

# MGF1106 Course Outline

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## *Topics in Math* .....(3) (P)

Description: This course gives an overview of various branches of mathematics and their development. Topics to be studied are inductive and deductive reasoning, sets and Venn diagrams, logic, geometry, counting principles, permutations and combinations, probability, and descriptive statistics.

General Education Learning Outcome: The primary General Education Learning Outcome (GELO) for this course is Quantitative Reasoning, which is to understand and apply mathematical concepts and reasoning, and analyze and interpret various types of data. The GELO will be assessed through targeted questions on either the comprehensive final exam or an outside assignment.

Prerequisite: MGF1100 with a grade of “C” or better; OR MAT1033 or MAT1034 with a grade of “D” or better, OR the equivalent.

Rationale: In order to function effectively, competitively, and productively in a technological society that places complex demands upon the individual, students need a basic understanding of various mathematical concepts and their relationships to their present and future needs. This course will provide such a basic foundation.

Impact Assessment: *Topics in Mathematics* provides students with skills for proficiency in quantitative and analytical description of these topics. This course applies toward the General Education mathematics requirement area A for an Associate of Arts degree. *Topics in Mathematics* is a terminal course. It is not a prerequisite for any course, but it empowers the students with quantitative and analytical skills the students can use in many aptitude tests and satisfies other needs such as meeting the requirement for many degrees in business, the sciences, and the social sciences.

Broad Course Objectives: This course supports the following goals of the Math Department.

- Engage students in sound mathematical thinking and reasoning. This should include students finding patterns, generalizing, and asking/answering relevant questions.
- Provide a setting that prepares students to read and learn mathematics on their own.
- Explore multiple representations of topics including graphical, symbolic, numerical, oral, and written. Encourage students to make connections among the various representations to gain a richer, more flexible understanding of each concept.
- Analyze the structure of real-world problems and plan solution strategies. Solve the problems using appropriate tools.
- Develop a mathematical vocabulary by expressing mathematical ideas orally and in writing.
- Enhance and reinforce the students’ understanding of concepts through the use of technology when appropriate.

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As a result of successfully completing MGF1106, students should be able to demonstrate the following:

- Analyze/interpret quantitative data verbally, graphically, symbolically, and numerically.
- Communicate quantitative data verbally, graphically, symbolically, and numerically.
- Appropriately integrate technology into mathematical processes.
- Use mathematical concepts in problem-solving through integration of new material and modeling.

## Topical Outline with Specific Course Objectives:

### *I. Inductive and Deductive Reasoning*

- A. Use inductive reasoning to reason to a general conclusion through observations of specific cases.
- B. Use deductive reasoning to reason to a specific conclusion from a general statement.

### *II. Sets and Venn Diagrams*

- A. Indicate sets by description, roster form, and set-builder notation.
- B. Categorize equal and equivalent sets.
- C. Use symbols to illustrate the relationship between sets and to distinguish elements from subsets.
- D. Construct Venn diagrams to illustrate set relationships.
- E. Determine new sets from old using any combination of the set operations complement, intersection, and union. (The difference of two sets and the Cartesian product are optional.)
- F. Use Venn diagrams to determine if statements involving sets are equal.
- G. Solve practical problems using sets.

### *III. Logic*

- A. Write negations of statements, including ones that contain quantifiers such as *all*, *none*, and *some*.
- B. Translate verbal compound statements (*not*, *and*, *or*, *if-then*, and *if and only if*) into symbolic form, and vice versa.
- C. Construct truth tables for compound statements.
- D. Determine if statements are logically equivalent.
- E. Use De Morgan's laws to write equivalent statements.
- F. Use variations of the conditional (converse, inverse, and contrapositive) to write equivalent statements.
- G. Determine whether symbolic arguments are valid or invalid.
- H. Use Euler diagrams to determine whether syllogistic arguments are valid or invalid.

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## IV. *Geometry*

- A. Classify lines (intersecting, parallel, perpendicular, skew) and angles (right, acute, obtuse, straight).
- B. State and apply the basic relationships between special pairs of angles such as complementary, supplementary, vertical, alternate interior, alternate exterior, and corresponding.
- C. Classify polygons including special types of triangles (acute, obtuse, right, isosceles, equilateral, scalene) and quadrilaterals (trapezoid, parallelogram, rhombus, rectangle, square).
- D. Use proportions to find missing lengths in similar figures.
- E. Calculate the perimeter and area of two-dimensional figures such as triangles, squares, rectangles, trapezoids, and circles.
- F. State and apply the Pythagorean theorem.
- G. Classify three-dimensional figures including special types of polyhedra (platonic solids, prisms, pyramids).
- H. Calculate the volume of three-dimensional figures such as rectangular solids, cubes, cylinders, cones, and spheres.
- I. Calculate the surface area of three-dimensional figures such as rectangular solids, cubes, cylinders, and spheres.

## V. *Probability*

- A. Determine empirical probabilities.
- B. Determine theoretical probabilities using the definition.
- C. Use the fact that the sum of the probabilities of all possible outcomes of an experiment is 1.
- D. Write the sample space for an experiment.
- E. Use tree diagrams to determine probabilities.
- F. Find the probability of event *A* or event *B*.
- G. Find the probability of event *A* and event *B*.
- H. Solve probability problems by using combinations.

## VI. *Counting Principles*

- A. Use the formula  $n(A \cup B) = n(A) + n(B) - n(A \cap B)$ .
- B. Count the number of items or events by listing them.
- C. State and apply the Fundamental Counting Principle.

## VII. *Permutations and Combinations*

- A. Evaluate factorials.
- B. Define the terms *permutation* and *combination*.
- C. Count permutations.
- D. Calculate a specified permutation.
- E. Count combinations
- F. Calculate a specified combination

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## VIII. *Descriptive Statistics*

- A. Organize and display data using tools such as frequency distributions, histograms, frequency polygons, and stem-and-leaf displays.
- B. Find and interpret measures of central tendency such as mean, median, and mode. Midrange is optional.
- C. Find and interpret measures of dispersion such as range and standard deviation.
- D. Apply the empirical rule which states the following. In any normal distribution,
  - Approximately 68% of all the data lies within one standard deviation of the mean (in both directions).
  - Approximately 95% of all the data lies within two standard deviations of the mean (in both directions).
  - Approximately 99.7% of all the data lies within three standard deviations of the mean (in both directions).
- E. Determine the relative relationships between the mean, median, and mode for various distributions.

Evaluation: Each instructor will determine the specific criteria for determining the final course grade. These criteria will be delineated in the first day handout provided to each student. Each instructor will give a comprehensive departmental common final exam during the assigned final exam period.

Commonality: All instructors will use the same textbook and cover all topics in the topical outline. A graphing calculator may be required for this course. Either the TI-83 or the TI-84 line of calculators is recommended; any other graphing calculator will need to be approved by the instructor. However, NO calculator may be used on the final exam.