

## **Academic Preparation for College: What Students Need to Know and Be Able to Do**

**Prepared by the College Board  
through the Educational Equality Project  
1983**

### **Why?**

The College Entrance Examination Board's Office of Academic Affairs was concerned about the vast number of high school graduates inadequately prepared for college. In an attempt to improve student success rates in college, the Educational Equality Project set out to improve the quality of high school education. The final product of the project, *What Students Need to Know and Be Able to Do*, provides a framework for curricula that outlines, and provides justification for, the knowledge and skills students need to get the most out of college education. It offers assistance in planning and prioritizing curriculum and also promotes collaboration between high schools and colleges to meet the needs of all students.

### **What?**

The Educational Equality Project, a 10-year effort of the College Entrance Examination Board's Office of Academic Affairs, was committed to strengthening the quality of education in the secondary schools, and assuring that an equal opportunity existed for all students to attend college.

### **Who?**

The College Board is a member organization consisting of more than 2,500 colleges, schools, school systems and educational organizations. Representatives of the membership served on the committees and councils for this project. The advisory committee for mathematics is detailed below, followed by a special committee assigned to address computer competency.

#### ***Mathematical Sciences Advisory Committee***

- Donald L. Kreider, Professor of Mathematics, Dartmouth College, Chair
- Floyd L. Downs, Mathematics Teacher, Hillsdale High School, San Mateo, California
- Stephen J. Garland, Professor of Mathematics and Chairman of Program in Computer and Information Services, Dartmouth College
- John W. Kenelly, Visiting Professor of Mathematics, United States Military Academy
- Jeremy Kilpatrick, Professor of Mathematics Education, University of Georgia
- Jane Cronin Scanlon, Professor of Mathematics, Rutgers University
- Ara B. Sullenberger, Associate Professor of Mathematics, Tarrant County Junior College, Texas

### ***Ad Hoc Panel on Computer Competency***

- Floyd L. Downs, Mathematics Teacher, Hillsdale High School, San Mateo, California
- Donald L. Kreider, Professor of Mathematics, Dartmouth College
- Marlaine Lockheed, Senior Research Scientist, Educational Testing Service
- Moises Perez-Martinez, Assistant to the Director of Education, National Urban League, Inc.
- Matthew Quinn, Graduate Dean, Iona College
- Paul Shapiro, Coordinator of High School Computer Programs, Newton Public Schools, Massachusetts
- Dorothy S. Strong, Director of Mathematics, Chicago Public Schools, Illinois

Other committees and advisory panels included the:

- English Advisory Committee
- Sciences Advisory Committee
- History Advisory Committee
- Foreign Language Advisory Committee
- Ad Hoc Arts Advisory Committee
- Members of the Council on Academic Affairs, 1980-83,
- Members of the Advisory Panel on Minority Concerns, 1980-82

Committees consisted of university professors and secondary teachers; panels included other school personnel and students.

### **What was produced?**

The final product of Educational Equality Project was a booklet that addressed the vast number of students who were inadequately prepared for college. The booklet, *What Students Need to Know and Be Able to Do*, attempted to improve student success rates in college by improving the quality of education in high school. The project focused not only on the quality, but also on equality. All students needed to be adequately prepared for their future, whether or not their future includes college. The major sections of the booklet are the following:

- I. Identifying the Outcomes
- II. The Basic Academic Competencies
- III. Computer Competency: An Emerging Need
- IV. The Basic Academic Subjects
- V. Achieving the Outcomes

#### Appendixes

- A. Observing: A Competency to Consider
- B. Members of the Council on Academic Affairs, 1980–83
- C. Members of the Advisory Panel on Minority Concerns, 1908–82
- D. Members of the Academic Advisory Committees, 1981–83
- E. Members of the Ad Hoc Panel on Computer Competency, 1983
- F. List of Dialogues

The College Board defined Academic Preparation as the “comprehensive description of the knowledge and skills needed by all college entrants” (p. 2). It focuses on *what* students learn. Granted, it is biased towards the knowledge that would be most beneficial for college success, but it is just as valuable to those not attending college. The “coherent, cumulative pattern of learning” (p. 3) proposed as Academic Preparation would be its own reward.

Academic Preparation would be attained through the interactions between the Basic Academic Subjects and the Basic Academic Competencies. The Basic Academic Competencies, the general skills necessary for effective work in all subjects, are a result of learning and intellectual discourse. The competencies are reading, writing, speaking and listening, mathematics, reasoning, and studying. The competencies are presented as a list of abilities students need to develop in high school. The Basic Academic Subjects, the outcomes of learning, are English, Arts, Mathematics, Science, Social Studies, and Foreign Language. *Why* the subject was valuable and *what* students need to know and do regarding the subject were described, followed by detailed lists of objectives. Finally, the Project identifies the characteristics needed for success in college, which are drive, motivation, interest, intelligence, experience, and adaptability.

The booklet states that it does not describe a curriculum for high school and it does not identify specific courses; rather, it provides a framework for curricula. It outlines the knowledge and skills students need to get the most out of their college education. It also indicates that while the competencies and proficiencies are listed independently, they are related in many ways. Following are the mathematics-related competencies and proficiencies identified by the Board:

## **The Basic Academic Subjects**

### ***Mathematics***

- ◆ The ability to apply mathematical techniques in the solution of real-life problems and to recognize when to apply those techniques.
- ◆ Familiarity with the language, notation, and deductive nature of mathematics and the ability to express quantitative ideas with precision.
- ◆ The ability to use computers and calculators.
- ◆ Familiarity with the basic concepts of statistics and statistical reasoning.
- ◆ Knowledge in considerable depth and detail of algebra, geometry, and functions.
- ◆ More specifically, college entrants will need the following preparation in mathematics.

## **Basic Mathematics-Related Academic Competencies**

### ***Mathematics***

- ◆ The ability to perform, with reasonable accuracy, the computations of addition, subtraction, multiplication, and division using natural numbers, fractions, decimals, and integers.
- ◆ The ability to make and use measurements in both traditional and metric units.
- ◆ The ability to use effectively the mathematics of: integers, fractions, and decimals; ratios, proportions, and percentages; roots and powers; algebra; geometry.
- ◆ The ability to make estimates and approximations, and to judge the reasonableness of a result.
- ◆ The ability to formulate and solve a problem in mathematical terms.

- ◆ The ability to select and use appropriate approaches and tools in solving problems (mental computation, trial and error, paper-and-pencil techniques, calculator, and computer).
- ◆ The ability to use elementary concepts of probability and statistics.

### ***Reasoning***

- ◆ The ability to identify and formulate problems, as well as the ability to propose and evaluate ways to solve them.
- ◆ The ability to recognize and use inductive and deductive reasoning, and to recognize fallacies in reasoning.
- ◆ The ability to draw reasonable conclusions from information found in various sources, whether written, spoken, or displayed in tables and graphs, and to defend one's conclusions rationally.
- ◆ The ability to comprehend, develop, and use concepts and generalizations.
- ◆ The ability to distinguish between fact and opinion.

### ***Science***

Additionally, the following mathematic skills were detailed under science in basic academic subjects:

- ◆ A quantitative understanding of one field of science.
- ◆ Ability to interpret data presented in tabular and graphic form.
- ◆ Ability to draw conclusions or make inferences from data.
- ◆ Ability to select and apply mathematical relationships to scientific problems.
- ◆ Ability to use mathematical relationships to describe results obtained through experiments and observations.
- ◆ Ability to interpret relationships presented in mathematical forms in nonmathematical language.

### **Basic Mathematics-Related Proficiencies**

*Detailed below are the proficiencies for college entrants. The solid diamonds represent the proficiencies for all college entrants. The discrete diamonds are for those college entrants expecting to major in science or engineering or to take advanced courses in mathematics or computer science.*

### ***Computing***

- ◆ Familiarity with computer programming and the use of prepared computer programs in mathematics.
- ◆ The ability to use mental computation and estimation to evaluate calculator and computer results.
- ◆ Familiarity with the methods used to solve mathematical problems when calculators or computers are the tools.
- ❖ The ability to write computer programs to solve a variety of mathematical problems.
- ❖ Familiarity with the methodology of developing computer programs and with the considerations of design, structure, and style that are an important part of this methodology.

### *Statistics*

- ◆ The ability to gather and interpret data and to represent them graphically.
- ◆ The ability to apply techniques for summarizing data using such statistical concepts as average, median, and mode.
- ◆ Familiarity with techniques of statistical reasoning and common misuses of statistics.
- ❖ Understanding of simulation techniques used to model experimental situations.
- ❖ Knowledge of elementary concepts of probability needed in the study and understanding of statistics.

### *Algebra*

- ◆ Skill in solving equations and inequalities.
- ◆ Skill in operations with real numbers.
- ◆ Skill in simplifying algebraic expressions, rational and radical expressions.
- ◆ Familiarity with permutations, combinations, problems, the binomial theorem, and simple counting techniques.
- ❖ Skill in solving trigonometric, exponential, and logarithmic equations.
- ❖ Skill in operations with complex numbers.
- ❖ Familiarity with arithmetic and geometric series and with proofs by mathematical induction.
- ❖ Familiarity with simple matrix operations and their relation to systems of linear equations.

### *Geometry*

- ◆ Knowledge of two- and three-dimensional figures and their properties.
- ◆ The ability to think of two- and three-dimensional figures in terms of symmetry, congruence, and similarity.
- ◆ The ability to use the Pythagorean theorem and special right triangle relationships.
- ◆ The ability to draw geometrical figures and use geometrical modes of thinking in the solving of problems.
- ❖ Appreciation of the role of proofs and axiomatic structure in mathematics and the ability to write proofs.
- ❖ Knowledge of analytic geometry in the plane.
- ❖ Knowledge of the conic sections.
- ❖ Familiarity with vectors and with the use of polar coordinates.

### *Functions*

- ◆ Knowledge of relations, functions, and inverses.
- ◆ The ability to graph linear and quadratic functions and use them in the interpretation and solution of problems.
- ❖ Knowledge of various types of functions including polynomial, exponential, logarithmic, and circular functions.
- ❖ The ability to graph such functions and to use them in the solution of problems.

## Significance of the Report

The *Academic Preparation* document:

- identified what students (college and non-college bound) need to learn to be successful;
- provided a powerful tool for students, teachers, guidance counselors, parents, principals, and school board members;
- created an opportunity for collaborative work between high schools and college to better meet the needs of all students;
- challenged the concerned parties to make the necessary changes in planning and prioritizing curriculum;
- was forward thinking in regards to technology requirements for students.

In addition, it suggested ways to include problem-solving activities, real-world problems, and the basic concepts of statistics and statistical reasoning in curricular materials and to align them with the recommendations from recent reports including *Agenda for Action*, National Institute of Education Conference on Basic Mathematics Skills and Learning, and the NACOME Report.