, John A. *A Mathematical Nature Walk*

Aufmann, R. et al. *Mathematical Excursions* (Chaps. 1, 3, 4, 5, 8, 11, and 13) 3rd Ed (International Edition).

COMAP Inc. *For All Practical Purposes, Introduction to Contemporary Mathematics* (2nd ed.)

Fisher, Carol Burns. *The Language of Mathematics* (from *One Mathematical Cat, Please!* by Carol Burns Fisher)

Fisher, Carol Burns. *The Language and Grammar of Mathematics*

Hersh, R. *What is Mathematics Really?* (Chaps. 4 & 5)

Johnson and Mowry. *Mathematics, A Practical Odyssey* (Chap. 12)

Moser and Chen. *A Student's Guide to Coding and Information Theory*

Stewart, Ian. *Nature's Numbers*

Vistro-Yu, C. *Geometry: Shapes, Patterns and Designs* (A chapter for the new ed. of the Math 12 textbook for Ateneo de Manila University).

VIDEO

- <https://vimeo.com/9953368>

Required only for teachers

Jamison, R. E. (2000). Learning the language of mathematics. *Language and Learning across the Disciplines*, 4(1), 45-54.

Recommended readings

Akiyama and Ruiz. *A Day's Adventure in Math Wonderland*

Aufmann et al. *Mathematical Excursions* (Chap. 2)

Averbach and Chein. *Problem Solving Through Recreational Mathematics*

Enzensberger. *The Number Devil*

Johnson and Mowry. *Mathematics, A Practical Odyssey* (Chaps. 1 and 4)

Nocheseda. *Palaspas*

Stewart, Ian. *Professor Stewart's Cabinet of Mathematical Curiosities*

Sobecki, Bluman, and Schirck-Matthews. *Math in Our World*

VIDEO

- <http://www.exploratorium.edu/ronh/secret/secret.html>