Mathematics and Computer Science

ABOUT THE DEPARTMENT
Mathematics and computer science are disciplines vital to both the liberal arts curriculum and to research in the natural and social sciences. The mission of the Mathematics and Computer Science Department at Bronx Community College is to prepare our diverse student population to be productive members of the global community with problem solving and critical thinking skills.

The department offers A.S. Degrees in both Mathematics and Computer Science.

Associate Professor and Chairperson: Dr. Nikolaos Apostolakis


Associate Professors: G. Leibman, S. Persinger, I. Petrovic, J. Pineiro, A. Togha, K. Taylor, Q. Fang


Lecturer: J. Kim, S. Donovan, S. Zybert

Approximately 60 adjuncts per semester

DEGREE PROGRAMS
Computer Science, A.S.
Mathematics, A.S.

COURSES
Computer Science (CSI)
Mathematics (MTH)

COMPUTER SCIENCE
Associate in Science Degree | Transfer Degree
Department of Mathematics and Computer Science

The Computer Science Curriculum provides an introduction to the field of computer science to ensure successful transfer to a senior college Computer Science program. Students learn to construct, verify and implement algorithms by writing and running programs in standard programming languages. The curriculum provides a broad background in science and the humanities as well as a thorough grounding in discrete and continuous mathematics. The Computer Science A.S. program articulates with the Computer Science B.S. program at Lehman College and the B.A. and B.S. programs at Iona College. BCC Computer Science graduates have successfully transferred to City College, Polytechnic University, Rensselaer Polytechnic University, Clarkson University, and others.

Students interested in curricula emphasizing computer applications such as the A.S. degree in Business Administration (Computer Programming Option) or the A.A.S. degree in Computer Information should consult the Business and Information Systems Department.

Curriculum Coordinator: Dr. Sharon Persinger

Computer Science Curriculum (Pathways)
60 Credits required for A.S. Degree

Common Core
A. English Composition (6 Credits)
B. Mathematical and Quantitative Reasoning (4 Credits)
  • MTH 31 Calculus and Analytic Geometry I (4 Credits)
C. Life and Physical Sciences
  • SCIENCE I BIO 11 General Biology I OR
    CHM 11 General College Chemistry I OR
    PHY 11 College Physics I OR
    PHY 31 Physics I (4 Credits)
SUBTOTAL 14

Flexible Core
A. World Cultures and Global Issues (3 Credits)
B. U.S. Experience in Diversity (3 Credits)
C. Creative Expression (3 Credits)
D. Individual and Society (3 Credits)
E. Scientific World
  • CSI 30 Discrete Mathematics I (3 Credits)
Additional course from the Flexible Core E
  • SCIENCE II BIO 12 General Biology II OR
    CHM 12 General College Chemistry II OR
    PHY 12 College Physics II OR
    PHY 32 Physics II (4 Credits)
SUBTOTAL 19
Specialization Requirements

- MTH 32 Analytic Geometry and Calculus II (5 Credits)
- MTH 33 Analytic Geometry and Calculus III (5 Credits)
- CSI 31 Introduction to Computer Programming I (3 Credits)
- CSI 32 Introduction to Computer Programming II (3 Credits)
- CSI 35 Discrete Mathematics II (3 Credits)
- CSI 33 Data Structures (3 Credits)

SUBTOTAL 22

Free Electives

MTH 30 † and / or Free Elective (1-5 Credits)

1 Students requiring MTH 30 must use free elective credits for this purpose.
2 SCI I and II must form a sequence, e.g., BIO 11 and 12.

NOTE: The program has been given a waiver to require its students to take MTH 31 to fulfill Required Area B, BIO 11 or CHM 11 or PHY 11 or PHY 31 to fulfill Required Area C, CSI 30 to fulfill Flexible Area E, BIO 12 or CHM 12 or PHY 12 or PHY 32 to fulfill the 6th course in the Flexible Core. If students transferring into this program complete different courses in these areas, they will be certified as having completed the Common Core requirements, but it may not be possible for them to finish their degree within the regular number (60) of credits.

COMPUTER SCIENCE (PRE-PATHWAYS)

Associate in Science Degree | Transfer Degree
Department of Mathematics and Computer Science

If you began studying at BCC in or after Fall 2013, Pathways applies. Pathways also applies to students who have returned to CUNY after an absence of more than one semester. If you are a continuing student who entered before Fall 2013, you will be able to choose whether you remain with your existing requirements or change to Pathways. You should consult with an academic advisor.

Curriculum Coordinator: Dr. Sharon Persinger

Core Requirements

- ENG 10 Fundamentals of Composition and Rhetoric OR ENG 11 Composition and Rhetoric I (3 Credits)
- CMS 11 Fundamentals of Interpersonal Communication (3 Credits)
- HIS 10 History of the Modern World OR HIS 11 Introduction to the Modern World (3 Credits)
- MTH 31 Calculus and Analytic Geometry I (4 Credits)
- SCIENCE* A two-semester sequence in a Laboratory science (8 Credits)

TOTAL 21

Required Areas of Study

- ENG 12 Composition and Rhetoric II OR ENG 14 Written Composition and Prose Fiction OR ENG 15 Written Composition and Drama OR ENG 16 Written Composition and Poetry (3 Credits)
- ART 11 Introduction to Art OR MUS 11 Introduction to Music (3 Credits)
- HISTORY OR SOCIAL SCIENCE Select from Anthropology, Economics, Geography, History, Philosophy, Political Science, Psychology, OR Sociology (3 Credits)

TOTAL 9

Specialization Requirements

- MTH 32 Calculus and Analytic Geometry II (5 Credits)
- MTH 33 Calculus and Analytic Geometry III (5 Credits)
- CSI 30 Discrete Mathematics I (3 Credits)
- CSI 31 Introduction to Programming I (3 Credits)
- CSI 32 Introduction to Programming II (3 Credits)
- CSI 35 Discrete Mathematics II (3 Credits)
- CSI 33 Data Structures OR DAT 41 Assembly Language Programming (3 Credits)

TOTAL 25

FREE ELECTIVES†

- To complete the 60 credit requirement (5 Credits)

NOTE: Students who are required to take MTH 30, a prerequisite for MTH 31, must use elective credits.

NOTE: At least two courses must be taken from a list designated as “Writing Intensive” as published each semester in the Registration Guide and Schedule of Classes.

*The laboratory science sequence may be chosen from BIO 11-12, CHM 11-22, PHY 11-12 or PHY 31-32. Students should consult the college to which they intend to transfer as to choosing an appropriate sequence. Students who plan to transfer to City College should take PHY 31-32 and are encouraged to take PHY 33, MTH 34, and MTH 35.

**Students should consult the requirements of the senior college of their choice.

†Students who plan to transfer to a senior college should consult the language requirements in “The Curricula and Programs” section of the college catalog. This program articulates with Lehman College’s B.S. in Computer Science program and Iona’s B.A. and B.S. in Computer Science.

MATHEMATICS

Associate in Science Degree | Transfer Degree
Department of Mathematics and Computer Science

The Mathematics curriculum provides a broad background in science and the humanities as well as a thorough grounding in higher mathematics, particularly calculus and its applications. In addition to computational techniques, students learn the rudiments of rigorous mathematical argument and proof. Problem-solving and reasoning skills learned in the course of studying mathematics not only provide a solid base for transfer to a senior college, but also assist in a wide variety of career options and disciplines such as physical and biological sciences, computer science, education, economics, business, finance, health, human services, and social science.

Curriculum Coordinator: Dr. Cormac O’Sullivan
Mathematics Curriculum (pathways)
60 Credits required for A.S. Degree

Required Core
A. English Composition (6 Credits)
B. Mathematical and Quantitative Reasoning
   • MTH 31 Calculus and Analytic Geometry I (4 Credits)
C. Life and Physical Sciences
   • SCIENCE I 1, 2, 3, 4, 5, 6
   • BIO 11 or CHM 11 or PHY 11 or PHY 31 (4 Credits)

Flexible Core
A. World Cultures (3 Credits)
B. U.S. Experience (3 Credits)
C. Creative Expression (3 Credits)
D. Individual and Society (3 Credits)
E. Scientific World
   • SCIENCE II 1, 2, 3, 4, 5, 6
   • BIO 12 or CHM 12 or PHY 12 or PHY 32 (4 Credits)

RESTRICTED ELECTIVE Select one course from Area A-E (3 Credits)

SUBTOTAL 19

Specialization Requirements
- MTH 32 Analytic Geometry and Calculus II (5 Credits)
- MTH 33 Analytic Geometry and Calculus III (5 Credits)
- MTH 42 Linear Algebra (4 Credits)
- MTH OR CSI (Two chosen from MTH 34, 35, 36, 37, 38, CSI 35) (7-8 Credits)

SUBTOTAL 21-22

FREE ELECTIVES
- MTH 30 1 and/or FREE ELECTIVE 1 (5-6 Credits)

1 Students requiring MTH 30 must use free elective credits for this purpose.
2 SCI I and II must form a sequence, e.g., BIO 11 and 12.

NOTE: The program has been given a waiver to require its students to take MTH 31 to fulfill Required Area B, BIO 11 or CHM 11 or PHY 11 or PHY 31 to fulfill Required Area C, and BIO 12 or CHM 12 or PHY 12 or PHY 32 to fulfill Flexible Area E. If students transferring into this program complete different courses in these areas, they will be certified as having completed the Common Core requirements, but it may not be possible for them to finish their degree within the regular number (60) of credits.

MATHEMATICS (PRE-PATHWAYS)
Associate in Science Degree | Transfer Degree
Department of Mathematics and Computer Science

If you began studying at BCC in or after Fall 2013, Pathways applies. Pathways also applies to students who have returned to CUNY after an absence of more than one semester. If you are a continuing student who entered before Fall 2013, you will be able to choose whether you remain with your existing requirements or change to Pathways. You should consult with an academic advisor.

Curriculum Coordinator: Dr. Cormac O'Sullivan

Mathematics Curriculum
60 Credits required for A.S. Degree

Core Requirements
- ENG 10 Fundamentals of Composition and Rhetoric OR ENG 11 Composition and Rhetoric I (3 Credits)
- CMS 11 Fundamentals of Interpersonal Communication (3 Credits)
- HIS 10 History of the Modern World OR HIS 11 Introduction to the Modern World (3 Credits)
- MTH 31 Calculus and Analytic Geometry I (4 Credits)
- SCIENCE* A two-semester sequence in a laboratory science (8 Credits)

TOTAL 21

Required Areas of Study
- ART 11 Introduction to Art OR MUS 11 Introduction to Music (3 Credits)
- ENGLISH Select one course from ENG 12, 14, 15, OR 16 (3 Credits)
- MODERN LANGUAGE*** (0-8 Credits)
- HISTORY or SOCIAL SCIENCE Select from Anthropology, Economics, Geography, History, Philosophy, Political Science, Psychology, or Sociology (3 Credits)

TOTAL 9-17

Specialization Requirements
- MTH 32 Analytic Geometry and Calculus II (5 Credits)
- MTH 33 Analytic Geometry and Calculus III (5 Credits)
- MTH 42 Linear Algebra (4 Credits)
- Restricted electives† (7-8 Credits)

TOTAL 21-22

FREE ELECTIVES
- To complete the required 60 credits, students may take up to 9 credits in any department or discipline (0-9 Credits)

NOTE: Students who are required to take MTH 30, a prerequisite for MTH 31, must use elective credits.

NOTE: At least two courses must be taken from a list designated as “Writing Intensive” as published each semester in the Registration Guide and Schedule of Classes.

NOTE: The Mathematics Degree program articulates with the B.A. in Actuarial Science at Baruch College as well as the B.S. in Applied Mathematics and the B.S. in Mathematics Education at New York City College of Technology.

*The laboratory science sequence may be chosen from BIO 11-12, CHM 11-22, PHY 11-12 or PHY 31-32. Students should consult the college to which they intend to transfer as to choosing an appropriate sequence. Students who intend to transfer to City College in Computer Science or Engineering should take PHY 31-32.

** Students should consult the requirements of the senior college of their choice.

*** Students who plan to transfer to a senior college should consult the language requirements in “The Curricula and Programs” section of this catalog.

† Choose from MTH 34, MTH 35, MTH 44, MTH 46, MTH 48, or CSI 35. Students who plan to transfer to City College and Hunter College should choose CSI 35 or MTH 34.
**MATHEMATICS COURSE PLACEMENT**

The zero-level courses are taken for no credit and are remedial or compensatory in nature. They are designed for students who lack the preparation necessary to enter the college-level mathematics courses.

**• COLLEGE CURRICULA MATHEMATICS REQUIREMENTS** (Effective Jan. 1, 2010)

**A. Mathematics Sequence by Curriculum.**

After identifying your curriculum (major) below from the list on the left, see the COMPASS Cut-Off Scores for Mathematics Placement Chart to determine the first mathematics course you need to take in the mathematics sequence for your choice of curriculum.

**NOTE:** The old sequence MTH 03 → MTH 04 (not offered after Sp 2010) can replace MTH 05 anywhere below

<table>
<thead>
<tr>
<th>Curricula</th>
<th>Required Mathematics Courses Sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accounting Curriculum A.A.S. Degree</strong></td>
<td>12** or 1 → 5 → 6 → 30 (→ 31)*#</td>
</tr>
<tr>
<td>Animal Care and Management Certificate Program</td>
<td>12** or 1 → 5 → 21</td>
</tr>
<tr>
<td><strong>Automotive Mechanics Certificate Program</strong></td>
<td>None</td>
</tr>
<tr>
<td><strong>Automotive Technology A.A.S. Degree</strong></td>
<td>1 → 5 → 6 → 13</td>
</tr>
<tr>
<td><strong>Biotechnology A.S. Degree</strong></td>
<td>1 → 5 → 6 → 30 → 31 → 37</td>
</tr>
<tr>
<td><strong>Business Administration A.S. Degree</strong></td>
<td>1 → 5 → 6 → 30 (→ 31#)</td>
</tr>
<tr>
<td>Community/School Health Education A.S. Degree</td>
<td>1 → 5 → 21 or 23 or 26</td>
</tr>
<tr>
<td><strong>Computer Information Systems Curriculum</strong></td>
<td>12** or (1 → 5 → 6 → 30 (→ 31))*</td>
</tr>
<tr>
<td>Web Page Development Option</td>
<td>1 → 5 → 30 → 31 → 32 → 33 → (MTH 34, 42)*</td>
</tr>
<tr>
<td>Computer Programming Option A.A.S. Degree</td>
<td>1 → 5 → 21 or 23</td>
</tr>
<tr>
<td><strong>Computer Science A.S. Degree</strong></td>
<td>12** or (1 → 5 → 21 or 23)</td>
</tr>
<tr>
<td><strong>Criminal Justice A.A. Degree</strong></td>
<td>12** or (1 → 5 → 6 → 30)†</td>
</tr>
<tr>
<td><strong>Digital Arts, Graphic Design Option A.A.S. Degree</strong></td>
<td>1 → 5 → 23</td>
</tr>
<tr>
<td><strong>Dietetics and Nutrition A.S. Degree</strong></td>
<td>1 → 5 → 21 or 23</td>
</tr>
<tr>
<td><strong>Education Associate A.A.S. Degree</strong></td>
<td>1 → 5 → 30 → 31</td>
</tr>
<tr>
<td><strong>Electronic Engineering Technology A.A.S. Degree</strong></td>
<td>1 → 5 → 6 → 13 or (1 → 5 → 6 → 30 → 31)</td>
</tr>
<tr>
<td><strong>Energy Services Technology A.A.S. Degree</strong></td>
<td>1 → 5 → 6 → 30 → 31 → 32 → 33 → 34 → (MTH 42)*</td>
</tr>
<tr>
<td><strong>Engineering Science A.S. Degree</strong></td>
<td>1 → 5 → 6 → 13 and 23</td>
</tr>
<tr>
<td><strong>Environmental Technology A.A.S. Degree</strong></td>
<td>12** or (1 → 5 → 21 or 23)*</td>
</tr>
<tr>
<td><strong>Human Services A.A.S. Degree</strong></td>
<td>1 → 5 → 21 or 22 or 23 or 26 / OR (1 → 5 → 6 → 30)†</td>
</tr>
<tr>
<td><strong>Liberal Arts and Sciences A.A. Degree</strong></td>
<td>12** or (1 → 5 → 6 → 30)†</td>
</tr>
<tr>
<td>Education Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>History Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Human Services Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>International Studies Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Media Studies Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Performing Arts Option</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td><strong>Liberal Arts and Sciences A.S. Degree</strong></td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Biology Option 139</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Chemistry Option 239</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Earth Systems and Environmental Science 639</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
<tr>
<td>Physics Option 339</td>
<td>1 → 5 → 6 → 30 → 31 → 32</td>
</tr>
</tbody>
</table>

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**BRONX COMMUNITY COLLEGE**

MATHEMATICS AND COMPUTER SCIENCE | 2014-2015 COLLEGE CATALOG 155
<table>
<thead>
<tr>
<th>Degree</th>
<th>Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Licensed Practical Nursing</td>
<td>See Nursing Department</td>
</tr>
<tr>
<td>Paralegal Certificate Program</td>
<td>None</td>
</tr>
<tr>
<td>Marketing Management Curriculum A.A.S. Degree</td>
<td>12** or (1 5 6 30 (31)*</td>
</tr>
<tr>
<td>Mathematics A.S. Degree</td>
<td>1 5 6 30 31 32 33 and MTH 42, two courses from (CSI 35, MTH 34, 35, 44, 46, 48)</td>
</tr>
<tr>
<td>Media Technology A.A.S. Degree</td>
<td>12** or (1 5 21)*</td>
</tr>
<tr>
<td>Medical Office Assistant Curriculum A.A.S. Degree</td>
<td>12** or (1 5 6 30)*</td>
</tr>
<tr>
<td>Medical Laboratory Technology A.A.S. Degree</td>
<td>1 5 6 13 14</td>
</tr>
<tr>
<td>Nuclear Medicine Technology A.A.S. Degree</td>
<td>1 5 6 30</td>
</tr>
<tr>
<td>Nursing A.A.S. Degree</td>
<td>See Nursing Department</td>
</tr>
<tr>
<td>Ornamental Horticulture A.A.S. Degree</td>
<td>None (5 6)*</td>
</tr>
<tr>
<td>General Horticulture Option 234</td>
<td></td>
</tr>
<tr>
<td>Interior Landscaping Option 334</td>
<td></td>
</tr>
<tr>
<td>Office Administration and Technology A.A.S. Degree</td>
<td>12** or (1 5 6 30)*</td>
</tr>
<tr>
<td>Paralegal Studies A.A.S. Degree</td>
<td>12** or (1 5 21 or 23)</td>
</tr>
<tr>
<td>Pharmaceutical Manufacturing Technology A.A.S. Degree</td>
<td>1 5 6 13 14 or (1 5 6 30 31)*</td>
</tr>
<tr>
<td>Pre-Clinical Nursing Program</td>
<td>See Nursing Department</td>
</tr>
<tr>
<td>Radiologic Technology A.A.S. Degree</td>
<td>1 5 6 13 OR (1 5 6 30 31)*</td>
</tr>
<tr>
<td>Science for Forensics A.S. Degree</td>
<td>1 5 6 30 31 32</td>
</tr>
<tr>
<td>Therapeutic Recreation A.S. Degree</td>
<td>1 5 21 or 22 or 23 or 26</td>
</tr>
<tr>
<td>Telecommunications Technology A.A.S. Degree</td>
<td>1 5 6 30 31</td>
</tr>
</tbody>
</table>

* Students who may later transfer to a four-year college should consider taking these courses.
# Recommended course but not a required course by curriculum.
† Student who may transfer to a four-year college other than CUNY colleges should consider taking these courses.
**For students entering with COMPASS proficiency (35 or more on M1 and 40 or more on M2). Students entering without COMPASS proficiency must take MTH 01 and/or MTH 05 before taking MTH 12 (see COMPASS cut-off scores for Mathematics Placement).
COMPASS CUT-OFF SCORES FOR MATHEMATICS PLACEMENT
(effective March 2011)

(TO PLACE OUT OF A COURSE)

<table>
<thead>
<tr>
<th>Place out of:</th>
<th>Arithmetic (MI) (pre-algebra)</th>
<th>Algebra (M2)</th>
<th>College Algebra (M3)</th>
<th>Geometry (S4)</th>
<th>Trigonometry (S5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 1*</td>
<td>M1 ≥35 OR M2≥30</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>MTH 5</td>
<td>≥35</td>
<td>≥40</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>MTH 6</td>
<td>≥35</td>
<td>≥45</td>
<td>N/A</td>
<td>N/A</td>
<td>≥30</td>
</tr>
<tr>
<td>MTH 30 or MTH 13**</td>
<td>≥35</td>
<td>≥45</td>
<td>≥45</td>
<td>N/A</td>
<td>≥40</td>
</tr>
</tbody>
</table>

*For nursing curriculum codes 003 and 046 and 047: If M1≥ 35 and M2 ≥ 40, or if the student is CUNY Math Exempt (Q/R/S/T/B), student is eligible to apply for PHM 10 at Nursing Department. Otherwise, students should take the appropriate remedial course.

CMAT CUT-OFF SCORES FOR MATHEMATICS PLACEMENT

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 1</td>
<td>≥12</td>
<td>-</td>
<td>≥25</td>
<td>≥13</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MTH 5</td>
<td>-</td>
<td>-</td>
<td>≥25</td>
<td>≥13</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>MTH 6</td>
<td>-</td>
<td>-</td>
<td>≥25</td>
<td>≥13</td>
<td>≥4</td>
<td>≥8</td>
</tr>
<tr>
<td>MTH 13 or MTH 30</td>
<td>-</td>
<td>-</td>
<td>≥25</td>
<td>≥13</td>
<td>≥4</td>
<td>≥8</td>
</tr>
</tbody>
</table>

HIGH SCHOOL EQUIVALENCY (REGENTS SCORE OF 75 OR BETTER)

<table>
<thead>
<tr>
<th>MTH 5</th>
<th>Seq Math II (SMQII): MQ3 and MQ4 (10th grade math) or Math A</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTH 6</td>
<td>Seq Math III (SMQ III): MQ5 and MQ6, or Math B</td>
</tr>
</tbody>
</table>

**NOTE:** If students have taken advanced algebra in high school and wish to take MTH 31, then they may be exempt from MTH 30 by taking an exemption examination administered by the Department of Mathematics and Computer Science.

The new New York State Regents exams (2010 and after) focus on Integrated Algebra, Geometry, and Algebra 2 and Trigonometry. For students entering in Fall 2011 or Spring 2012, CUNY Math Proficiency is measured by passing one of the three Regents exams with a score of 75, and completion of the three-year Regents course sequence Integrated Algebra/Geometry/Algebra 2 and Trigonometry. For students entering in Fall 2012 or after, CUNY Math Proficiency can be demonstrated by achieving a score of 80 or higher on any of the three Regents math courses, and successfully completing Algebra 2 and Trigonometry or higher.

A student may place out of MTH 06 by passing all three Regents exams with a score of 75 or above.

Note that in order to transfer to a CUNY senior college, students must have achieved CUNY Math Proficiency either by achieving a 35/40 on their entering COMPASS placement test, or having demonstrated proficiency by means of Regents or other exemptions, or by having passed a credit-bearing math course (three or more credits) with a grade of C or higher

MATHEMATICS COURSE SEQUENCES:

- **Liberal Arts (non-science):** Entering with COMPASS proficiency (M1 ≥ 35 and M2 ≥ 40): MTH 21 or MTH 23
  Entering without COMPASS proficiency: MTH 1→MTH 5→MTH 21 or MTH 23

- **Mathematics, Science, Technology, and Business (transfer programs):** Entering with COMPASS proficiency (M1 ≥ 35 and M2 ≥ 40): MTH 06→MTH 30 (or MTH 13)
  Entering without COMPASS proficiency: MTH 1→MTH 5→MTH 6→MTH 30 (or MTH 13)

- **Curricula Requiring MTH 12 (non-science, non-transfer):** Entering with COMPASS proficiency (M1 ≥ 35 and M2 ≥ 40): MTH 12
  Entering without COMPASS proficiency: MTH 1→MTH 5→MTH 12
  (Note: MTH 12 is not recommended for transfer to a four year college.)

Exemption Examinations

Qualified students may take exemption examinations for all courses offered by the Mathematics Department upon application to the department. In general, a grade of B+ or better is required for exemption with credit. A passing grade less than B+, but C or better, will qualify for exemption without credit.
COURSES

Mathematics

MTH 1 4 rec 0 cr
Fundamental Concepts and Skills in Arithmetic and Algebra
Topics selected from basic operations in arithmetic, geometry, verbal problems whose solutions involve arithmetic processes, generalizations of the principles of arithmetic leading to the fundamental concepts of algebra. Elementary treatment of signed numbers and linear equations. Liberal Arts (non-science) and Science, Technology and Business (transfer programs) should refer to the Mathematics Placement charts above for appropriate course. Corequisite: RDL 01 if required.

MTH 5 6 rec 0 cr
Elementary Algebra
Signed numbers, evaluation of algebraic expressions, linear equations and their graphs, polynomials, factoring, radical expressions, quadratic equations. Prerequisite: Math 01 or equivalent and RDL 01 if required. Refer to COLLEGE CURRICULA MATHEMATICS REQUIREMENTS and COMPASS CUT-OFF SCORES FOR MATHEMATICS PLACEMENT. Corequisite: RDL 02 if required.

MTH 6 6 rec 0 cr
Intermediate Algebra and Trigonometry
Topics selected from real and complex numbers, function concept, coordinate geometry, linear and quadratic equations, systems of equations, geometry, elements of trigonometry. Prerequisite: MTH 05 or two years of high school mathematics consisting of algebra and geometry or equivalent, and RDL 02 if required.

MTH 10 4 rec 4 cr
Technical Mathematics I
(For Telecommunications Technology Verizon students only.) First course in a two-semester sequence of intermediate algebra and trigonometry with technical applications. Topics include trigonometry functions, vectors, units of measurement and approximate numbers, fundamental concepts of algebra, functions and graphs, systems of linear equations, determinants, factoring and fractions, quadratics, variation and geometry. A scientific calculator is used throughout the course. Prerequisite: MTH 06 or equivalent and ENG 02 and RDL 02 if required.

Computer Science

CSI 30 3 rec 3 cr
Discrete Mathematics I
Introduction to mathematical methods in computer science. Topics include basic concepts of mathematical logic, set theory, elementary number theory, counting methods and probability, and informal proof. Prerequisite: MTH 06. Corequisites: ENG 02 and RDL 02 if required.

CSI 31 2 lect 2 lab 3 cr
Introduction to Computer Programming I
Introduction to computer systems and computer logic; techniques of structured programming; data representation; basic algorithm design and implementation in a modern structured language; computer solutions to problems taken from engineering, science, physics, mathematics, business and other applications. Prerequisites: CSI 30, and MTH 30 if required; and ENG 02 and RDL 02 if required. Corequisite: MTH 31

CSI 32 2 rec 2 lab 3 cr
Introduction to Computer Programming II
Continuation of CSI 31. Introduction to object-oriented programming including encapsulation, polymorphism, and inheritance; class templates; recursion and recursive analysis; analysis of algorithms; program style; documentation of programs; debugging; development of major projects. Prerequisites: CSI 31 and ENG 02 and RDL 02 if required.

CSI 33 2 rec 2 lab 3 cr
Data Structures
Introduction to data structures and algorithms for developing solutions to various computational problems for sorting and searching large collections of data. Topics include container classes, pointers and dynamic arrays, linked lists, stacks, queues, and trees. Prerequisites: CSI 32, and ENG 02 and RDL 02 if required.

CSI 35 2 rec 2 lab 3 cr
Discrete Mathematics II
Introduction to the theory and application of abstract mathematical structures, the design and analysis of algorithms modeling mathematics and other disciplines. Topics selected from relations, partial orderings, graphs and trees, mathematical reasoning, and methods of proof. Prerequisites: CSI 30, and MTH 31; ENG 02 and RDL 02 if required.
MTH 11  4 rec 4 cr
**Technical Mathematics II**
(For Telecommunications Technology Verizon students only.)
Second course in a two-semester sequence of intermediate algebra and trigonometry with technical applications.
Topics include trigonometric functions of any angle, oblique triangles, exponents and radicals, graphs of exponential and logarithmic functions, basic operations with complex numbers, inequalities, introduction to statistics. A scientific calculator is used throughout the course.
Prerequisites: MTH 10 or equivalent and ENG 02 and RDL 02 if required.

Any course numbered 12 through 15 is, with some modification, recommended only for those students enrolled in career (A.A.S.) programs.

MTH 12  3 rec 3 cr
**Introduction to Mathematical Thought**
Topics selected from probability, statistics, logic, set theory, geometry, matrices, number system structures. (Not recommended for transfer curricula, and not accepted for credit in the Liberal Arts curriculum.)
Prerequisites: CUNY Math Proficiency as measured by the COMPASS exam and ENG 01 and RDL 02 if required. Students who have not attained CUNY Math Proficiency should refer to COLLEGE CURRICULA MATHEMATICS REQUIREMENTS and COMPASS CUT-OFF SCORES FOR MATHEMATICS PLACEMENT.

ENG 02 and RDL 02, if required, are prerequisites for all MTH courses numbered 13 and higher. MTH 13, 14, and 15 are recommended for students in career technology curricula such as Automotive Technology, Electronic Engineering Technology, Medical Laboratory Technology and Telecommunications Technology curricula.

MTH 13  4 rec 3 cr
**Trigonometry and College Algebra**
Vectors, complex numbers, functions and graphs, exponential, logarithmic and trigonometric functions, analytic trigonometry, systems of linear equations.
Prerequisites: MTH 06 or equivalent and ENG 02 and RDL 02 if required.

MTH 14  3 rec 3 cr
**College Algebra and Introduction to Calculus**
Analytic geometry, the derivative and its applications, differentiation of transcendental functions.
Prerequisites: MTH 13 or equivalent and ENG 02 and RDL 02 if required.

MTH 15  3 rec 3 cr
**Calculus**
The integral and its applications, methods of integration, elementary differential equations, expansion of functions in series.
Prerequisites: MTH 14 or equivalent and ENG 02 and RDL 02 if required. MTH 21, 22, 23 and 26 are non-sequential courses primarily for Liberal Arts students enrolled in non-science transfer programs. MTH 21, 22 and 26 are recommended for Liberal Arts students and as electives for students in other curricula. MTH 23 is recommended for students in such social sciences as economics, political science, psychology, human services and sociology.

MTH 21  3 rec 3 cr
**Survey of Mathematics I**
Designed for non-science liberal arts students. Emphasis on key concepts and structure of mathematics. Topics selected from decimal notation, computation in other bases, groups, sets, logic, elementary number theory, development of real number system, analytic geometry, linear programming, networks, complex numbers.
Prerequisites: MTH 05 or equivalent and ENG 02 and RDL 02 if required. Required Core - Mathematical and Quantitative Reasoning

MTH 22  3 rec 3 cr
**Survey of Mathematics II**
Topics selected from geometry, algebra, graphs, functions, game theory, mathematical induction, permutations, combinations, probability, logic; Euclidean, non-Euclidean, projective, finite, and coordinate geometries; groups, matrices.
Prerequisites: MTH 05 or equivalent and ENG 02 and RDL 02 if required.

MTH 23  3 rec 3 cr
**Probability and Statistics**
Organization and presentation of data, measures of central tendency and variation, correlation and regression, elementary probability, the binomial distribution.
Prerequisites: MTH 05 or equivalent and ENG 02 and RDL 02 if required. Required Core - Mathematical and Quantitative Reasoning

MTH 26  2 rec 2 lab 3 cr
**Mathematics in the Modern World**
Topics selected from BASIC computer language; mathematical simulation of problems from diverse fields including water pollution, population studies, political polls, and artificial intelligence; mathematical algorithms and interpretation of graphs.
Prerequisites: MTH 05 or equivalent and ENG 02 and RDL 02 if required. MTH 30 through 35 are designed for students majoring in mathematics, physics, biology, chemistry, engineering science, computer science, and are recommended for those in other curricula with advanced preparation.
MTH 30  4 rec 4 cr
Pre-Calculus Mathematics
The relation between a function and its graph, composition and inversion of functions, polynomial, rational, exponential and logarithmic functions, trigonometry.
Prerequisites: MTH 06 or equivalent and ENG 02 and RDL 02 if required.
Required Core - Mathematical and Quantitative Reasoning

MTH 31  6 rec 4 cr
Analytic Geometry and Calculus I
Limits, rates of change, differentiation and anti-differentiation of algebraic functions, applications, integrals, curve sketching. For Mathematics, Computer Science, and Engineering Science majors, or for Liberal Arts and Sciences students planning to major in one of the physical sciences.
Prerequisites: MTH 30 or equivalent and ENG 02 and RDL 02 if required.
Required Core - Mathematical and Quantitative Reasoning

MTH 32  6 rec 5 cr
Analytic Geometry and Calculus II
Differentiation and integration of transcendental functions, hyperbolic functions, applications of the definite integral; parametric equations, mean value theorems, polar coordinates, plane analytic geometry.
Prerequisites: MTH 31 or equivalent and ENG 02 and RDL 02 if required.

MTH 33  5 rec 5 cr
Analytic Geometry and Calculus III
Vectors, applications of vectors to analytic geometry and calculus, partial differentiation, multiple integrals, volumes and surface area, infinite series, applications.
Prerequisites: MTH 32 or equivalent and ENG 02 and RDL 02 if required.

MTH 34  4 rec 4 cr
Differential Equations and Selected Topics in Advanced Calculus
Methods of solving ordinary differential equations; selected topics from among the following: hyperbolic functions, power series, Fourier series, gamma functions, Bessel functions, problems of motion, electric circuits, damped and forced vibrations, Laplace transform.
Prerequisites: MTH 33 or equivalent and ENG 02 and RDL 02 if required.

MTH 35  4 rec 4 cr
Selected Topics in Advanced Calculus and Linear Algebra
Matrices, introduction to linear algebra and vector analysis, integral theorems of Gauss, Green and Stokes; applications.
Prerequisites: MTH 33 or equivalent and ENG 02 and RDL 02 if required.

MTH 32  4 rec 4 cr
Linear Algebra
Vector spaces, basis and dimension, matrices, linear transformations, determinants, solution of systems of linear equations, eigenvalues and eigenvectors.
Prerequisites: MTH 32 or equivalent and ENG 02 and RDL 02 if required.

MTH 44  4 rec 4 cr
Vector Analysis
Differential geometry of curves, line integrals, surface integrals, change of variables, Green’s theorem, Stokes’ theorem, Gaussian’s Theorem.
Prerequisites: MTH 33 or equivalent and ENG 02 and RDL 02 if required.

MTH 46  4 rec 4 cr
Abstract Algebra
Properties of integers, permutations, groups, alternating groups, groups of symmetries, quotient groups, sets, mappings, isomorphisms, homomorphisms, rings, fields, polynomials.
Prerequisites: MTH 42 or equivalent and ENG 02 and RDL 02 if required.

MTH 48  4 rec 4 cr
Advanced Calculus
Advanced treatment of the real number system, properties of continuous functions, derivatives and differentials, rigorous work with limits, the definite integral, uniform continuity, uniform convergence, infinite sequences, functions defined by series.
Prerequisites: MTH 33 or equivalent and ENG 02 and RDL 02 if required.