

Department of Mathematics & Computer Science

California State University, East Bay
Hayward, CA 94542-3092

Bachelor of Science in Mathematics

Important University Resources

Department of Mathematics and Computer Science,
North Science 335; 885-3414

Mathematics and Computer Science Student Center,
North Science 337; 885-4011

Enrollment Services, Warren Lobby; 885-2784

University Advisement Center (UAC), 885-4682

Office of Financial Aid, Warren Hall 545; 885-3616

Office of Assessment & Evaluations,
Warren Hall 438; 885-3661

Open University, Warren Hall 245; 885-3814

Transfers from California public colleges:
Equivalent courses: <http://www.assist.org>

University Web Page: <http://www.csueastbay.edu>

Department E-mail: mathcs@csueastbay.edu

Department Web Page:
<http://www.mcs.csueastbay.edu>

See BS Math Brochure on Department Web Page:
Planning the major (sample programs)
Tentative plan for evening class offerings
Department scholarships (apply in early Spring)
Other information

If you are considering graduate school, mathematics is often an excellent undergraduate background – not only for graduate work in mathematics itself, but even for an M.B.A. program, or medical or law school. Many people look at a degree in mathematics as proof of intelligence and a logical approach to problem solving.

2 Mathematics at Cal State East Bay

The Mathematics and Computer Science Department is a large and flourishing department, offering a variety of courses at a variety of times. There are over 30 full-time faculty members, with a wide range of backgrounds and interests. The Department offers more than 50 undergraduate mathematics courses, and about 15 graduate courses. It offers a mathematics major (B.S.), a minor, a mathematics option for liberal studies majors, and a graduate degree program (M.S.).

Besides the day program, there are many evening classes. A student can complete the mathematics major entirely in the evening. Many students at the University are working and attending school only evenings or part-time, and the Department and University pays special attention to their needs.

Cal State East Bay offers unique opportunities. Students choose CSUEB because it is a low-cost, convenient school with a good reputation. It is located in the Hayward hills, overlooking the San Francisco Bay and is within easy reach of most of the Bay Area. Many students commute to class; there are a limited number of on-campus housing units available. CSUEB is large enough (about 13,000 students) to offer many specialities, but small enough that each student can receive individual attention. The University offers a multicultural environment, with students of many nationalities, ethnic backgrounds, and of all ages. It operates on the quarter system, with four full quarters each year. Students can arrange their schedules to fit their needs, taking four quarters each year to finish more quickly, or taking summer (or a different) quarter off as vacation.

Financial aid (loans, grants, work-study) based on need is available through the university. Also, both the Department and the School of Science offer merit scholarships.

1 Mathematics as a Major

Modern technological society has many fields that need specialists in mathematics. In the coming years, there will be an increasing number of job opportunities for those who know and use mathematics. These include scientists, researchers, space technicians, mathematics teachers, actuaries and insurance specialists, and people who can combine mathematical knowledge with a scientific, computer, or business background.

3 The Mathematics Major

The mathematics major requires a certain number of specific courses, plus a choice of electives. Note that some of these courses have **CS** prefixes. Also, some electives are offered by the Statistics Department; these have a **Stat** prefix.

3.1 Lower Division Courses: 24 units

First, there are six required lower division courses. These are generally taken during the first two years, and may be taken at a community college. Notice that the sequence begins with a calculus course; some students may need to begin with college algebra or trigonometry courses for preparation. Students taking the calculus sequence at a community college should be particularly careful about equivalencies; it may require four quarters (or three semesters) of calculus to cover the three-quarter sequence below. Information about equivalent courses at local community colleges is available from the Mathematics and Computer Science Student Center.

Math 1304 Calculus I

Math 1305 Calculus II

Math 2304 Calculus III

Math 2101 Elements of Linear Algebra

Math 2150 Discrete Structures

CS 1160 Introduction to Computer Programming

3.2 Upper Division Requirement: 44 units

There are three different options within the mathematics major, and each student is required to complete the courses under one of them. The option that you choose should correspond to your interests and the use you plan to make of your major. You might also note that many courses are required for all three of the options, so that it is possible to delay choosing an option until well into your junior (or even senior) year.

Classes required for all options include: Differential Equations (3331), Abstract Algebra I (3121), Analysis I (3300), and Linear Algebra (3100).

Two general recommendations are in order. First, the four courses above are basic to the major and should be taken early in upper division standing. Second, all majors need at least one of the sequences 3121-3122 and 3300-3301. The two parts of each sequence should be taken in consecutive quarters. This keeps basic material fresh in the mind, and also allows a better transition from one course to the next, with no overlaps or missing gaps. Note that courses required under any option can be used as electives in the other, so that you will probably not have any problems if you change your mind about the option you are working toward.

Each option requires upper division 44 units. The options do have a varying number of electives. In all cases, these can be chosen from the upper division mathematics courses, including the upper division cross-listed courses from Statistics and Computer Science. The exception is that they may

not include Math 3898, 4021, 4022, 4023. Most electives are 4 unit courses; exceptions include Math 4900 and 4901.

Option A This might be called the "general math" option.

It is a good choice for many students. It includes sequences in what are sometimes thought of as the two most fundamental areas of mathematics, algebra and analysis. Those considering graduate school should definitely take both sequences, and may take this option.

Math 3000 Introduction to Abstract Mathematics and Proofs

Math 3331 Differential Equations

Math 3121-3122 Abstract Algebra, two course sequence

Math 3300-3301 Analysis, two course sequence

Math 3100 Linear Algebra

Sequence One two-course sequence chosen from:

Math 3151-4151 Combinatorial Mathematics *or*

Math 3215-4215 Geometry *or*

Math 3361-4361 Differential equations *or*

Math 3750-4750 Numerical Analysis *or*

Math 3841-4841 Optimization

Electives 8 units of upper division mathematics courses.

Option B Applied Mathematics. This option is aimed toward applications of mathematics. It is especially useful for students interested in scientific applications, computer science, or actuarial work.

Math 3000 Introduction to Abstract Mathematics and Proofs

Math 3331 Differential Equations

Math 3100 Linear Algebra

Math 3121 Abstract Algebra I

Math 3300 Analysis I

Math 3122 or Math 3301 Either Abstract Algebra II *or* Analysis II

Sequences Two sequences chosen from

Math 3151-4151 Combinatorial Mathematics *or*

Math 3361-4361 Differential equations *or*

Math 3750-4750 Numerical Analysis *or*

Math 3841-4841 Optimization

Electives 4 units of upper division electives.

Option C Mathematics Teaching. These courses include a wide background in mathematics, including its history. Many areas are represented; geometry and number theory are specifically required. These courses are chosen to prepare majors for careers in secondary school teaching. See section 3.3 which discusses the credential program.

Math 3000 Introduction to Abstract Mathematics and Proofs

Math 3331 Differential Equations
Math 3121 Abstract Algebra I
Math 3100 Linear Algebra
Math 3215 Geometry I
Math 3300 Analysis I
Math 3600 Number Theory
Math 4040 History of Mathematics
Stat 3401 Introduction to Probability Theory
Math 3122 or Math 3301 or Math 4215
 Abstract Algebra II or Analysis II or Geometry II
Electives 4 units of upper division electives

Math 3331 Differential Equations (4)
Math 4215 Geometry II (4)
CS 1020 Introduction to Computers (4)
CS 2360 Programming Methodology and Intro. to Software Engineering (4)
CS 2340 Computer Organization and Assembly Language Programming (4)
Stat 2010 Elements of Statistics for Business and Economics (5)
Stat 3010 Statistical Methods in the Social Sciences (4)
Stat 3401 Introduction to Probability Theory (4)
Stat 3502 Statistical Inference I (4)
Chem 1101, 1102, 1103 General Chemistry (5 each)
Econ 2301, 2302 Principles of Microeconomics (4 each)
Mgmt 3100 Introduction to Quantitative Methods in Business (4)
Phil 1001 Introduction to Logic (4)
Phil 3002 Modern Logic (4)
Phys 1101, 1102, 1103 General Physics (5 each)

3.3 Credential Program in Mathematics

Those students completing option C can easily satisfy the requirements of the Single Subject Matter Preparation Program in Mathematics, designed to prepare students for entry into the Credential Program in Mathematics.

To do this, a student should choose the following electives under Option C.

Math 4901 Senior Seminar
Math 4900 Independent Study/Tutoring in Mathematics ¹
Elective 4-unit upper division Mathematics elective

Besides the major, the student needs certain other courses. Also required are twenty-two units of approved courses for breadth and perspective. These courses should be chosen with the help and approval of the student's advisor. Note that 7 of these can be used toward the major. These are CS 1160, Math 4900, Math 3100, Math 3331, Math 4215, and Stat 3501, Stat 3502.

The twenty-two units must be chosen as follows:
 One course in computer science

CS 1160 Introduction to Computer Science (4)

One course from the following list, or other field experience approved by the Mathematics Credential Preparation Advisor.

TED 2801 Field Experience in Teaching (3)
Math 3898 Cooperative Education (2)

Math 4900 Independent Study: Tutoring in Mathematics (2-3)

Remaining courses are to be chosen from the following list, or from other related courses approved by the Mathematics Credential Preparation Advisor.

Math 3100 Linear Algebra (4)

¹ Two units experience in teaching and tutoring mathematics. These may be earned by tutoring in the departmental Math Lab for 3 hours per week over a period of two quarters, or for 6 hours per week during a single quarter. Prospective Math Lab tutors must apply in the Math/C.S. Student Center.

Further information is available in the catalog (see Single Subject Matter Preparation Programs) or from the department.

3.4 Mathematics Minor

A Mathematics minor consists of the lower division Calculus and Linear Algebra courses, which are also required for the Computer Science major, along with three approved upper division mathematics electives. Two of the electives must be from the following list.

Math 3100 Linear Algebra
Math 3121 Abstract Algebra I
Math 3215 Geometry I
Math 3300 Analysis I
Math 3331 Differential Equations

The courses Math 3100 and Math 3331 are particularly recommended for their applications in Computer Science. Note that Math 3121 is a prerequisite for Math 3100.

Computer Science majors may complete a Mathematics minor with few (or no) additional courses by using the two math courses from the above list as the eight hours of non-C.S. courses allowed in the Electives area). They may also use a cross-listed course such as Math/CS 3750, 4750, 4245, or 4170 as the mathematics minor elective.

The above satisfies the University requirements for a minor: at least 12 units upper division, at least 18 units outside the major, and at least 12 units taken at Cal State East Bay.

3.5 Computer Science Minor

All mathematics majors should consider taking Computer Science courses since the two disciplines are closely related and knowing both is an advantage in knowledge and job possibilities. The minor in Computer Science is fairly easy to get for mathematics majors; a double major is also possible.

A student can complete a major in mathematics with a minor in Computer Science by completing the courses listed above for mathematics and in addition, taking

CS 2360 Programming Methodology and Introduction to Software Engineering

CS 2430 Assembly Language Programming

Any two of: CS 3120, CS 3240, CS 3430, CS 4560 (Programming Language Concepts, Data Structures and Algorithms, Computer Architecture, Operating Systems)

One Elective Wide choice of upper division Computer Science courses

The above satisfies the University requirements for a minor: at least 12 units upper division, at least 18 units outside the major, and at least 12 units taken at Cal State East Bay.

4 Graduation Requirements

To graduate from CSUEB, a student must complete at least 186 quarter units, meet the General Education/Breadth requirements, and satisfy certain other requirements listed in the catalog (Writing Skills, U.S. History, etc.). The Mathematics Major consists of 68 units (17 or more courses).

To complete the graduation requirements in four years (12 quarters), a student must take about 15 or 16 units per quarter. Many CSUEB students are attending school while working or fulfilling family obligations; the "average" student takes about 12 units per quarter, and requires more than four years to graduate.

The units not used for the major or for G.E. requirements can be used for (i) a second major, (ii) a minor, (iii) courses in other areas that interest the student.

Transfer students must meet certain unit requirements. For instance,

- at least 45 units in residence at CSUEB
- at least 60 units in courses numbered 3000 or above
- at least 18 units in Mathematics at CSUEB (for a mathematics major)
- at least 12 General Education (G.E.) units at CSUEB

One course may count toward several of these requirements at once. For example, a 3000 level history course may count for residence units, for units above 3000, and for G.E. units taken in residence.

A complete description of graduation requirements is listed in the catalog, and each student should read carefully the section in the catalog for the year that covers his graduation.

4.1 Double Majors: Math and CS

Students who wish to combine two majors, Mathematics and Computer Science. This double major should give a strong background, impressing future employers or preparing the student for graduate study. All students should consider a double major, or a major with a minor in Computer Science. Many courses are common to both majors (such as the three calculus courses, linear algebra, and introductory computer science), so that a double major is possible with hours free for General Education courses and electives.

4.2 Restrictions in planning your own schedule

Students planning their own schedules should take careful note of course prerequisites. Consult the catalog when choosing courses!

They should also take note of some restrictions on when courses are offered. Many upper division courses are given only once a year, or once every other year.

Most of the lower division courses are offered every quarter, including summer. This includes calculus (1304, 1305, 2304), linear algebra (2101), and discrete mathematics (2150).

5 Part-time, Evening Students

Many students at CSUEB are completing their educations while managing other responsibilities. The Department and University try to pay attention to the needs of part-time and evening students.

A part-time student will generally only take one to three courses each quarter. Mathematics courses are often challenging, and should probably be combined with electives for a manageable schedule.

Many part-time students are transferring from community colleges, and have completed all their lower division mathematics requirements and sixty quarter units of general education courses. This student would then need 44 units of mathematics and 58 units more of mathematics, G.E., and electives.

Part-time students who want to work out their own schedules should keep in mind the general pattern of the Department course offerings.

For students restricted to evening classes, the Mathematics Department offers some courses at night (and late afternoon) every quarter. Some remedial courses (below 1000), both courses for business majors (1810, 1820), and courses for elementary school teachers (4021-4023) are always available at night, except summer quarter. In addition, Math 1130 (College Algebra) is always available at night.