

Test Content — Mathematics (4IMF)

The Major Field Test in Mathematics consists of 50 questions, some of which may be grouped in sets and based on such materials as diagrams and graphs. The questions are drawn from the courses of study most commonly offered as part of an undergraduate mathematics curriculum. Programs can choose when and where to administer the tests. It is designed to take two hours and may be split into two sessions. This test must be given by a proctor. Mathematical operations do not require the use of a calculator.

The outline below shows the content areas covered on the test and the approximate distribution of questions among the areas.

The Test Outline

I. Calculus (~30%): includes the usual material from three semesters of:

- A. Calculus
- B. Single-variable calculus
- C. Multivariable calculus
- D. Separable differential equations

II. Algebra (~30%)

- A. Linear Algebra
 - 1. Matrices
 - 2. Linear transformations
 - 3. Eigenvalues and eigenvectors
 - 4. Vector spaces
 - 5. Systems of linear equations
- B. Abstract Algebra
 - 1. Elementary theory of groups, rings and fields
 - 2. Elementary topics from number theory

III. Additional Topics (~40%)

- A. Complex analysis
- B. Differential equations
- C. Discrete mathematics (including graph theory and combinatorics)
- D. Foundations (including logic, proofs, sets, functions and relations)
- E. Geometry
- F. Point-set topology
- G. Probability and statistics
- H. Real analysis

The relative percentages of mathematics questions at various cognitive levels are listed below:

- I. Routine (~55%): Includes only two or three definitions and no more than a two-step reasoning process, or involves standard techniques normally taught and practiced extensively in a course that is generally required or strongly recommended for all math majors at most institutions.
- II. Nonroutine (~25%): Includes all items that are considered insightful. Also includes items that require several steps of reasoning and items that require either the use of several definitions or a new definition that the student would not be expected to know. Some questions may require bringing techniques from two or more areas to bear on one problem (e.g., treating differentiable functions as elements of an algebraic system).

- III. Applied (~20%): There is conceptual overlap between the cognitive-level categories of applied, routine, and non-routine. The general nature of the question will determine the category for the question. For example, all questions with real-world settings are placed in the applied category. On the other hand, questions involving standard applications of one area of mathematics to another, such as using differential calculus to solve geometric problems, would not be placed in the applied category.

How scores for the Major Field Test in Mathematics are reported

Total Score – Reported for each student and summarized for the group.

Assessment Indicators – Reported for the group* only.

- Calculus (15)
- Algebra (15)
- Routine (27–28)
- Nonroutine (12–13)
- Applied (10)

Numbers in parentheses are the approximate number of questions in each category.

* A minimum of five (5) students is required for assessment indicators to be reported.