KINGSBOROUGH COMMUNITY COLLEGE
The City University of New York

CURRICULUM TRANSMITTAL COVER PAGE

Department: Mathematics & Computer Science **Date:** March 23, 2017

Title Of Course Or Degree: MAT 00500 – Introduction to Mathematical Thought

Change(s) Initiated: (Please check)

- ☐ Closing of Degree
- ☐ Closing of Certificate
- ☐ New Certificate Proposal
- ☐ New Degree Proposal
- ☐ New Course
- ☐ New 82 Course
- ☐ Deletion of Course
- ☐ Change in Degree or Certificate Requirements
- ☐ Change in Degree Requirements (adding concentration)
- ☐ Change in Pre/Co-Requisite
- ☐ Change in Course Designation
- ☐ Change in Course Description
- ☐ Change in Course Title, Numbers Credit and/or Hour
- ☐ Change in Academic Policy
- ☑ Pathways Submission:
  - ☐ Life and Physical Science
  - ☑ Math and Quantitative Reasoning
  - ☐ A. World Cultures and Global Issues
  - ☐ B. U.S. Experience in its Diversity
  - ☐ C. Creative Expression
  - ☐ D. Individual and Society
  - ☐ E. Scientific World

☐ Other (please describe): _____

PLEASE ATTACH MATERIAL TO ILLUSTRATE AND EXPLAIN ALL CHANGES

DEPARTMENTAL ACTION

Action by Department and/or Departmental Committee, if required:

Date Approved: 03/21/2017 Signature, Committee Chairperson: _____

I have reviewed the attached material/proposal

Signature, Department Chairperson: Rina Yarmish

Revised/Dec.2015/AK

CUNY Common Core
Course Submission Form

Instructions: All courses submitted for the Common Core must be liberal arts courses. Courses submitted to the Course Review Committee may be submitted for only one area of the Common Core and must be 3 credits. Colleges may submit courses to the Course Review Committee before or after they receive college approval. STEM waiver courses do not need to be approved by the Course Review Committee. This form should not be used for STEM waiver courses.

College	Kingsborough Community College of City University of New York
Course Prefix and Number (e.g., ANTH 101, if number not assigned, enter XXX)	MAT 00500
Course Title	Introduction to Mathematical Thought
Department(s)	Mathematics and Computer Science Department
Discipline	Mathematics
Credits	3
Contact Hours	7
Pre-requisites (if none, enter N/A)	Open to all students who have passed the arithmetic part of CUNY's entrance exam.
Co-requisites (if none, enter N/A)	N/A
Catalogue Description	This course emphasizes quantitative reasoning skills for informed citizens to understand the world around them. Topics include basic probability, data analysis, and solution of elementary algebraic equations, word problems and modeling from data.
Special Features (e.g., linked courses)	
Sample Syllabus	See Attached.

Indicate the status of this course being nominated:

☐ current course ☐ revision of current course ☒ a new course being proposed

CUNY COMMON CORE Location

Please check below the area of the Common Core for which the course is being submitted. (Select only one.)

Required Core	Flexible Core
☐ English Composition	☐ World Cultures and Global Issues (A)
☒ Mathematical and Quantitative Reasoning	☐ US Experience in its Diversity (B)
☐ Life and Physical Sciences	☐ Creative Expression (C)
	☐ Individual and Society (D)
	☐ Scientific World (E)

Learning Outcomes **In the left column explain the course assignments and activities that will address the learning outcomes in the right column.**	
I. Required Core (12 credits)	
A. English Composition: Six credits A course in this area must meet all the learning outcomes in the right column. A student will:	
	• Read and listen critically and analytically, including identifying an argument's major assumptions and assertions and evaluating its supporting evidence.
	• Write clearly and coherently in varied, academic formats (such as formal essays, research papers, and reports) using standard English and appropriate technology to critique and improve one's own and others' texts.
	• Demonstrate research skills using appropriate technology, including gathering, evaluating, and synthesizing primary and secondary sources.
	• Support a thesis with well-reasoned arguments, and communicate persuasively across a variety of contexts, purposes, audiences, and media.
	• Formulate original ideas and relate them to the ideas of others by employing the conventions of ethical attribution and citation.
B. Mathematical and Quantitative Reasoning: Three credits A course in this area must meet all the learning outcomes in the right column. A student will:	
One module devoted to analyzing a variety of data curves, utilizing formulae and tables. For example (p.416): Given a table and a graph, express Fahrenheit body temperatures as a function of time represented by hours, from 8AM through 3PM. The student constructs a graph showing one's body temperature from 8AM through 3PM deciding to let x represent the number of hours after 8AM and y represent one's body temperature at time x. Students understand that there is a break in values between 0 and 98, and that the first tick mark on the y-axis represents temperature of 98 Fahrenheit degrees. Students are able to demonstrate their understanding of graphs by recognizing the period of time when the temperature is decreasing, increasing or steady. Students are also able to estimate the minimum temperature during the time period shown. In this case, the student can locate or plot the point (3, 98.7) on the graph, which means that at 11AM, after three hours from the starting point 8AM, one has a temperature of 98.7 Fahrenheit degrees.	• Interpret and draw appropriate inferences from quantitative representations, such as formulas, graphs, or tables.

One module devoted to statistical thinking, including tables and graphs, numerical measures of central tendency and dispersion. For example (p. 700-801): Calculate the mean and standard deviation of a data set, and then determine if the data set values exhibit a normal distribution. Students will understand the importance of the mean (average) as the value obtained by dividing the sum of several quantities by their number and the standard deviation as a measure of the dispersion of a set of data from its mean. The students are asked to calculate the standard deviation as the square root of variance by determining the variation between each data point relative to the mean. The students are asked what a small standard deviation implies, namely that the data values are close together, whereas a large deviation implies that the data values are further from the mean. They will also visualize this using a typical bell-curve where the mean always lies at the center. A small standard deviation corresponds to a bell-shaped curve that is tall and narrow whereas a large standard deviation corresponds to a bell-curve that is short and wide.	• Use algebraic, numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems.
One module in the course is devoted to the basics of finite set theory, as found in Chapter 2 of the text. In this module students are instructed in how to represent data given verbally as Venn Diagrams that may then be analyzed mathematically using tools such as the formula for the cardinal number for the union of two finite sets (pg. 79). As a specific example, students will study the example of responses to a survey with various possible responses. Students will learn how to translate information given in a verbal survey into a Venn diagram which mathematically represents the data. Another way in which students will learn how to express natural language information in a mathematical format will be covered in the module on linear equations. There in section 6.3 of the text the focus will be on taking problems given in natural language and translating the information thus conveyed into mathematical formulas. Emphasis will be placed on correctly assigning variables to quantities given in the problem and determining how to appropriately mathematically express the relationship of the variables given in the natural language problem. For example, on pg. 371 of the text example 4 states: "Your local computer store is having a terrific sale on digital	• Represent quantitative problems expressed in natural language in a suitable mathematical format.

cameras. After a 40% price reduction, you purchase a digital camera for $276. What was the camera's price before the reduction?" The students will learn that the appropriate means to solve this problem is by assigning the variable "x" to the unknown quantity (the camera's original price) and that the relationship the variable satisfies can mathematically be expressed as: x-(.4*x)=276. A final example of an instance where students will learn to express natural language problems mathematically occurs in the final module of the course, focusing on chapter 14 of the text on graph theory. Here students will learn how to interpret descriptions of, for example, data on street layouts in a town as mathematically meaningful graphs (dot and line diagrams) which can be put to use in developing efficient transportation routes.	
One module devoted to interpreting information given in a table and determining relationship between quantities. For example (p.821-832): Interpret information given in a table, find the correlation coefficient and then determine whether there is a correlation in population. Two data items for every person in a sample of ten people are collected in a table. Students are instructed to interpret information given in the table. That is, one data item (listed in the top row) shows the number of years of school completed and the other (listed in the bottom row) shows the score on a test measuring prejudice. Students are asked to determine whether these two quantities are correlated. When students find people with increased education tend to have a lower score on the test measuring prejudice, they conclude that there is a negative correlation between these two quantities. Students are asked to describe the strength and direction of a relationship between these two quantities by finding the correlation coefficient. The correlation coefficient found by a formula is approximately -0.92, fairly close to -1. Students will describe there is a strong negative correlation. This means the more education a person has, the less prejudiced that person is. Students are also asked to determine whether a correlation really exists in the population when the sample size is relatively small. Table 12.19 on page 828 lists the absolute	• Effectively communicate quantitative analysis or solutions to mathematical problems in written or oral form.

values for determining correlations in a population with significance level of 1% and 5% respectively for sample size between 4 and 102. For sample size ten, the absolute value of correlation coefficient for the significance level of 1% is 0.765 that is less than 0.92. Thus, students can conclude that there is a 1% probability that, when the statistician says the variables are correlated, they are actually not related in the population.	
Students will be taught to verify that their answers correspond to basic principles they have been taught. In the module on the theory of sets (chapter 2 of the text) students will be taught to always analyze their answer for feasibility in regards to obvious counting principles that cannot be violated. For example, in a situation where a student has two sets A and B with A a subset of B if they are told that B has 6 elements and A has seven elements they should immediately be able to recognize this is impossible in that a subset must have smaller size. Students will also learn to make sure that their solutions to problems are "real world" feasible. For example, in the module on probability (chapter 11 of the text) when computing the probability of two events joined by on "or" students will be able to recognize that a result is feasible in that it must be true that the probability of two events joined by an "or" must be greater than or equal to the probability of either event individually, as is clear from "real world" experience. Students will learn to recognize if their computations are reasonable by estimation. For example in the module on the real number system (chapter 5 of the text) and specifically in the section on scientific notation (section 5.6 of the text) students will learn to estimate the feasibility of a multiplication computation by recognizing that the product of a number with n digits and a number with m digits must have approximately n+m digits.	• Evaluate solutions to problems for reasonableness using a variety of means, including informed estimation.
Some examples of applied problems: 1. Use of scientific notation in astronomy, finance, and biology (p. 314-321). Students will observe how many quantities in these fields are best expressed in scientific notation. For example: the universe is 1.375 × 10^10 years old, in 2010, humankind generated 1.2 × 10^21 bytes of digital information, the length of the AIDS virus is 1.1 × 10^{-4} millimeters. Students learn to multiply,	• Apply mathematical methods to problems in other fields of study.

divide and raise to a power numbers in scientific notation. For example (p. 318): As of December 2011, the national debt was 15.2 trillion dollars and the US population was approximately 312 million. Use scientific notation to find how much each citizen has to pay? Answer: The amount each citizen must pay is the total debt, 15.2 trillion dollars meaning 15.2 × 10^12 dollars, divided by the number of citizens, 312 million = 3.12 × 10^8.

$$\frac{15.2 \times 10^{12}}{3.12 \times 10^{8}} = \left(\frac{15.2}{3.12}\right) \times \left(\frac{10^{12}}{10^{8}}\right)$$
$$\approx 4.87 \times 10^{12-8}$$
$$= 4.87 \times 10^{4}$$
$$= 48{,}700$$

Every US citizen would have to pay approximately $48,700 to the federal government to pay off the national debt.

2. Computing FICA Tax (p.503). For example: if you are not self-employed and earn $150,000, what are your FICA taxes? Answer: The tax rates are 5.65% on the first $110,000 of income and 1.45% on income in excess of $110,000.
FICA Tax = 0.0565 × $110,000 + 0.0145 × ($150,000 - $110,000)
= 0.0565 × $110,000 + 0.0145 × $40,000
=$6,215 + $580
=$6,795
The FICA taxes are $6,795.

3. The Fundamental Counting Principle for setting up phone numbers and license plates. For example (p.692): telephone numbers in the United States begin with three-digit area codes followed by seven-digit local telephone numbers. Area codes and local telephone numbers cannot begin with 0 or 1. How many different telephone numbers are possible? Answer: We use the Fundamental Counting Principle to determine the number of different telephone numbers that are possible. The total number of telephone numbers possible is:
8×10×10×8×10×10×10×10×10×10=6,400,000,000.
There are six billion four hundred million different numbers that are possible.

C. Life and Physical Sciences: Three credits A course in this area must meet all the learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a life or physical science.
	• Apply the scientific method to explore natural phenomena, including hypothesis development, observation, experimentation, measurement, data analysis, and data presentation.
	• Use the tools of a scientific discipline to carry out collaborative laboratory investigations.
	• Gather, analyze, and interpret data and present it in an effective written laboratory or fieldwork report.
	• Identify and apply research ethics and unbiased assessment in gathering and reporting scientific data.
II. Flexible Core (18 credits) Six three-credit liberal arts and sciences courses, with at least one course from each of the following five areas and no more than two courses in any discipline or interdisciplinary field.	
A. World Cultures and Global Issues	
A Flexible Core course must meet the three learning outcomes in the right column.	
	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.
A course in this area (II.A) must meet at least three of the additional learning outcomes in the right column. A student will:	
	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring world cultures or global issues, including, but not limited to, anthropology, communications, cultural studies, economics, ethnic studies, foreign languages (building upon previous language acquisition), geography, history, political science, sociology, and world literature.
	• Analyze culture, globalization, or global cultural diversity, and describe an event or process from more than one point of view.
	• Analyze the historical development of one or more non-U.S. societies.
	• Analyze the significance of one or more major movements that have shaped the world's societies.
	• Analyze and discuss the role that race, ethnicity, class, gender, language, sexual orientation, belief, or other forms of social differentiation play in world cultures or societies.
	• Speak, read, and write a language other than English, and use that language to respond to cultures other than one's own.

B. U.S. Experience in its Diversity

A Flexible Core course must meet the three learning outcomes in the right column.

	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.

A course in this area (II.B) must meet at least three of the additional learning outcomes in the right column. A student will:

	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the U.S. experience in its diversity, including, but not limited to, anthropology, communications, cultural studies, economics, history, political science, psychology, public affairs, sociology, and U.S. literature.
	• Analyze and explain one or more major themes of U.S. history from more than one informed perspective.
	• Evaluate how indigenous populations, slavery, or immigration have shaped the development of the United States.
	• Explain and evaluate the role of the United States in international relations.
	• Identify and differentiate among the legislative, judicial, and executive branches of government and analyze their influence on the development of U.S. democracy.
	• Analyze and discuss common institutions or patterns of life in contemporary U.S. society and how they influence, or are influenced by, race, ethnicity, class, gender, sexual orientation, belief, or other forms of social differentiation.

C. Creative Expression

A Flexible Core course must meet the three learning outcomes in the right column.

	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.

A course in this area (II.C) must meet at least three of the additional learning outcomes in the right column. A student will:

	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring creative expression, including, but not limited to, arts, communications, creative writing, media arts, music, and theater.
	• Analyze how arts from diverse cultures of the past serve as a foundation for those of the present, and describe the significance of works of art in the societies that created them.
	• Articulate how meaning is created in the arts or communications and how experience is interpreted and conveyed.
	• Demonstrate knowledge of the skills involved in the creative process.
	• Use appropriate technologies to conduct research and to communicate.

D. Individual and Society

A Flexible Core course must meet the three learning outcomes in the right column.

	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.

A course in this area (II.D) must meet at least three of the additional learning outcomes in the right column. A student will:

	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the relationship between the individual and society, including, but not limited to, anthropology, communications, cultural studies, history, journalism, philosophy, political science, psychology, public affairs, religion, and sociology.
	• Examine how an individual's place in society affects experiences, values, or choices.
	• Articulate and assess ethical views and their underlying premises.
	• Articulate ethical uses of data and other information resources to respond to problems and questions.
	• Identify and engage with local, national, or global trends or ideologies, and analyze their impact on individual or collective decision-making.

E. Scientific World

A Flexible Core course must meet the three learning outcomes in the right column.

	• Gather, interpret, and assess information from a variety of sources and points of view.
	• Evaluate evidence and arguments critically or analytically.
	• Produce well-reasoned written or oral arguments using evidence to support conclusions.

A course in this area (II.E) must meet at least three of the additional learning outcomes in the right column. A student will:

	• Identify and apply the fundamental concepts and methods of a discipline or interdisciplinary field exploring the scientific world, including, but not limited to: computer science, history of science, life and physical sciences, linguistics, logic, mathematics, psychology, statistics, and technology-related studies.
	• Demonstrate how tools of science, mathematics, technology, or formal analysis can be used to analyze problems and develop solutions.
	• Articulate and evaluate the empirical evidence supporting a scientific or formal theory.
	• Articulate and evaluate the impact of technologies and scientific discoveries on the contemporary world, such as issues of personal privacy, security, or ethical responsibilities.
	• Understand the scientific principles underlying matters of policy or public concern in which science plays a role.

KINGSBOROUGH COMMUNITY COLLEGE

THE CITY UNIVERSITY OF NEW YORK

1) DEPARTMENT, COURSE NUMBER, AND TITLE: Department of Mathematics & Computer Science, MAT 00500 Introduction to Mathematical Thought

2) BULLETIN DESCRIPTION OF COURSE: This course emphasizes quantitative reasoning skills for informed citizens to understand the world around them. Topics include basic probability, data analysis, solution of elementary Algebraic equations, word problems and modeling from data.

3) CREDITS AND HOURS: Three Credits, Seven hours per week.

4) COURSE PREREQUISITES AND COREQUISITES:

A. PREREQUISITE(S): Open to all students who have passed the arithmetic part of CUNY's entrance exam or have earned a passing grade in MAT M1 or have earned a passing grade in a Mathematics-department –administered "M1 workshop."

B. COREQUISITE(S): None.

C. PRE/COREQUISITE(S): None.

5) ENROLLMENT AND RATIONAL:

A. PROJECTED ENROLLMENT: 50-90 Students.

B. SUGGESTED CLASS LIMITS: 30 Students.

C. FREQUENCY COURSE IS LIKELY TO BE OFFERED: Course to be offered every term.

D. ROLE OF COURSE IN DEPARTMENT'S CURRICULUM AND COLLEGE'S MISSION: Mathematics 5 is designed to provide the non-mathematics, non-science major students with an understanding of the role of mathematics in today's society.

6) PROPOSED TEXT BOOK(S) AND/OR OTHER REQUIRED INSTRUCTIONAL MATERIAL(S):

Robert Blitzer, *Thinking Mathematically*, 6th Edition, Prentice Hall/Pearson Publishing, 2015.

7) REQUIRED COURSE FOR MAJOR OR AREA OF CONCENTRATION? No.

8) WHAT STUDENTS WILL KNOW AND BE ABLE TO DO UPON COMPLETION OF COURSE: Students will be able to evaluate solutions to problems for reasonableness using a variety of means, including estimation. Students will learn effective communication of quantitative analysis or solutions to mathematical problems. Students will have the basic knowledge of the usage of algebraic numerical, graphical, or statistical methods to draw accurate conclusions and solve mathematical problems. Students will understand the fundamentals of statistics. Students will know how to represent quantitative problems. Students will understand the principles of mathematical modeling. Students will understand the application of mathematical methods to problems in other fields of study.

9) METHODS OF TEACHING –E.G. LECTURES, LABORATORIES, AND OTHER ASSIGNMENTS FOR STUDENTS, INCLUDING ANY OF THE FOLLOWING: DEMONSTRATIONS, GROUP WORK, WEBSITE OR E-MAIL INTERACTIONS AND/OR ASSIGNMENTS, PRACTICE IN APPLICATION OF SKILLS, ETC.:

Mathematics 5 is taught by classroom lecture and demonstration of specific mathematical concepts, operations, and procedures, combined with homework assignments designed to improve and solidify student understanding and mastery of these concepts, operations and procedures.

10) ASSIGNMENTS TO STUDENTS: Assignments are taken from the textbook, and are chosen at the discretion of the instructor.

11) METHOD OF EVALUATING LEARNING:

Evaluation is based upon regular classroom examinations and a final examination. The instructor will administer a final exam that will constitute 40% of the final grade. The remaining 60% is to be divided between in-class tests, homework, and class participation at the discretion of the instructor. A final percentage of 60% or better will be deemed to sufficient to pass the course.

12) Topical Course Outline for the 12 week semester:

Hours	Topics	Text Sections
1	Basic Set Concepts	2.1
1	Subsets	2.2
1	Venn Diagrams and Set Operations	2.3
2	Set Operations and Venn Diagrams with Three Sets	2.4
4	The integers; Order of Operations	5.2
2	Algebraic Expressions and Formulas	6.1
3	Linear Equations in One Variable and Proportions	6.2
1	Applications of Linear Equations	6.3
1	Measuring Length: The Metric System Measuring Weight and Temperature	9.1 9.3
2	Measuring Area and Volume	9.2
2	Linear Inequalities in One Variable	6.4
4	The Irrational Numbers	5.4
2	Exponents and Scientific Notation	5.6
2	Percent, Sales Tax, and Discounts Exponents and Scientific Notation	8.1 5.6
3	Simple Interest Compound Interest	8.3 8.4
2	Annuities, Methods of Savings, and Investments	8.5
4	Quadratic Equations	6.5
4	Sampling, Frequency Distributions, and Graphs	12.1
2	Scatter Plots, Correlation, and Regression Lines	12.6

2	Measures of Central Tendency The Normal Distribution	12.2 12.4
2	Measures of Dispersion	12.3
4	The Normal Distribution	12.4
1	Graphing and Functions	7.1
4	Linear Functions and Their Graphs	7.2
1	Systems of Linear Equations in Two Variables	7.3
7	The Fundamental Counting Principle Fundamentals of Probability Events Involving Not and Or; Odds Events Involving And; Conditional Probability	11.1 11.4 11.6 11.7
4	Permutations Combinations	11.2 11.3
2	Expected Value	11.8
2	Modeling Data; Exponential, Logarithmic, and Quadratic Functi	7.6
1	Graphs, Paths, and Circuits	14.1
1	Euler Paths and Euler Circuits	14.2
1	Hamilton Paths and Hamilton Circuits	14.3
1	Trees	14.4
9	Tests and Reviews	