

MA 202 MATHEMATICS FOR ELEMENTARY TEACHERS (UK Course) (3 credit hours)

Official Course Description	Algebraic reasoning, introduction to statistics and probability, geometry, and measurement. Prerequisites: A grade of "C" or better in MA 201. Also recommended: a course in logic (e.g. PHI 120) or a course in calculus (e.g. MA 123).
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OFFICIAL COURSE COMPETENCIES/OBJECTIVES

Upon completion of this course, the student can:

1. Develop an understanding of fundamental concepts of geometry including point, line, angle, and plane.
2. Describe data and its characteristics including dispersion and central tendency, and solve problems involving these concepts.
3. Understand concepts of symmetry such as congruence, similarity, proportionality, and isometries as they relate to various plane shapes.
4. Select the appropriate representation for data display and interpret information presented in such graphical displays including bar graphs, line plots, circle graphs, and stem and leaf plots.
5. Practice the process of measurement and identify units in the standard systems of measurement.
6. Calculate the perimeter and area of various different shapes and the volume of various solids.
7. Draw reasonable conclusions based on the characteristics of a data set, and solve problems that involve finding the probability of an event.
8. Demonstrate an understanding of and solve application problems involving the concepts of permutations and combinations.
9. Identify projections, cross sections, and decompositions of common two dimensional and three dimensional figures.
10. Use deductive reasoning and counter examples to prove or disprove statements about two dimensional and three dimensional figures.
11. Develop notions about probability of events empirically through simulations and calculate these probabilities.

OFFICIAL COURSE OUTLINE (Approved Fall 2007)

- I. Geometry and Measurement
 - A. Develop visualization skills:
 1. Be familiar with projections, cross-sections, and decomposition of common two- and three-dimensional figures.
 2. Represent three-dimensional shapes in two dimensions and constructing three-dimensional objects from two-dimensional representations.
 3. Manipulate mentally physical representations of two- and three-dimensional shapes.
 4. Determine the rotational and line symmetries for two-dimensional shapes.
 - B. Develop familiarity with basic shapes and their properties:
 1. Know fundamental objects of geometry, including point, ray, line, and line segment.
 2. Develop an understanding of angles and how they are measured.
 3. Be familiar with plane isometries - reflections (flips), rotations (turns), and translations (slides).
 4. Understand congruence, similarity, and proportional reasoning via similarity.
 5. Learn technical vocabulary and understanding the importance of definition.
 6. Be familiar with currently available manipulatives and software that allow exploration of shapes.
 - C. Understanding the process of measurement and measurement techniques:
 1. Recognize different aspects of size.
 2. Understand the idea of unit and the need to select a unit appropriate to the attribute being measured.
 3. Know the standard (English and metric) system of units.
 4. Use measurement tools such as rulers and meter sticks to make measurements.
 5. Estimate using common units of measurement.
 6. Compare units and relate measurements within each of the two common systems of measure, English and metric.
 7. Understand that measurements are approximate and that different units affect precision.
 8. Understand role of π in measurement.
 9. Understand and use Pythagorean Theorem.
 - D. Understand length, area, and volume:
 1. Know what is meant by one-, two-, and three-dimensions.
 2. See rectangles as arrays of squares and rectangular solids as arrays of cubes.

3. Recognize the behavior of measure (length, area, and volume) under uniform dilations.
4. Devise area formulas for triangles, parallelograms, and trapezoids; knowing the formula for the area of a circle; be familiar with volume and surface area formulas for prisms, cylinders, and other three-dimensional objects.
5. Decompose and recompose non-regular shapes to find area or volume.
6. Understand the independence of perimeter and area; surface area and volume.

II. Data Analysis, Statistics, and Probability

A. Design data investigations (optional):

1. Understanding the kinds of questions that can be addressed by data.
2. Make decisions on what and how to measure.
3. Be familiar with how surveys and statistical experiments are designed and what can be learned from them.
4. Understand what constitutes a random sample and how bias is reduced.

B. Describe data:

1. Describe shape: symmetric versus skewed data distribution and what this indicates about the question being addressed by the data. (optional)
2. Describe spread: range, outliers, clusters (optional), gaps (optional), and what these indicate about the question being addressed by the data.
3. Describe center: mean, median, and mode and what these indicate about the question being addressed by the data.
4. Be familiar with different forms of graphical data representation, e.g. line plots, histograms, line graphs, bar graphs, box plots, pie charts, stem-and-leaf plots, among others; recognize that different forms of representation communicate different features of the data and that some representations are more appropriate than others for a given data set.
5. Comparing two sets of data (not always of the same size).

C. Draw conclusions:

1. Choose among representations and summary statistics to communicate conclusions.
2. Understand variability and the role it plays in decision making. (optional)
3. Understand some of the difficulties that arise in sampling and inference.
4. Recognize some of the ways that statistics and graphical displays of data can be misleading.

D. Develop notions of probability:

1. Making judgements under uncertainty.
2. Assign numbers as a measure of likelihood to single-stage and multi-stage events.
3. Understand conditional probability and some of its applications.
4. Be familiar with the idea of randomness.
5. Develop empirical probabilities through simulations; relate to theoretical probability.
6. Understand the notions of expected value and fairness and use probability to determine fairness. (optional)

GENERAL EDUCATION COMPETENCIES

- A. Knowledge of human cultures and the physical and natural worlds through study in the sciences and mathematics, social sciences, humanities, histories, languages, and the arts.
- B. Intellectual and practical skills, including
 - inquiry and analysis
 - critical and creative thinking
 - written and oral communication
 - quantitative literacy
 - information literacy
 - teamwork and problem solving
- C. Personal and social responsibility, including
 - civic knowledge and engagement (local and global)
 - intercultural knowledge and competence
 - ethical reasoning and action
 - foundations and skills for lifelong learning
- D. Integrative and applied learning, including synthesis and advanced accomplishment across general and specialized skills.

STUDENT LEARNING OUTCOMES FOR QUANTITATIVE REASONING (Approved Fall 2017)

In MA 202, students will learn to:

1. Interpret information presented in mathematical and/or statistical forms by (Gen Ed Comp B):
 - Developing an understanding of fundamental concepts of geometry including point, line, angle, and plane.
 - Describing data and its characteristics including dispersion and central tendency, and solve problems involving these concepts.
2. Illustrate and communicate mathematical and/or statistical information symbolically, visually, and/or numerically by (Gen Ed Comp A, B, C):
 - Understanding concepts of symmetry such as congruence, similarity, proportionality, and isometries as they relate to various plane shapes.
 - Selecting the appropriate representation for data display and interpret information presented in such graphical displays including bar graphs, line plots, circle graphs, and stem and leaf plots.
3. Determine when computations are needed and execute the appropriate computations by (Gen Ed Comp A, B):
 - Practicing the process of measurement and identify units in the standard systems of measurement.
 - Calculating the perimeter and area of various different shapes and the volume of various solids.
4. Apply an appropriate model to the problem to be solved by (Gen Ed Comp A, B, C):
 - Drawing reasonable conclusions based on the characteristics of a data set, and solve problems that involve finding the probability of an event.
 - Demonstrating an understanding of and solve application problems involving the concepts of permutations and combinations.
5. Make inferences, evaluate assumptions, and assess limitations in estimation modeling and/or statistical analysis by (Gen Ed Comp A, D):
 - Identifying projections, cross sections, and decompositions of common two dimensional and three dimensional figures.
 - Using deductive reasoning and counter examples to prove or disprove statements about two dimensional and three dimensional figures.
 - Developing notions about probability of events empirically through simulations and calculate these probabilities.