

Mathematics Graduate: Graduate Programs and Careers

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Scope of the Mathematical Sciences

A century ago, the field we are discussing probably would have been called “mathematics” and the associated research community would have been known as “the mathematicians”. We found that most people in the field today would accept “pure math”, applied math, statistics, and computational math, etc.

The mathematical sciences research community includes:

Pure mathematicians, who create the discipline itself;

Research areas:

- Set theory and logic
- Number theory (elementary, analytic, algebraic, and combinatorial)
- Algebra (commutative, algebraic geometry, associative rings and algebras, category theory,

homological algebra, K-theory, group theory and generalization, topological groups, Lie groups)

- Analysis (real, complex, functional, operator theory)
- Differential equations (ODE, PDE)
- Differential geometry
- Topology (general, algebraic)
- Global analysis (analysis on manifolds)
- Non-linear analysis
- Linear algebra (multilinear, matrix theory)
- Combinatorics (graph theory)

Applied mathematicians, who develop mathematical tools, techniques, and models to understand scientific phenomena or solve basic technological problems; specialists in numerical analysis and scientific computing;

Research areas:

- Special functions
- Integral equations
- Operational calculus
- Mechanics of particles and systems
- Mechanics of solids
- Fluid mechanics
- Optics, electromagnetic theory
- Classical thermodynamics, heat transfer
- Quantum theory
- Statistical mechanics, structure of matter
- Relativity and gravitational theory
- Systems theory; control

Statisticians, who develop and apply mathematical techniques to analyze and interpret data for use in inference, prediction, and decision-making;

Research areas:

- Probability theory and stochastic processes
- Statistics
- Bio-statistics

Mathematicians in operations research, who develop and apply optimization techniques to management and decision-making;

Research areas:

- Operations research
- Mathematical programming (linear, integer, etc.)
- Game theory

Mathematical specialists in field of engineering, e.g., communication and control theories;

Research areas:

- Cryptography
- Theory of error-correcting codes
- Communication theory
- Circuits and networks

Mathematical biologists, mathematical economists, etc.;

Research areas:

- Mathematical biology
- Genetics and population dynamics
- Mathematical economics

Group I Public

Michigan State University
Ohio State University, Columbus
Pennsylvania State University
Purdue University
Rutgers The State University of New Jersey
State University of New York at Stony Brook
University of California, Berkeley
University of California, Los Angeles
University of California, San Diego
University of California, Santa Barbara
University of Illinois at Chicago

University of Illinois, Urbana-Champaign
University of Maryland, College Park
University of Michigan, Ann Arbor
University of Minnesota - Twin Cities
University of North Carolina at Chapel Hill
University of Oregon
University of Texas at Austin
University of Utah
University of Virginia
University of Washington
University of Wisconsin, Madison

Group I Private

Boston University
Brandeis University
Brown University
California Institute of Technology
Carnegie Mellon University
Columbia University
Cornell University
Duke University
Harvard University
Johns Hopkins University, Baltimore
Massachusetts Institute of Technology
New York University, Courant Institute

Northwestern University
Princeton University
Rensselaer Polytechnic Institute
Rice University
Stanford University
University of Chicago
University of Notre Dame
University of Pennsylvania
University of Southern California
Washington University
Yale University

Group II Public

Arizona State University	University of California, Riverside
Auburn University	University of California, Santa Cruz
Case Western Reserve University	University of Cincinnati
Claremont Graduate University	University of Colorado, Boulder
Clemson University	University of Connecticut, Storrs
Colorado State University	University of Delaware
Dartmouth College	University of Florida
Florida State University	University of Georgia
Iowa State University	University of Hawaii at Mano
Kansas State University	University of Houston
Kent State University, Kent	University of Iowa
Lehigh University	University of Kentucky
Louisiana State University, Baton Rouge	University of Massachusetts, Amherst
North Carolina State University, Raleigh	University of Miami
Northeastern University	University of Missouri-Columbia
Oregon State University	University of Nebraska-Lincoln
Polytechnic Institute of New York	University of North Texas
Binghamton University, New York State	University of Oklahoma
State University of New York at Buffalo	University of Pittsburgh, Pittsburg
Syracuse University	University of Rochester
Temple University	University of South Carolina
Texas A&M University	University of Tennessee, Knoxville
Texas Tech University	University of Texas at Arlington
The University of Albany, SUNY	Vanderbilt University
Tulane University	Virginia Polytechnic Institute & State
University of Arizona	Washington State University
University of California, Davis	Wayne State University
University of California, Irvine	Wesleyan University

Group III Ranked

Bowling Green State University
Clarkson University
Colorado School of Mines
Drexel University
George Washington University
Howard University
Idaho State University
Illinois State University
Missouri University of Science & Technology
New Mexico State University, Las Cruces
Northern Illinois University
Ohio University, Athens
Old Dominion University
Southern Illinois University, Carbondale

Southern Methodist University
St. Louis University
Stevens Institute of Technology
University of Alabama
University of Alabama - Huntsville
University of Louisiana at Lafayette
University of Maryland, Baltimore County
University of Mississippi
University of Rhode Island
University of South Florida
University of Texas at Dallas
University of Wisconsin, Milwaukee
University of Wyoming
Western Michigan University

Group III Not Ranked

Air Force Institute of Technology
Baylor University
Boston College
Brigham Young University
Bryn Mawr College
Central Michigan University
College of William & Mary
Emory University
Florida Atlantic University
George Mason University
Georgia State University
Indiana University-Purdue University Indianapolis
Marquette University
Michigan Technological University
Mississippi State University
Montana State University, Bozeman
Naval Postgraduate School

New Mexico Institute of Mining & Technology
New Jersey Institute of Technology
North Dakota State University, Fargo
Oakland University
Oklahoma State University
Portland State University
Rutgers University - Newark
South Dakota State University
Texas State University - San Marcos
The University of Southern Mississippi
Tufts University
University of Akron
University of Alabama at Birmingham
University of Alaska, Fairbanks
University of Arkansas at Fayetteville
University of Central Florida
University of Colorado, Denver
University of Denver

Group III Not Ranked

University of Idaho
University of Kansas
University of Memphis
University of Missouri - Kansas City
University of Missouri - St. Louis
University of Montana - Missoula
University of Nevada, Las Vegas
University of New Hampshire
University of New Mexico
University of North Carolina at Charlotte
University of North Carolina at Greensboro
University of Northern Colorado
University of Southern Mississippi
University of Toledo
University of Vermont
Utah State University
West Virginia University
Wichita State University
Worcester Polytechnic Institute

Group IV (Statistics/Biostatistics)

Baylor University
Boston University, School of Public Health
Brown University
Carnegie Mellon University
Case Western Reserve University
Case Western Reserve University
Colorado State University
Columbia University
Cornell University
Duke University
Emory University
Florida State University
George Washington University
Harvard University
Iowa State University
Johns Hopkins University
Kansas State University
Louisiana State University, New Orleans
Medical College of Georgia
Medical College of Wisconsin
Medical University of South Carolina
Michigan State University
New York University
North Carolina State University
North Dakota State University, Fargo
Northwestern University
Ohio State University, Columbus
Oklahoma State University
Oregon State University
Pennsylvania State University, Uni. Park
Purdue University
Rice University
Rutgers University - New Brunswick
Southern Methodist University
Stanford University
SUNY at Buffalo
Temple University
Texas A&M University
The University of Albany, SUNY
Tulane University
University of Alabama at Birmingham

University of Alabama - Tuscaloosa
University of Arizona
University of California, Berkeley
University of California, Davis
University of California, Los Angeles
University of California, Riverside
University of California, Santa Barbara
University of Chicago
University of Cincinnati
University of Colorado Denver
University of Connecticut, Storrs
University of Florida
University of Georgia
University of Illinois at Chicago
University of Illinois at Urbana-Champaign
University of Iowa
University of Kentucky
University of Louisville
University of Massachusetts, Amherst
University of Michigan, Ann Arbor
University of Minnesota - Twin Cities
University of Missouri, Columbia
University of Nebraska - Lincoln
University of North Carolina Chapel Hill
University of Oklahoma
University of Pennsylvania
University of Pittsburgh, Pittsburgh
University of Rochester
University of South Carolina
University of Texas (Houston)
University of Virginia
University of Washington
University of Wisconsin, Madison
University of Wyoming
Virginia Commonwealth University
Virginia Polytechnic Institute & State
Western Michigan University
Yale University

Group Va (Applied/Computational/etc.)

Brown University
California Institute of Technology
Cornell University
Florida Institute of Technology
Harvard University
Illinois Institute of Technology
Johns Hopkins University, Baltimore
Louisiana Tech University
Naval Postgraduate School
Northwestern University
Princeton University
Rice University
State University of New York, Stony Brook
University of Arizona
University of California, Merced
University of California, Santa Cruz
University of Colorado, Boulder
University of Iowa
University of Louisville
University of Notre Dame
University of Texas at Austin
University of Washington
Washington University

Math Ph.D.s

1632 Mathematics Ph.D.s awarded
by 299 departments in 2010

_ of these to US citizens

_ of these to women

_ to African-American men
and women

_ to Hispanic or Latino men
and women

Jobs for Math Majors

Secondary School Mathematics Teacher

The teaching of mathematics at the K-12 level is a high-demand field and the need is expected to grow in the future. Every year, roughly half of positions advertised for secondary math teachers go unfilled. We need great mathematics teachers! Each state has licensure requirements for public school teachers (some independent/private schools do not require teachers to be licensed). Alternatively, you can obtain licensure and a master's degree through a Master of Arts in Teaching program which combines courses in education and mathematics with an internship experience. For example, check out the programs at Duke (www.duke.edu/web/MAT).

More information: National Council of Teachers of Mathematics (www.nctm.org)

Jobs for Math Majors

Financial Engineer

Financial engineering (finance mathematics) uses mathematical tools to model and forecast financial markets and form financial products and strategies. In particular, financial engineers help corporations and financial institutions develop and use financial instruments to structure their transactions, increase earnings, and generate capital. They design strategies to ensure desired income streams and increase returns for investments and to manage risks for financial institutions. A typical problem would be to develop a model for pricing and managing a complex derivative product. The mathematics used includes probability, statistics, differential equations, and linear algebra. Financial engineers are employed by energy firms; financial data, software, and research firms; investment firms and banks; insurance companies; stock exchanges; and the Federal Reserve.

Graduate Academic Programs (selected)

- Baruch College, City University of New York (MS Financial Engineering)
- Boston University (MA Mathematical Finance)
- Carnegie Mellon University (MS Computational Finance, MBA Financial Engineering)
- Claremont Graduate University (MS Financial engineering)

- Columbia University (MS Financial Engineering, MA Mathematics with specialization in Mathematics of Finance)
- Cornell University (MBA Financial Engineering, M. Eng. in Operations Research and Industrial Eng.)
- Florida State University (MS, Ph.D. Financial Mathematics)
- Georgia Institute of Technology (MS Quantitative and Computational Finance)
- Georgia State University (Mathematical Risk Management)
- Johns Hopkins University Whiting School of Engineering (MSE Financial Mathematics)
- National Tsing Hua University Taiwan (MSc Quantitative Finance)
- National University of Singapore (MS Financial Engineering)
- New Jersey Institute of Technology (MS Mathematical and Computational Finance)
- New Mexico State University (Professional Master in Financial Mathematics)
- New York University Courant Institute of Mathematical Sciences (MS Mathematics in Finance)
- North Carolina State University (MS Financial Mathematics)
- Northwestern University (Ph.D. Industrial Engineering and Management Sciences)
- Princeton (MSE, Ph.D. Operations Research and Financial Engineering)
- Purdue University (MS Computational Finance)
- Rutgers University (MS in Mathematical Finance)
- Stanford University (MS Financial Mathematics, MS Management Science & Engineering)
- Stony Brook University (MS Applied Mathematics and Statistics-Quantitative Finance)

- Texas A&M University (MS Financial/Industrial Mathematics)
- University of Alberta (MSc, Ph.D. in Mathematical Finance)
- University of California at Berkeley (MS Financial Engineering)
- University of California Los Angeles (Master of Financial Engineering)
- University of California Santa Barbara (Ph.D. Financial Mathematics and Statistics)
- University of Chicago (MS Financial Mathematics)
- University of Connecticut (MS Applied Financial Mathematics)
- University of Southern California (Professional MS in Mathematical Finance)
- University of Waterloo (Mathematical Finance)
- University of Western Ontario (MS Applied Finance-Financial Mathematics)
- University of Pittsburgh (Professional Science MS Mathematical Finance)
- Worcester Polytechnic Institute (MSc Financial Mathematics)

Jobs for Math Majors

Computer Science

Computer science is the study of the theoretical foundations of information and computation and their implementation and application in computer systems. Mathematicians, with their training in logical and precise thinking, are highly prized in this field.

The computer industry provides many lucrative jobs for math majors. Beyond mere proficiency in computer programming, math majors are trained to address the more fundamental issues involved in the creation of new algorithms. Furthermore, many sophisticated applications of computers such as creation of computer graphics and the compression of video and audio signals (to name a few examples) involve a great deal of deep mathematics, and as a result, many computer companies specifically hire math majors.

See the student section of the Association for Computing Machinery for career advice.

Jobs for Math Majors

Actuary

Actuarial science takes mathematics and statistics and applies them to finance and insurance. Actuarial science includes a number of interrelating disciplines, including probability and statistics, finance, and economics. About 60 percent of all actuaries are employed by insurance carriers. Approximately 20 percent work for management, scientific and technical consulting services. Others work for insurance agents and brokers and in the management of companies and enterprises. A relatively small number of actuaries are employed by government agencies.

Work lies in many areas. Examples are:

- Insurance – Assess risk, determine premiums, and product development (creating new types of insurance policies)
- Pensions – Manage pensions and consult with clients

Note: Some employees must pass a series of exams (companies typically pay for study time and award bonuses when you pass)

Career information is available from: American Society of Pension Professionals & Actuaries (www.aspa.org), Society of Actuaries (www.soa.org), Casualty Actuarial Society (www.casact.org and www.beanactuary.org), American Academy of Actuaries (www.actuary.org)

Masters and Ph.D. Programs (with curriculum covering all topics on the first four CAS/SOA exams)

- Ball State University
- Boston University
- Bowling Green State University
- Central Connecticut State University
- University of Connecticut
- College of Statistical and Actuarial Sciences
- Columbia University
- DePaul University
- Florida State University
- George Mason University
- Georgia State University
- The University of Hong Kong
- University of Illinois at Urbana
- Illinois State University
- University of Iowa
- Temple University
- University of Michigan
- Middle Tennessee State University
- University of Minnesota
- University of Nebraska–Lincoln
- Northern Arizona University
- Oregon State University
- Pennsylvania State University
- University of Texas at Austin
- St. John's University (College of Insurance)
- University of Waterloo

- University of Wisconsin–Madison
- University of Wisconsin–Milwaukee
- Youngstown State University
- University of Toronto
- University of Western Ontario
- University of Pennsylvania (Wharton School)

Jobs for Math Majors

Biostatistician

Biostatisticians design research studies and analyze data related to human health, animals or plants. The healthcare, biomedical, and pharmaceutical fields employ biostatisticians who are responsible for analyzing genetic data, disease occurrence, and medical imaging data. These biostatisticians develop clinical trials to assess drug treatments.

Biostatistics Departments:

United States

Alabama

University of Alabama, Birmingham

California

University of California, Berkley

University of California, Davis

University of California, Los Angeles

University of California, San Francisco

Colorado

University of Colorado

Connecticut

Yale University

District of Columbia

George Washington University

Florida

University of Florida

Georgia

Emory University

Illinois

University of Illinois at Chicago

Maryland

Johns Hopkins University

Massachusetts

Boston University

Harvard University

Michigan

University of Michigan

Missouri

Washington University School of Medicine

Minnesota

University of Minnesota

New York

Columbia School of Public Health

Cornell University Biometrics

University of Rochester

North Carolina

Duke University

University of North Carolina-Chapel Hill

Ohio

Case Western Reserve University

Ohio State University

Pennsylvania

Penn State

University of Pennsylvania

University of Pittsburgh

South Carolina

University of South Carolina

Texas

University of Texas Medical Branch

Vermont

University of Vermont

Virginia

Medical College of Virginia-Virginia Commonwealth
University

Washington

University of Washington

Wisconsin

Medical College of Wisconsin

University of Wisconsin - Madison

International

Canada

McGill University

University of Western Ontario

Turkey

Biometry and Genetics Unit, University of Cukurova

Jobs for Math Majors

Cryptanalyst

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Jobs for Math Majors

Operations Researcher

Operations researchers help organizations plan and operate in the most efficient and effective manner. They use mathematics to forecast the implications of various choices and decide on the best alternatives. Much of this work is done using analytical and numerical techniques to develop and manipulate mathematical and computer models of organizational systems. Types of models they use include simulation, linear programming, networks, and game theory. Examples of problems an operations researcher would investigate are: How can a dress manufacturer lay out its patterns to minimize wasted material? How many elevators should be installed in a new office building to cut waiting time? How could fire stations be relocated to reduce response time? Operations researchers obtain jobs working for government and policy agencies, or industries such as airline, pharmaceutical, logistics, and financial services.

Doctoral Programs (selected)

- Columbia University (OR)
- Cornell University (OR)
- Georgia Institute of Technology (Industrial Engineering)
- MIT (OR)
- North Carolina State University (OR)
- Penn State University (OR)

- Princeton University (OR)
- Rutgers University (OR)
- University of Illinois-Chicago (Math, OR)
- University of North Carolina Chapel Hill (OR)
- University of Texas at Austin (OR, Industrial Engineering)

Note: Many Industrial Engineering departments offer OR.

Jobs for Math Majors

Professor

Life as a Math Professor:

- Write and give lectures
- Grade homework, quizzes, exams
- Advise majors
- Choose textbooks, hire new faculty
- Oversee student groups
- Continue research
- Attend conferences, present research
- Apply for grants