

# Math and your career - using math at work

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Math skills help us cope with today's complex world. We use math to carry out everyday tasks such as balancing a checkbook, shopping for groceries, cooking, and creating a personal budget. Other important skills we learn from studying math include problem solving, analysis, and estimating. And math knowledge is essential for earning a living in many occupations, including most higher-paying occupations.

There are about 15,500 mathematicians employed in the United States, but millions of workers have jobs in which mathematics is a necessary part. In fact, almost all jobs require at least some understanding of basic mathematics. For example, carpenters must be able to measure lengths and angles when installing wood trim. Machinists need to understand and manipulate angles and dimensions. Loan officers must determine applicants' debt-equity ratios before approving mortgage applications. And math skills are required for any science, engineering, computer, and technical occupation.

Math is also an important part of a well-rounded education. Most high schools require students to take at least 2 years of math to graduate. And most colleges require some proficiency in math for all applicants, regardless of their intended majors.

## Careers for people interested in math

Although most occupations require basic math skills, some jobs rely on math more heavily than others. If you have taken many math courses, have a high aptitude for math, or major in math in college, you might be interested in some of the following occupations.

**Actuaries.** Actuaries answer questions about future risk, formulate investment strategies, and make pricing decisions. They may design insurance, financial, and pension plans by calculating probabilities of events such as sickness, disability, or death based on known statistics.

A bachelor's degree in mathematics or statistics is required for an entry-level position in a life or casualty insurance company. Applicants must be proficient in several mathematics subjects, including calculus, probability, and statistics, and have passed the beginning actuarial exams.

**Mathematicians.** Mathematicians use their mathematical knowledge and computational tools to create mathematical theories and techniques. They use these theories and techniques to solve economic, scientific, engineering, and business problems. Mathematicians often work with computers to solve problems, develop models, analyze relationships between variables, and process large amounts of data.

Mathematicians need a minimum of a bachelor's degree. People with bachelor's degrees may assist senior mathematicians or work on less advanced problems. Most mathematicians in the private sector need a master's or doctoral degree.

**Operations research analysts.** Operations research analysts are problem solvers who usually work for large organizations or businesses. They help these organizations operate more efficiently by applying mathematics principles to organizational issues. They work on problems such as facilities layout, personnel schedules, forecasting, and distribution systems. They often use mathematical models to explain how things happen within an organization and to determine how to organize things more effectively.

Most employers prefer to hire analysts who have a master's degree in operations research, industrial engineering, or management science.

**Statisticians.** Statisticians collect, analyze, and present numerical data and design, carry out, and interpret the results of surveys and experiments. Statisticians use mathematics techniques to predict things such as economic conditions or population growth, to develop quality control tests for manufactured products, and to help business managers or government officials make decisions and evaluate the results of new programs.

For most beginning jobs in statistics, a bachelor's degree in mathematics or statistics is the minimum requirement. Many research positions require a master's or doctoral degree.

## Careers requiring strong math skills

Some other jobs require a strong background in math. The following occupations are among those in which strong math skills are very important.

Physical and life scientists. Physical and life scientists, including biologists, physicists, chemists, and geologists, work to discover the basic principles of how the earth, universe, and living things operate. The ability to use mathematical relationships to understand and describe the workings of nature is vital.

Most scientists need a doctoral degree in their field, especially those who work in basic research, but some scientists in applied research may need only a bachelor's or master's degree.

Social scientists. Social scientists perform research that helps us understand how individuals and groups make decisions, exercise power, and respond to change. Many social scientists, especially economists, describe behavior with mathematical models. Also, much of social scientists' research depends on gathering and understanding statistics that describe human behavior.

As with physical and life scientists, many jobs involving research require a doctorate. However, many social science jobs involving applied research require only a bachelor's or master's degree.

Computer scientists and systems analysts. Workers in computer science occupations design computer systems and perform research to improve these systems. They may also program computers. Advanced mathematics skills might not be necessary for computer programming; however, training in mathematics helps develop an ability to think logically--a necessary qualification for working with computers.

Most of these workers have bachelor's degrees in computer science, information systems, or computer engineering. Some research positions require a master's or doctoral degree.

Engineers. Engineers use the theories and principles of mathematics to help solve technical problems. They also use mathematics to design machinery, products, or systems. Most entry-level engineering jobs require a bachelor's degree.

Science and engineering technicians. Science and engineering technicians use the principles and theories of science, engineering, and mathematics to solve technical problems in research and development, manufacturing, and other areas. Their jobs are more limited in scope and more practically oriented than those of scientists and engineers, but technicians rely heavily on mathematics techniques in their work.

There are many different ways of qualifying for a position as a science and engineering technician, but most jobs require at least some training beyond earning a high school diploma.

Other careers that require math skills

Math skills are useful in a number of other occupations. For example, most jobs in the financial industry use math skills. Bank tellers must have strong math skills to be both accurate and efficient. Accountants need proficiency in math to calculate and analyze numbers. Air traffic controllers need to understand maps and geometry when directing planes. Managers of all kinds use math skills; for example, hotel managers and assistants must be able to estimate costs for items the hotel needs to order, such as food and drinks.

### Preparing for careers in math

The accompanying lists show occupations that require different levels of math skills: Advanced, applied, practical, or general. Occupations in the advanced or theoretical math skills category require an understanding of more complex math concepts such as calculus and linear algebra. Occupations in the applied math skills category include those in which workers need to understand mathematical concepts and be able to apply them to their work; in these occupations, knowledge of statistics and trigonometry may also be needed. Occupations in the practical math category may require algebra and geometry in addition to general math skills. Occupations in the general math skills category require basic arithmetic such as addition, subtraction, multiplication, and division.

For more information on the level of education and training needed for specific occupations, consult the Occupational Outlook Handbook, available in most libraries, career centers, and placement offices and on the Internet at <http://stats.bls.gov/ocohome.htm>.

### Advanced or theoretical mathematics

- Actuaries
- Agricultural scientists
- Architects
- Biological and medical scientists
- Chemists
- Computer scientists, computer engineers, and systems analysts
- Economists and marketing research analysts
- Engineering, science, and data processing managers
- Engineers
- Foresters and conservation scientists
- Geologists, geophysicists, and oceanographers
- Mathematicians
- Mathematics teachers (secondary school and college)
- Meteorologists
- Operations research analysts
- Physicists and astronomers
- Social scientists
- Statistician

### Applied mathematics

- Accountants and auditors
- Administrative services managers
- Aircraft pilots
- Budget analysts
- Chiropractors
- College and university faculty (nonmathematics)
- Computer programmers
- Construction and building inspectors
- Construction contractors and managers
- Cost estimators
- Dentists
- Dispensing opticians
- Drafters
- Education administrators
- Engineering technicians
- Farmers and farm managers
- Financial managers
- General managers and top executives
- Government chief executives and legislators
- Industrial production managers
- Insurance agents and brokers
- Insurance underwriters
- Loan officers and counselors
- Management analysts and consultants
- Optometrists
- Pharmacists
- Physician assistants
- Physicians
- Podiatrists
- Psychologists
- Real estate agents, brokers, and appraisers
- Respiratory therapists
- School teachers, kindergarten, elementary, and secondary
- Science technicians
- Securities and financial services sales representatives
- Special education teachers
- Surveyors and mapping scientists
- Urban and regional planners
- Veterinarians

### Practical application of mathematics

- Air traffic controllers
- Aircraft mechanics, including engine specialists
- Automobile mechanics
- Automotive body repairers
- Blue collar worker supervisors
- Boilermakers
- Broadcast technicians
- Carpenters
- Concrete masons and terrazzo workers
- Diesel mechanics
- Dietitians and nutritionists
- Electric power generating plant operators and power distributors and dispatchers
- Electricians
- Electronic equipment repairers
- Elevator installers and repairers
- Farm equipment mechanics
- Funeral directors
- General maintenance mechanics
- Heating, air-conditioning, and refrigeration technicians
- Industrial machinery repairers
- Inspectors, testers, and graders
- Jewelers
- Landscape architects
- Machinists and tool programmers
- Millwrights
- Mobile heavy equipment mechanics
- Motorcycle, boat, and small-engine repairers
- Ophthalmic laboratory technicians
- Photographers and camera operators
- Purchasers and buyers
- Sheetmetal workers
- Stationary engineers
- Tool-and-die makers
- Water and wastewater treatment plant operators
- Welders, cutters, and welding machine operators

### General mathematics

- Bank tellers
- Billing clerks and billing machine operators
- Bindery workers
- Bookkeeping, accounting, and auditing clerks
- Bricklayers and stonemasons
- Brokerage clerks and statement clerks
- Cashiers
- Counter and rental clerks
- Drywall workers and lathers
- Glaziers
- Interviewing and new accounts clerks
- Library assistants and bookmobile drivers
- Loan clerks and credit authorizers, checkers, and clerks
- Manufacturers' and wholesale sales representatives
- Medical assistants
- Metalworking and plastic-working machine operators
- Order clerks
- Payroll and timekeeping clerks
- Plasterers
- Postal clerks and mail carriers
- Precision assemblers
- Prepress workers
- Printing press operators
- Private detectives and investigators
- Reservation and transportation ticket agents and travel clerks
- Roofers
- Secretaries
- Stock clerks
- Structural and reinforcing ironworkers
- Taxidrivers and chauffeurs
- Teacher aides
- Tilesetters
- Traffic, shipping, and receiving clerks

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