The 15 Most Valuable College Majors

With rising tuition costs and a rapidly changing job landscape, a student’s college major is more important than ever. It can either set you up for lifetime career success and high earnings or sink you into debt with few avenues to get ahead of it.

“Unless you go to a top-20 brand name school, what matters most to employers is your major,” says Katie Bardaro, lead economist at compensation research firm PayScale. In fact, in a new report by Gen-Y researcher Millennial Branding, a full 69% of managers agreed that relevant coursework is important when considering job candidates.

So which college majors are most likely to land you a well-paying job right out of school? Analysts at PayScale compared its massive compensation database with 120 college majors and job growth projections through 2020 from the U.S. Bureau of Labor Statistics (BLS) to determine the 15 most valuable majors in the current marketplace. Ranked by median starting pay, median mid-career pay (at least 10 years in), growth in salary and wealth of job opportunities, engineering and math reigned supreme.

At No. 1, biomedical engineering is the major that is most worth your tuition, time and effort. Biomedical engineers earn a median starting salary of $53,800, which grows an average of 82% to $97,800 by mid-career. Moreover, the BLS projects a whopping 61.7% growth of job opportunities in the field—the most of any other major on the list.

Engineering concentrations comprise one third of the most valuable majors. Software engineering majors (No. 4) earn a median of $87,800 after 10 years on the job; environmental engineering majors (No. 5) earn a median of $88,600; civil engineering majors (No. 6) earn a median of $90,200; and petroleum engineering majors (No. 9) earn a median of $155,000—the highest paycheck on the list.

“These aren’t majors that anyone could do. They’re hard, and these programs weed people out,” says Bardaro. “However, there is high demand for them and a low supply of people with the skills, so it drives up the labor market price.”

In the Millennial Branding survey, employers reported engineering and computer information systems majors as their top recruits. Also, nearly half of these employers (47%) said the competition for new science, technology, engineering and math talent is steep. That means while other recent grads fight for jobs, these students will likely field multiple offers. Math and science concentrations are also well-represented on this list. Biochemistry (No. 2), computer science (No. 3), applied mathematics (No. 10), mathematics (No. 11), physics (No. 14) and statistics (No. 15) majors are increasingly in demand and well-paid.

Bardaro believes that the new data-driven market makes math skills, particularly statistics, more and more valuable to employers. Many companies now collect large datasets on consumer behavior, be it online search patterns or user demographics. Statisticians who understand data and can use it to forecast trends and behavior will do especially well, she says.

Conversely, the worst-paying college majors are child and family studies, elementary education, social work, culinary arts, special education, recreation and leisure studies, religious studies, and athletic training.

(Source: www.forbes.com 2012)
College Degrees With The Highest Starting Salaries

A new salary survey from the National Association of Colleges and Employers (NACE) has some good news for 2012 college graduates. The overall median salary for new grads has risen to $43,000, up 4.5% from the median for the class of 2011 (I’ve rounded NACE’s numbers to the nearest $1,000). A Bethlehem, Pa. non-profit, NACE links college placement offices with employers. Its employer members tend to be large companies, but for its salary survey it went beyond its members and combed through data from the Bureau of Labor Statistics, the Census Bureau and a master set of data developed by a compensation measurement company called Job Search Intelligence.

Engineering majors earn the best salaries, according to the survey, at a median of $59,000. Not surprisingly, the lowest earners graduate in humanities and social science, with a median salary of just $35,000.

The survey includes some interesting information about the earnings of students who pursue a particular focus within a major. It also offers some clues about where those students are most likely to find work. For instance, the top earners among engineering grads are those who concentrate on computer engineering. They make a median of $68,000. Among computer science majors, those who go into the information sector earn the most, at $64,000. For business grads, a finance focus is the most lucrative, with those who take jobs as financial managers earning $66,000.

While humanities and social science majors have the least lucrative starting salaries, those who major in political science earn the best, starting at a median of $38,000. The biggest employer for humanities grads? The education services industry, with an average starting salary of $38,000.

The worst earners in NACE’s survey are, not surprisingly, visual and performing arts majors. Their biggest employer is “retail trade,” with an average starting salary of just $26,000.

Here is a list of median salaries by discipline, with the top-earning major leading the list.

<table>
<thead>
<tr>
<th>Discipline</th>
<th>Median Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engineering</td>
<td>$59,000</td>
</tr>
<tr>
<td>Computer Science</td>
<td>$56,000</td>
</tr>
<tr>
<td>Business</td>
<td>$48,000</td>
</tr>
<tr>
<td>Health Sciences</td>
<td>$43,000</td>
</tr>
<tr>
<td>Math &amp; Sciences</td>
<td>$41,000</td>
</tr>
<tr>
<td>Communications</td>
<td>$40,000</td>
</tr>
<tr>
<td>Education</td>
<td>$37,000</td>
</tr>
<tr>
<td>Humanities &amp; Social Sciences</td>
<td>$35,000</td>
</tr>
</tbody>
</table>

(Source: www.forbes.com 2012)
Mathematics in Careers

"The top 15 highest-earning college degrees all have one thing in common -- math skills. That's according to a recent survey from the National Association of Colleges and Employers, which tracks college graduates' job offers."

The following is a list of careers that use math and their respective high-end salaries. *Salary figures are from the current US Bureau of Labor of Statistics website and represent the 90th percentile.*

<table>
<thead>
<tr>
<th>Career</th>
<th>Salary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actuary</td>
<td>$158,240/yr</td>
</tr>
<tr>
<td>Air Traffic Controller</td>
<td>$161,650/yr</td>
</tr>
<tr>
<td>Animator</td>
<td>$99,130/yr</td>
</tr>
<tr>
<td>Architect</td>
<td>$122,640/yr</td>
</tr>
<tr>
<td>Astronaut</td>
<td>$93,000/yr</td>
</tr>
<tr>
<td>Attorney</td>
<td>$166,400/yr</td>
</tr>
<tr>
<td>Biologist</td>
<td>$100,580/yr</td>
</tr>
<tr>
<td>Biostatistician</td>
<td>$117,210/yr</td>
</tr>
<tr>
<td>Budget Analyst</td>
<td>$100,880/yr</td>
</tr>
<tr>
<td>Cartographer</td>
<td>$90,410/yr</td>
</tr>
<tr>
<td>Chemical Engineer</td>
<td>$132,980/yr</td>
</tr>
<tr>
<td>Chemist</td>
<td>$114,880/yr</td>
</tr>
<tr>
<td>Climatologist</td>
<td>$127,250/yr</td>
</tr>
<tr>
<td>College Professor</td>
<td>$128,330/yr</td>
</tr>
<tr>
<td>Computational Biologist</td>
<td>$100,580/yr</td>
</tr>
<tr>
<td>Computer Scientist</td>
<td>$155,420/yr</td>
</tr>
<tr>
<td>Cost Estimator</td>
<td>$95,190/yr</td>
</tr>
<tr>
<td>Cryptanalyst</td>
<td>$112,780/yr</td>
</tr>
<tr>
<td>Economist</td>
<td>$153,210/yr</td>
</tr>
<tr>
<td>Electrical Engineer</td>
<td>$126,810/yr</td>
</tr>
<tr>
<td>Epidemiologist</td>
<td>$92,610/yr</td>
</tr>
<tr>
<td>Foreign Exchange Trader</td>
<td>$139,517/yr</td>
</tr>
<tr>
<td>Forensic Analyst</td>
<td>$84,260/yr</td>
</tr>
<tr>
<td>Geographer</td>
<td>$99,540/yr</td>
</tr>
<tr>
<td>Geologist</td>
<td>$161,260/yr</td>
</tr>
<tr>
<td>High-School Math Teacher</td>
<td>$82,000/yr</td>
</tr>
<tr>
<td>Hydrologist</td>
<td>$110,110/yr</td>
</tr>
<tr>
<td>Inventory Control Specialist</td>
<td>$146,030/yr</td>
</tr>
<tr>
<td>Market Research Analyst</td>
<td>$111,900/yr</td>
</tr>
<tr>
<td>Mathematical Biophysicist</td>
<td>$138,820/yr</td>
</tr>
<tr>
<td>Mathematical Physicist</td>
<td>$165,750/yr</td>
</tr>
<tr>
<td>Mathematician</td>
<td>$140,500/yr</td>
</tr>
<tr>
<td>Mechanical Engineer</td>
<td>$117,550/yr</td>
</tr>
<tr>
<td>National Security Analyst</td>
<td>$105,581/yr</td>
</tr>
<tr>
<td>Nuclear Engineer</td>
<td>$140,140/yr</td>
</tr>
<tr>
<td>Operations Research Analyst</td>
<td>$119,140/yr</td>
</tr>
<tr>
<td>Petroleum Engineer</td>
<td>$150,310/yr</td>
</tr>
<tr>
<td>Physician</td>
<td>$166,400/yr</td>
</tr>
<tr>
<td>Political Scientist</td>
<td>$151,360/yr</td>
</tr>
<tr>
<td>Psychometrician</td>
<td>$200,000/yr</td>
</tr>
<tr>
<td>Purchasing Agent</td>
<td>$101,480/yr</td>
</tr>
<tr>
<td>Quantitative Financial Analyst</td>
<td>$139,350/yr</td>
</tr>
<tr>
<td>Statistic</td>
<td>$117,210/yr</td>
</tr>
<tr>
<td>Stockbroker</td>
<td>$118,640/yr</td>
</tr>
<tr>
<td>Technical Writer</td>
<td>$100,020/yr</td>
</tr>
<tr>
<td>Urban Planner</td>
<td>$94,800/yr</td>
</tr>
</tbody>
</table>

(Source: WeUseMath.org)
Actuary
An actuary is a business professional who deals with the financial impact of risk and uncertainty. Actuaries apply mathematical and statistical theories to solve real business problems. Actuaries assemble and analyze data to estimate the probability and likely cost of an event such as death, sickness, injury, disability, or loss of property. They also address financial questions; including those involving the way a company should invest its resources to maximize its return on investments. “Actuaries are in high demand, and they are highly paid for the services they render.”

**Education:** Actuaries need a strong foundation in mathematics, statistics, and general business. They generally have a bachelor’s degree and are required to pass a series of exams in order to become a certified actuary.

**When Math Is Used:** Actuaries assemble and analyze data to estimate the probability and likely cost of an event such as death, sickness, injury, disability, or loss of property. Using their broad knowledge of statistics, finance, and business, actuaries help design insurance policies, pension plans, and other financial strategies in a manner which will help ensure that the plans are maintained on a sound financial basis.

**Potential Employers:** Actuaries are essential to the insurance industry; to other businesses and corporations, including sponsors of pension plans; and to government agencies, such as the Government Actuary’s Department in the UK or the Social Security Administration in the US.

**Facts:** In 2009, a Wall Street Journal survey on the best jobs in the United States listed an actuary as the second best job. In 2006, U.S. News & World Report included actuaries among the 25 Best Professions that it expects will be in great demand in the future.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Probability and Mathematical Statistics, Applied statistics, Actuarial Mathematics, Optional courses in numerical analysis, some training in operations research, and substantial training in computer science

**Citations:**
http://en.wikipedia.org/wiki/Actuary
http://www.bls.gov/oco/ocos041.htm
http://online.wsj.com/article/SB123119236117055127.html
http://www.bls.gov/oes/current/oes152011.htm
http://math.uww.edu/oldsite/mathsdept/actuary1.htm
http://www.beanactuary.org/hs/preparing.cfm

Animator
An animator is an artist who creates multiple images called frames and key frames that form an illusion of movement called animation when rapidly displayed. Animators can work in a variety of fields including film, television, video games, and the internet.

**Education:** Although formal training, such as a Bachelor or Master degree in Fine Arts isn’t always required, it can help one who wants to work as an animator develop sought after skills. These programs often include course work in mathematics, art history, studio art, and computer techniques.

**When Math Is Used:** An animator has to have knowledge of many applied math subjects. It allows the animator to find unknowns from a simple set of equations and to work out aspects of geometric figures when you are dealing with objects that move and change. An animator uses linear algebra to show the way that an object is rotated and shifted and made larger and smaller—all major actions in animation.

**Potential Employers:** There are only so many jobs at Disney and Pixar, and not every 3D animator wants to work on motion picture cartoons. Animators also find success in computer and console game development, television programming, broadband internet animation, broadcast and web advertising, education, research, and military and corporate training.

**Facts:** Generally, an animator will average about a hundred frames a week (that's 4 seconds of actual screen time).

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Linear Algebra

**Citations:**
http://en.wikipedia.org/wiki/Animator
http://careerplanning.about.com/od/occupations/p/animator.htm
http://www.skulpt.com/3d-animator-career-options.htm
http://www.pixar.com/artistscorner/gini/interview.html
http://www.bls.gov/oes/current/oes271014.htm
http://wwwanimationschoolreview.com/sketches/2005/09/3d-computer-animat...
Astronaut
An astronaut is a person trained by a human spaceflight program to command, pilot, or serve as a crew member of a spacecraft. There are three types of astronauts in the U.S. space program: the commander/pilot, mission specialist, and payload specialist. The commander is responsible for the mission, the crew, and the vehicle. The pilot assists the commander in operating the vehicle and deploying satellites. The mission specialist works with the commander and pilots in shuttle operations, performs spacewalks and conducts experiments. The payload specialist performs specialized duties as the mission requires. Payload specialists are people other than NASA personnel, and some are foreign nationals.

**Education:** The education required to become an astronaut includes a bachelor's degree in mathematics, physical sciences, biological sciences, or engineering. Then it is required to gain three years of related experience after obtaining a bachelor’s degree. A master’s degree equals one year of experience and a doctorate equals three years.

**When Math Is Used:** Astronauts use math in order to make precise mathematical calculations, from how the spacecraft leaves Earth’s atmosphere to how the astronauts pilot the craft. Designers use math to calculate distance, speed, velocity, and their own safety when creating space-faring vehicles.

**Potential Employers:** Most U.S. astronauts work for the National Aeronautics and Space Administration (NASA). They live and train at the Lyndon B. Johnson Space Center in Houston.

**Facts:** When astronauts fly into space to conduct missions, it is made possible because of precise mathematical calculations, from how the spacecraft leaves Earth’s atmosphere to how the astronauts pilot the craft. Designers use math to calculate distance, speed, velocity, and their own safety when creating space-faring vehicles. The height requirements of an astronaut are 64 to 76 inches for pilots and 58.5 to 76 inches for mission/payload specialists.

**Math Required:** College Algebra, Trigonometry, Calculus I, II, III, Ordinary Differential Equations, Linear Algebra

**Citations:**
http://en.wikipedia.org/wiki/Astronaut
http://money.howstuffworks.com/question534.htm
http://www.govcentral.com/benefits/articles/1660
http://chelseahouse.infobasepublishing.com/BookList.asp?pageID=2&gradeTy...
http://saas.byu.edu/catalog/2008-2009ucat/departments/ECEn/ElectricalEng...

Biologist
Biologists study living organisms and their relationship to the environment. They perform research to gain a better understanding of fundamental life processes or apply that understanding to developing new products or processes. Most specialize in one area of biology, such as zoology (the study of animals) or microbiology (the study of microscopic organisms).

**Education:** A Ph.D. degree usually is necessary for independent research, industrial research, and college teaching, as well as for advancement to administrative positions. A master’s degree is sufficient for some jobs in applied research, product development, management, or inspection; it also may qualify one to work as a research technician or a teacher. The bachelor’s degree is adequate for some non-research jobs. In addition to required courses in chemistry and biology, undergraduate biological science majors usually study allied disciplines such as mathematics, physics, engineering, and computer science. Computer courses are beneficial for modeling and simulating biological processes, operating some laboratory equipment, and performing research in the emerging field of bioinformatics.

**When Math Is Used:** Biologists use math as they plot graphs to help them understand equations, run small "trial and error" tests with some sample numbers when developing algorithms, and use the R project for analyzing protein sequences and structures. Biologists also use software with a lot of underlying mathematics.

**Potential Employers:** About 39 percent of all biological scientists are employed by Federal, State, and local governments. Federal biological scientists work mainly for the U.S. Departments of Agriculture, Interior, and Defense and for the National Institutes of Health. Most of the rest work in scientific research and testing laboratories, the pharmaceutical and medicine manufacturing industry, or colleges and universities.

**Facts:** Biologists who leave the field generally look for a career that will satisfy both their scientific and social interests. They become doctors, veterinarians, laboratory managers, statisticians, and even dentists at a higher salary than do those who leave most other professions.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Statistics

**Citations:**
http://www.bls.gov/oco/ocos047.htm
http://www.cbsalary.com/national-salary-chart.aspx?specialty=Biologist&c...
http://saas.byu.edu/catalog/2009-2010ucat/departments/Biology/BiologyMaj...
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. Other academic and government biostatisticians analyze data of populations exposed to environmental chemicals and conditions to understand their risks and effects.

**Education:** A bachelor's degree is sufficient for entering the field of Biostatistics as an assistant. However, most Biostatisticians have M.S. or Ph.D. degrees in Biostatistics, Statistics, or Applied Mathematics.

**When Math Is Used:** Biostatisticians collaborate with researchers as they design studies, helping them find the best approach to data gathering given the question the researchers are trying to answer. These statisticians provide advice on such topics as sample size and data collection (what methods will be used to gather the data). Once the raw data have been gathered, biostatisticians use statistical software to turn the data into useful information. They use standard statistical procedures and terms to help researchers pinpoint which results were significant and which were inconclusive, warranting further study. Biostatisticians sometimes find themselves cleaning up an imperfect data set to help researchers glean conclusions from it.

**Potential Employers:** Biostatisticians may be hired by a number of different employers. For instance, they may work at universities or large health care institutions. They may be employees of federal or state government agencies, such as the Department of Health and Human Services. Or they may work in private companies' research and development groups.

**Facts:** Biostatisticians research topics such as the association between a psychotropic drug and weight gain or the relationship between heart disease and smoking.

**Math Required:** Algebra I and II, Trigonometry, Calculus I and II, Applied Data Analysis, Survey and Research Methods, Mathematical Statistics, Biostatistics

**Citations:**
http://education-portal.com/articles/Biostatistician_Job_Description_and...

Budget Analyst

Budget analysts develop, analyze, and execute budgets, which are used to allocate current resources and estimate future financial needs. They examine budget estimates and proposals for completeness; accuracy; and conformance with established procedures, regulations, and organizational objectives. Sometimes they employ cost-benefit analyses to review financial requests, assess program tradeoffs, and explore alternative funding methods.

**Education:** A bachelor's degree is sufficient for entering the field of Biostatistics as an assistant. However, most Biostatisticians have M.S. or Ph.D. degrees in Biostatistics, Statistics, or Applied Mathematics.

**When Math Is Used:** Budget analysts require the mathematical problem-solving skills necessary in order to develop, analyze, and execute budgets for various sizes of companies. They must be good and comfortable with numbers as they allocate current resources and estimate future financial needs.

**Potential Employers:** Budget analysts require the mathematical problem-solving skills necessary in order to develop, analyze, and execute budgets for various sizes of companies. They must be good and comfortable with numbers as they allocate current resources and estimate future financial needs.

**Facts:** As of 2009, budget analysts have been assisting the States in cutting back on their budgets. An article in the Wall Street Journal said, "State budgets look bad now, but they are set to get worse . . . tax collections aren't likely to be enough to take their place—even if the economy is recovering. The drop in tax revenue is set to be deeper and last longer."

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I, II, III, Linear Algebra, Theory of Analysis, Statistics

**Citations:**
http://www.bls.gov/oco/ocos003.htm
http://online.wsj.com/article/SB124398568837379031.html?mod=relevancy
http://www.bls.gov/oes/current/oes132031.htm
http://statistics.byu.edu/index.php
http://www.bls.gov/oco/ocos003.htm
**Cartographer**
Cartographers design, prepare and revise maps, charts, plans, three-dimensional models and spatial information databases, often using computer-based techniques, and applying principles from science, mathematics and graphic design. Cartographers may specialize in topographical maps (which show earth surface features and land use); or maps used for operational purposes in fields such as town planning, weather forecasting, tourism, hydrography, geological or mineral exploration and the military.

**Education:** There are several routes into cartographic occupations. Employers look for applicants who have a high school education, plus two to four years of formal education in mathematics, trigonometry, geography, geology, drafting, or related fields. Depending upon the particular job, specialized courses such as surveying, cartography, and photogrammetry may be needed. Preparation in high school for should include computer sciences, algebra, trigonometry, geography, and CAD.

**When Math Is Used:** Math helps cartographers with map scale, coordinate systems, and map projection. Map scale is the relationship between distances on a map and the corresponding distances on the earth’s surface expressed as a fraction or a ratio, coordinate systems are numeric methods of representing locations on the earth’s surface, and map projection is a function or transformation which relates coordinates of points on a curved surface to coordinates of points on a plane.

**Potential Employers:** Most cartographers work with engineering, architectural, and surveying firms, but a substantial number work for federal, regional, state, and local governments. Government agencies hire cartographers in areas such as highway departments, land management, natural resources planning, and national defense. Many are also employed by businesses, which specialize in map publishing or map drafting services.

**Facts:** Cartography is an ancient discipline that dates from the prehistoric times, often depicting hunting and fishing territories.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Discrete Mathematics, Elementary Statistics, Spatial Statistics

**Citations:**
http://www.myfuture.edu.au/services/default.asp?FunctionID=5050&SCO=212311A
http://www.britannica.com/EBchecked/topic/97492/cartography
http://www.bls.gov/oco/ocos040.htm
http://www.bls.gov/oes/current/oes171021.htm
http://academics.concord.edu/allenj/reqs.html
http://math.rice.edu/~lanius/pres/map/mappro.html

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**Chemical Engineer**
Chemical engineering is the branch of engineering that deals with the application of physical science and life sciences with mathematics to the process of converting raw materials or chemicals into more useful or valuable forms. In addition to producing useful materials, modern chemical engineering is also concerned with pioneering valuable new materials and techniques.

**Education:** Engineers typically enter the occupation with a bachelor’s degree in mathematics or an engineering specialty, but some basic research positions may require a graduate degree. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

**When Math Is Used:** Much of chemical engineers’ mathematical work is planning and the theoretical “modeling” of production processes and analysis that takes place on computer or in preliminary reports.

**Potential Employers:** About 37 percent of engineering jobs are found in manufacturing industries and another 28 percent in professional, scientific, and technical services, primarily in architectural, engineering, and related services. Many engineers also work in the construction, telecommunications, and wholesale trade industries. Some engineers also work for Federal, State, and local governments in highway and public works departments. Ultimately, the type of engineer determines the type of potential employer.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Statistics

**Citations:**
http://en.wikipedia.org/wiki/Chemical_engineering
http://www.cbsalary.com/national-salary-chart.aspx?specialty=Chemical+En...
http://www.bls.gov/oco/ocos027.htm
**Chemist**

Chemists study the composition of matter and its properties such as density, acidity, size and shape. They carefully describe the properties they study in terms of quantities, with detail on the level of molecules and their component atoms. Chemists use this knowledge to learn the composition, and properties of unfamiliar substances, as well as to reproduce and synthesize large quantities of useful naturally occurring substances and create new artificial substances and useful processes.

**Education:** To become a chemist, a person needs to have a bachelor’s degree in chemistry or a related subject such as mathematics. Materials scientists need a college degree in materials science, or chemistry, physics, or electrical engineering. However, chemists and materials scientists usually need a Ph.D. for research jobs.

**When Math Is Used:** Chemists use math for a variety of tasks. They balance the equation of a chemical reaction, use mathematical calculations that are absolutely necessary to explore important concepts in chemistry, and utilize dimensional analysis to find any range of information about reactions from finding the mass of chemicals reacted to the concentration of a chemical in a solution. Math is also used to calculate energy in reactions, compression of a gas, grams needed to add to a solution to reach desired concentration, and quantities of reactants needed to reach a desired product.

**Potential Employers:** About 4 out of 10 jobs are in manufacturing firms. A lot of the firms are in the chemical manufacturing industry, which produces plastics and synthetic materials, drugs, soaps and cleaners, paints, industrial organic chemicals, and other chemical products. Others work for scientific research and development firms. In addition, thousands of chemists teach in high schools and colleges and universities.

**Facts:** Chemists are “paid to be creative, careful, and productive. It’s a career for people who think about the future.”

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Statistics

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**Climatologist**

Climatologists study climate conditions averaged over a period of time. They use climate models for a variety of purposes, from the study of the dynamics of the weather and climate system to projections of future climate. In contrast to meteorology, which focuses on short term weather systems lasting up to a few weeks, climatology studies the frequency and trends of those systems. Climatology considers the past and can help predict future climate change.

**Education:** Climatologists need to have a strong background in mathematics and science. In fact, a bachelor’s degree in mathematics provides excellent preparation for graduate study in climatology. Climatologists often pursue higher education by obtaining a master’s degree and a Ph.D.

**When Math Is Used:** A climatologist uses mathematical skills in collecting climate data, investigating climate indicators, and making predictions regarding climate patterns. They may use computer models to study how Earth’s climate changes with time, and sophisticated computer software programs that assist them in modeling the Earth’s climate and check that data against known information. They conduct research to determine if humans are affecting Earth’s present and future climate.

**Potential Employers:** About 37 percent of atmospheric scientists are employed by the Federal Government; most of these work in the National Weather Service. Others worked for professional, scientific, and technical services firms, including private weather consulting services; radio and television broadcasting; air carriers; and State government.

**Facts:** Climatologists are able to study and research special occurrences of the Earth’s climate. For example, in 1995 climatologists declared that year “the hottest year on record.” Four years later, the 1990s were confirmed as the hottest decade in 1,000 years.


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**Citations:**

http://en.wikipedia.org/wiki/Climatology
http://www.cbsalary.com/national-salary-chart.aspx?specialty=Chemist&cty...
http://www.bls.gov/k12/science01.htm
http://www.chem.byu.edu/Site/MajorAcademicPlans
http://answers.yahoo.com/question/index?qid=20081108091621AASNIHe
http://wiki.answers.com/Q/How_does_a_chemist_use_math
College Professor
Postsecondary teachers instruct students in a wide variety of academic and vocational subjects beyond the high school level. Postsecondary teachers include college and university faculty, postsecondary career and technical education teachers, and graduate teaching assistants.

**Education:** The education and training required of postsecondary teachers varies widely, depending on the subject taught and educational institution employing them. Educational requirements for teachers are generally highest at research universities, where a Ph.D. is the most commonly held degree; at career and technical institutes, experience and expertise in a related occupation is the principal qualification.

**When Math Is Used:** A college professor's time is largely spent on research, preparing class material, meeting with students, or however else he or she chooses. Math is used when the professor teaches the specific courses he or she chooses and when the professor conducts mathematical research.

**Potential Employers:** Professors are hired everywhere at universities, state colleges, and technical institutes.

**Facts:** With the exception of scheduled classes—which can consume as few as three hours a week in graduate universities or up to sixteen hours per week for undergraduates—a professor's time is largely spent on research, preparing class material, meeting with students, or however else he or she chooses. This profession is thus best suited for motivated self-starters, and its highest rewards are given to those who can identify and explore original problems in their fields.

**Math Required:** College Algebra, Trigonometry, Calculus I, II, III, Linear Algebra, Ordinary Differential Equations, Real Analysis, Abstract Algebra, Theory of Analysis, Complex Analysis — Although faculty at junior colleges may only need the math in this list, most math professors at research universities need much more math than this.

**Citations:**
http://www.bls.gov/oco/ocos066.htm
http://saas.byu.edu/catalog/2008-2009ucat/departments/Mathematics/MathMa...

Computational Biologist
A computational biologist applies the techniques of computer science, applied mathematics and statistics to address biological problems. His/her main focus lies on developing mathematical modeling and computational simulation techniques. By these means it addresses scientific research topics without a laboratory.

**Education:** Until recently, there were no formal educational opportunities in computational biology at the graduate level. Therefore, most of the current practitioners and authorities in the field have a combination of degrees at the graduate (master’s or doctorate) and undergraduate levels in mathematics, computer science, and biology.

**When Math Is Used:** Computational biologists use math as they apply algorithms and statistical techniques to the interpretation, classification and understanding of biological data. These typically consist of large numbers of DNA, RNA, or protein sequences. They also are concerned with building computational models of biological systems and mathematically modeling the behavior or molecules.

**Potential Employers:** Highly qualified individuals are in demand at academic, private, and government research institutes alike.

**Facts:** The International Society for Computational Biology (ISCB) is an organization for computational biologists and it serves over 2500 members from nearly 70 countries around the world.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Numerical Analysis, Differential Equations, Probability and Statistics

**Citations:**
http://www.answers.com/topic/computational-biologist
http://www.simplyhired.com/a/salary/search?q=Computational+Biologist
http://www.cb.cornell.edu/courses/
Cost Estimator
Cost estimators figure out how much a project or product will cost. This helps business owners and managers decide whether to build a structure or manufacture a product. If a business doesn’t think it can make enough money, it will not do it. Cost estimators also find out which jobs are making a profit. The exact method of figuring out the cost varies, depending on the industry in which you work. Cost estimators study information on all of the things that can change the cost of a project. This includes supplies, labor, location, special equipment, like computer hardware and software.

Education: Employers prefer to hire individuals with a degree in mathematics, statistics, engineering, physical science, or operations research. They can also have a degree in accounting, finance, business, economics, or a related subject. Math and computer skills are very important. Strong communication and analytical skills are also important.

When Math Is Used: Cost estimators compile and analyze data on all of the factors that can influence costs. The estimator’s goal is to accurately estimate the costs associated with making products, constructing a building, etc. They are able to do this through asking for pricing information from outside vendors, mathematically determining the cost of each component, and preparing time-phase charts and learning curves. Using all of this information, the estimator then calculates the hours necessary to produce a specified number of units. These hours are then converted to dollar values. The estimator then compares the total cost of purchasing with the total cost of manufacturing to determine which is cheaper.

Potential Employers: About 62 percent of estimators are in the construction industry, and another 15 percent are employed in manufacturing. The remainder work in a wide range of other industries. Cost estimators work throughout the country, usually in or near major industrial, commercial, and government centers and in cities and suburban areas undergoing rapid change or development.

Facts: The United States’ Central Intelligence Agency (CIA) employs cost estimators in order to perform a wide range of acquisition activities for large space system development and acquisition programs, design and execute analytic studies to offer insights into programs and activities, and estimate the full costs for selected new initiatives and expanded projects.

Math Required: College Algebra, Trigonometry, Calculus I, II, III, Ordinary Differential Equations, Linear Algebra

Citations:
http://www.bls.gov/k12/math05.htm
http://www.bls.gov/oco/ocos006.htm
https://www.cia.gov/careers/jobs/view-all-jobs/nro-acquisition-cost-estim...
http://www.bls.gov/oes/current/oes131051.htm
http://saaas.byu.edu/catalog/2008-2009ucat/departments/Mathematics
Cryptanalyst
Cryptanalysts design, implement, and analyze algorithms for solving problems. They analyze and decipher secret coding systems and decode messages for military, political, or law enforcement agencies or organizations. They help provide privacy for people and corporations, and keep hackers out of important data systems. They are constantly working on new ways to encrypt information.

**Education:** Most cryptanalysts have at least a bachelor’s degree in mathematics or computer science. In fact, many cryptanalysts have graduate degrees in mathematics. A Ph.D. is usually required for cryptanalysts employed in a research environment or those who teach at the university level.

**When Math Is Used:** Cryptanalysts use math to perform the following tasks: Study and test ideas and alternative theories, Follow mathematical theorems and formulas, Encode and encrypt systems and databases, Perform cryptic computations and apply methods of numerical analysis, Devise systems for companies to help keep hackers out and to protect the company and consumer, Use computers to make graphs, tables and charts of data, Act as consultant to research staff concerning cryptical and mathematical methods and applications.

**Potential Employers:** Cryptanalysts are employed by educational institutions, bank and trust companies, financial institutions, insurance companies, scientific institutions, and research agencies. They also may work for telecommunications companies, computer design firms, consulting firms, science and engineering firms, and all levels of government, including special services and intelligence agencies.

**Facts:** Mathematicians landed the top spot in the 2009 ranking of “Best Occupations in the U.S.”

**Math Required:** College Algebra, Trigonometry, Calculus I, II, III, Linear Algebra, Differential Equations, Partial Differential Equations, Elementary Number Theory, Introduction to Real Analysis, Analysis I and II, Methods of Complex Analysis, Mathematical Cryptography

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**Economist**
Economists study how society distributes resources, such as land, labor, raw materials, and machinery, to produce goods and services. They may conduct research, collect and analyze data, monitor economic trends, or develop forecasts. Economists research a wide variety of issues including energy costs, inflation, interest rates, exchange rates, business cycles, taxes, and employment levels, among others.

**Education:** A master’s or Ph.D. degree in economics is required for many private sector economist jobs and for advancement to more responsible positions. In the Federal Government, candidates for entry-level economist positions must have a bachelor’s degree with a minimum of 21 semester hours of economics and 3 hours of statistics, accounting, or calculus. Undergraduate economics majors can choose from a variety of courses, ranging from microeconomics, macroeconomics, and econometrics to more philosophical courses, such as the history of economic thought.

**When Math Is Used:** Economists perform the following mathematical tasks: Use mathematical models to better understand such issues as the nature and length of business cycles, the effects of inflation, or the effects of tax legislation on unemployment levels, Develop data collection methods and procedure methods such as questionnaires, Apply all knowledge to advise businesses and other organizations.

**Potential Employers:** The Government employs 52 percent of economists, in a wide range of agencies, with 32 percent in Federal Government and 20 percent in State and local government. The remaining jobs are spread throughout private industry, particularly in scientific research and development services and management, scientific, and technical consulting services. Employment of economists is concentrated in large cities. Some work abroad for companies with major international operations, for U.S. Government agencies, and for international organizations, such as the World Bank, International Monetary Fund, and United Nations.

**Facts:** Economists made #11 in a 2009 Wall Street Journal survey of the best jobs in the United States.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Mathematical Economics, Game Theory, Statistics for Economists

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**Citations:**
- http://online.wsj.com/article/SB1231192361170555127.html
- http://www.mathematics.jhu.edu/new/undergrad/courses.htm
- http://online.wsj.com/article/SB1231192361170555127.html
Electrical Engineer

Electrical engineers design, develop, test, and supervise the manufacture of electrical equipment. Some of this equipment includes electric motors; machinery controls, lighting, and wiring in buildings; automobiles; aircraft; radar and navigation systems; and power generation, control, and transmission devices used by electric utilities.

**Education:** Engineers typically enter the occupation with a bachelor's degree in mathematics or an engineering specialty, but some basic research positions may require a graduate degree. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

**When Math Is Used:** There are three keys reasons why mathematics is important for all types of engineers:

1. The laws of nature (e.g., Maxwell's equations for electromagnetics, Kirchhoff's rules for circuit analysis) are mathematical expressions. Mathematics is the language of physical science and engineering.
2. Mathematics is more than a tool for solving problems; mathematics courses can develop intellectual maturity.
3. Computers do not make traditional mathematical analysis obsolete! First, computer programs contain mathematical relations; understanding these relations is still necessary. Second, debugging computer programs is a difficult art. One of the best ways to validate a program is to compare the computer simulation to the analytical solution for the same situation. Knowledge of traditional mathematical analysis is essential for this method of validating computer programs. Third, it is relatively easy to write brute-force computer code that requires a long runtime and produces significant error, owing to accumulation of errors from the limited resolution of machine numbers. Great increases in both speed and accuracy can be obtained by using analytical solutions for parts of the problem, or by careful development of appropriate algorithms.

**Potential Employers:** About 37 percent of engineering jobs are found in manufacturing industries and another 28 percent in professional, scientific, and technical services, primarily in architectural, engineering, and related services. Many engineers also work in the construction, telecommunications, and wholesale trade industries. Some engineers also work for Federal, State, and local governments in highway and public works departments.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Statistics

**Citations:**

- http://www.bls.gov/oco/ocos027.htm
- http://www.rbs0.com/math.htm

Epidemiologist

An epidemiologist investigates and describes the causes and spread of disease and develops the means for prevention or control. They may study many different illnesses, often focusing on major infectious diseases such as influenza or cholera.

**Education:** Undergraduate students should have a solid background in mathematics, chemistry, and computer science. Once a student is prepared for graduate studies, he or she can choose a specialty within epidemiology (e.g., water pollution, air pollution, pesticide use, toxicology, molecular biology, or outbreak investigation). Some jobs may require a Ph.D. or medical degree.

**When Math Is Used:** Epidemiologists use mathematical models in order to track the progress of most infectious diseases. They may also discover the likely outcome of an epidemic or to help manage them by vaccination. Some specific areas that epidemiologists may track are as follows: transmission, spread and control of infection, persistence of pathogens within hosts, immuno-epidemiology, virulence, strain structure and interactions, evolution and spread of resistance. One specific type of mathematical model used for many infectious diseases, such as measles, mumps, and rubella, is the SIR model. This model consists of three variables: S (for susceptible), I (for infectious) and R (for recovered).

**Potential Employers:** Among epidemiologists, 57 percent are employed in government; 12 percent are employed in hospitals; 11 percent are employed in colleges and universities; and 9 percent are employed in scientific research and development services, such as the American Cancer Society.

**Facts:** In 2009, epidemiologists conducted a study and found middle-aged women who indulge in just a few alcohol-containing drinks each day may have a higher risk of cancer than those who drink less often.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Applied Data Analysis, Survey and Research Methods, Mathematical Statistics, Biostatistics

**Citations:**

- http://www.bls.gov/oco/ocos008.htm
- http://www.mast.queensu.ca/graduate/biostatsprogram.php
- http://en.wikipedia.org/wiki/Mathematical_modelling_of_infectious...
Forensic Analyst
Forensic analysts use scientific techniques to solve criminal cases. They may use traditional methods such as fingerprinting, assisted by computers; in addition, blood analysis, forensic dentistry, voice and speech spectrograms, and genetic fingerprinting. Chemicals, such as poisons and drugs, are analyzed by chromatography and ESDA (electrostatic document analysis) is a technique used for revealing indentations on paper, which helps determine if documents have been tampered with.

**Education:** A career as a forensic analyst requires an undergraduate degree in mathematics, chemistry, biology, or a related natural science field. If the coursework is well planned, after finishing one of these degrees, you could immediately start applying for crime lab jobs. Another option would be to continue your education in graduate school earning a MSFS degree (2 year program). This will make you more competitive for entry level jobs and once hired will qualify you for promotions to supervisory positions.

**When Math Is Used:** A forensic analyst uses bloodstain pattern analysis in order to tell the story of the crime. It turns out that the location where the blood lands, and the shape of the blood on the landing surface, reveal both the direction in which the blood was moving and how much force was used to wound the victim. Analysts use math principles to figure out the location of the victim when the blood was shed and even the type of weapon or impact that caused the victim’s injury. Sometimes, blood from a weapon can even reveal a criminal’s mentality.

**Potential Employers:** About 30 percent of forensic analysts are self-employed, and around 34 percent of detective and investigator jobs are in investigation and security services, including private detective agencies, while another 9 percent are in department or other general merchandise stores. The rest work mostly in State and local government, legal services firms, employment services companies, insurance agencies, and credit mediation establishments, including banks and other depository institutions.

**Facts:** The first recorded reference to forensics comes from a book written in China in 1248. The book, called “Hsi Duan Yu” (which means “The Washing Away of Wrongs”) explained how to tell the difference between a person who has drowned and a person who has been strangled.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Statistics

**Citations:**
http://encyclopedia.farlex.com/Forensic+analyst
http://main.uab.edu/show.asp?durki=81041
http://www.baypath.edu/UndergraduateExperience/Academics/
http://www.myforensicsciencedegree.com/bloodstain-analysis/

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Geographer
A geographer is a scientist whose area of study is geography, the study of Earth’s physical environment and human habitat. Geographers study not only the physical details of the environment but also its impact on human and wildlife ecologies, weather and climate patterns, economics, and culture.

**Education:** Graduates with master’s degrees in applied specialties usually are qualified for positions outside of colleges and universities, although requirements vary by field. A Ph.D. degree may be required for higher-level positions. Bachelor’s degree holders have limited opportunities and do not qualify for most occupations. A bachelor’s degree does, however, provide a suitable background for many different kinds of entry-level jobs.

**When Math Is Used:** Training in math and statistics is essential for many geographers. They are increasingly using mathematical and quantitative research methods to solve the issues and problems dealing with geography. For example, geographers use mathematical calculations in order to identify population centers in the United States and China. Geographers also work extensively with maps and tables.

**Potential Employers:** About 41 percent work for Federal, State, and local governments, mostly for the Federal Government. Other employers include scientific research and development services; management, scientific, and technical consulting services; business, professional, labor, political, and similar organizations; and architectural, engineering, and related firms.

**Facts:** A literal translation of “geography” would be “to describe or write about the Earth.” The first person to use the word “geography” was Eratosthenes around 200 B.C. He calculated the size of the Earth.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Quantitative Reasoning, Statistics

**Citations:**
http://en.wikipedia.org/wiki/Geographer
http://www.bls.gov/oco/ocos054.htm
http://en.wikipedia.org/wiki/Geography
http://www.geog.byu.edu/BS/bsOverview.dhtml
**High-School Math Teacher**

High-school math teachers teach students subject like geometry, statistics, algebra and calculus. Daily tasks include planning lessons, creating sample problems, giving assignments, and writing tests. Most math teachers follow a state or district curriculum and use a textbook. In addition to teaching in the classroom, math teachers help students during office hours or before or after school. Teaching in a high school can be strenuous, but teaching is also cited as one of the most fulfilling careers.

**Education:** Math teachers begin their careers by earning a bachelor’s degree in math and completing a teacher preparation program. Some aspiring math teachers also earn a master’s degree in math or education. Coursework includes upper-level math classes and teaching-methods classes. Before graduating, students must work in a high school math classroom under the supervision of a math teacher.

**When Math Is Used:** High-school teachers use math to demonstrate sample problems in class, create assignments for students, and write and grade tests.

**Potential Employers:** After completing a degree, math teachers will be qualified to teach in any secondary school. In the United States, Arizona, Hawaii, and Montana have the highest concentration of math teachers (employment per thousand workers), while New York, Illinois, and Alaska are the top-paying states for math teachers.

**Math Required:** Calculus I and II, Linear Algebra, Calculus of Several Variables, Ordinary Differential Equations, Theory of Analysis, Abstract Algebra, Statistics

**Citations:**
- http://education-portal.com/how_to_become_a_high_school_math_teacher
Hydrologist

Hydrologists apply scientific knowledge and mathematical principles to solve water-related problems in society, such as problems of quantity, quality, and availability. They may be concerned with finding water supplies for cities or irrigated farms, or controlling river flooding or soil erosion. Or, they may work in environmental protection: preventing or cleaning up pollution or locating sites for safe disposal of hazardous wastes.

**Education:** A bachelor's degree in a field related to hydrology, such as mathematics, is required and a master's degree is strongly preferred to become a hydrologist.

**When Math Is Used:** Math is used by hydrologists as measurement is fundamental for assessing water resources and understanding the processes involved in the hydrologic cycle. Observations of hydrologic processes are used to make predictions of the future behavior of hydrologic systems. Hydrologists may also analyze the statistical properties of hydrologic records, such as rainfall or river flow, or use hydrologic models to show simplified, conceptual representations of a part of the hydrologic cycle.

**Potential Employers:** Hydrologists are employed in architectural, engineering, and related services; management, scientific, and technical consulting services; the Federal Government, mostly within the U.S. Department of the Interior for the U.S. Geological Survey (USGS) and within the U.S. Department of Defense; and some are self-employed and work as consultants to industry or government.

**Facts:** An unusually warm spring thaw in Alaska caused some of the state’s worst flooding in decades, with rising rivers wiping out one entire village and bombarding another town with ice chunks as big as houses. The floods resulted from a rare combination of unusually heavy winter snow and a spring warm-up that saw temperatures soar into the 70s—a good 20 degrees higher than normal for this time of year.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Ordinary Differential Equations, Probability and Statistics

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Market Research Analyst

Market researchers gather information about what people think. They help companies understand what types of products people want and at what price. They also help companies market their products to the people most likely to buy them. Gathering statistical data on competitors and examining prices, sales, and methods of marketing and distribution, they analyze data on past sales to predict future sales.

**Education:** A bachelor's degree is the minimum educational requirement for many market research jobs. However, a master's degree may be required, especially for technical positions. Because of the importance of quantitative skills to market and survey researchers, courses in mathematics, statistics, sampling theory and survey design, and computer science are extremely helpful.

**When Math Is Used:** Market research analysts use math every day as they perform the following tasks: Analyze statistical data on past sales to predict future sales, Gather data on competitors and analyze prices, sales, and methods of marketing and distribution, Devise methods and procedures for collecting data, Evaluate product and consumer data and make recommendations to the firm’s management or client so that decisions can be made on the promotion, distribution, design, and pricing of goods and services.

**Potential Employers:** Because of the applicability of market research to many industries, market research analysts are employed throughout the economy. The industries that employ the largest number of market research analysts are management of companies and enterprises; management, scientific, and technical consulting services; insurance carriers; computer systems design and related services; and other professional, scientific, and technical services—which includes marketing research and public opinion polling.

**Facts:** One great aspect of being a market research analyst is that you get to test products before they hit the market. You talk to lots of people and get to ask them personal questions you wouldn’t dare pose at a party.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus, Mathematical Economics, Statistics

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**Citations:**

- http://ga.water.usgs.gov/edu/hydrology.html
- http://online.wsj.com/article/SB124173392622498125.html
- http://www.sci.uidaho.edu/HydrologyProgram/
Mathematical Biophysicist
Mathematical biophysicists develop theories and methods of the physical sciences for the investigation of biological systems.

**Education:** A Ph.D. degree usually is required for independent research, but a master’s degree is sufficient for some jobs in applied research or product development.

**When Math Is Used:** Mathematical biophysicists use math as they apply models and experimental techniques to larger systems such as tissues, organs, populations, and ecosystems. Scientists in this field conduct research concerned with understanding the interactions between the various systems of a cell, including the interactions between DNA, RNA and protein biosynthesis.

**Potential Employers:** About 39 percent of all biological scientists were employed by Federal, State, and local governments. Federal biological scientists work mainly for the U.S. Departments of Agriculture, Interior, and Defense and for the National Institutes of Health. Most of the rest work in scientific research and testing laboratories, the pharmaceutical and medicine manufacturing industry, or colleges and universities.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Linear Algebra

**Citations:**
http://en.wikipedia.org/wiki/Biophysics
http://www.careerplanner.com/Job-Outlook/Biological-Scientists.cfm
http://www.careercornerstone.org/biology/bioearn.htm
http://www.apu.edu/clas/mathphysics/physics/careers/
http://en.wikipedia.org/wiki/Biophysics

Mathematical Physicist
A mathematical physicist applies mathematics to problems in physics and develops mathematical methods suitable for the formulation of physical theories.

**Education:** Usually a Ph.D. in mathematics or physics is needed to work as a mathematical physicist. People who want permanent jobs in basic research at universities and government labs need even more training. People with a master's degree in physics often get jobs in manufacturing and applied research and development. Those with a bachelor's degree often work as technicians or research assistants.

**When Math Is Used:** Math is constantly used as a mathematical physicist as they use models and equations to solve a variety of physics-related problems.

**Potential Employers:** About 38 percent of mathematical physicists work in scientific research and development services firms. Another 21 percent work for the Federal Government, mostly in the Department of Defense or the National Aeronautics and Space Administration. Others work in colleges and universities, usually in research.

**Facts:** The great seventeenth century English physicist and mathematician, Isaac Newton, developed a wealth of new mathematics (for example, calculus and several numerical methods) to solve problems in physics.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Topology, Combinatorics

**Citations:**
http://en.wikipedia.org/wiki/Mathematical_physics
http://www.bls.gov/k12/math04.htm
http://www.bls.gov/oco/ocos052.htm
Mechanical Engineer

Mechanical engineers research, design, develop, manufacture, and test tools, engines, machines, and other mechanical devices. Mechanical engineering is one of the broadest engineering disciplines. Engineers in this discipline work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also work on power-conditioning equipment, machine tools, material handling systems, elevators and escalators, industrial production equipment, and robots used in manufacturing.

Education: Engineers typically enter the occupation with a bachelor’s degree in mathematics or an engineering specialty, but some basic research positions may require a graduate degree. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

When Math Is Used: There are three keys reasons why mathematics is important for all types of engineers:
1. The laws of nature (e.g., Maxwell’s equations for electromagnetics, Kirchhoff’s rules for circuit analysis) are mathematical expressions. Mathematics is the language of physical science and engineering.
2. Computers do not make traditional mathematical analysis obsolete! First, computer programs contain mathematical relations; understanding these relations is still necessary. Second, debugging computer programs is a difficult art. One of the best ways to validate a program is to compare the computer simulation to the analytical solution for the same situation. Knowledge of traditional mathematical analysis is essential for this method of validating computer programs. Third, it is relatively easy to write brute-force computer code that requires a long runtime and produces significant error, owing to accumulation of errors from the limited resolution of machine numbers. Great increases in both speed and accuracy can be obtained by using analytical solutions for parts of the problem, or by careful development of appropriate algorithms.

Potential Employers: About 37 percent of engineering jobs are found in manufacturing industries and another 28 percent in professional, scientific, and technical services, primarily in architectural, engineering, and related services. Many engineers also work in the construction, telecommunications, and wholesale trade industries. Some engineers also work for Federal, State, and local governments in highway and public works departments. Ultimately, the type of engineer determines the type of potential employer.

Math Required: College Algebra, Geometry, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Statistics

Citations:  
http://www.bls.gov/oco/ocos027.htm  
National Security Analyst

National security analyst, also known as intelligence analysts, use the process of taking known information about situations and entities and with appropriate statements of probability, the future actions in those situations and by those entities. They reduce the ambiguity of highly uncertain situations.

**Education:** The minimum requirement includes an advanced degree and experience in fields involving mathematics, statistics, econometrics, operations research, computer or mathematical programming, and/or modeling.

**When Math Is Used:** National security analysts utilize mathematics, computer programming, engineering, and language skills as well as new technologies and creativity to solve tomorrow’s problems.

**Potential Employers:** The national security analyst practice is found in its purest form inside intelligence agencies, such as the Central Intelligence Agency (CIA) in the United States or the Secret Intelligence Service (SIS) in the UK. Its methods are also applicable in fields such as business intelligence or competitive intelligence.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Introduction to Real Analysis, Analysis I and II, Statistics

**Citations:**
http://en.wikipedia.org/wiki/Intelligence_analysis
https://www.cia.gov/careers/opportunities/analytical/analytic-methodolog...
http://www.mathematics.jhu.edu/new/undergrad/courses.htm
http://math.tntech.edu/who-is-hiring.html

Nuclear Engineer

Nuclear engineers devise how to use radioactive materials in manufacturing, agriculture, medicine, power generation, and many other ways. Many nuclear engineers design, develop, monitor, and operate nuclear plants used to generate power. They may work on the nuclear fuel cycle -- the production, handling, and use of nuclear fuel and the safe disposal of waste produced by the generation of nuclear energy. Others research the production of fusion energy. Some specialize in the development of power sources for spacecraft that use radioactive materials. Others develop and maintain the nuclear imaging technology used to diagnose and treat medical problems.

**Education:** A bachelor’s degree in engineering is required for almost all entry-level engineering jobs, but graduates with a degree in mathematics may qualify for some engineering jobs, especially in specialties that are in high demand. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and science. A doctoral degree is essential for faculty positions at universities and many research programs at national laboratories but is not required for the majority of entry-level engineering jobs. Many engineers obtain graduate degrees in engineering or business administration to learn new technology and broaden their education.

**When Math Is Used:** Math is required for all nuclear engineering, but some branches use math more than others. Math is specifically used in the computer code side of nuclear engineering, the instrumentation and control (I&C) area, and the heat transfer and fluid flow areas. Neutron transport, shielding work, nuclear criticality, and nuclear safety also involve a lot of math.

**Potential Employers:** Almost half of nuclear engineers are employed in utilities; one-quarter in professional, scientific, and technical services firms; and 14 percent in the Federal Government. Many federally employed nuclear engineers are civilian employees of the U.S. Navy, and others work for the U.S. Department of Energy or the Nuclear Regulatory Commission. In addition to the nuclear power industry, Nuclear Engineers also find employment in sectors such as medical equipment manufacturing, construction firms, national laboratories, research facilities, and consulting firms. Nuclear Engineers may also focus on fission or fusion energy.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Statistics

**Citations:**
http://www.bls.gov
http://www.newton.dep.anl.gov/askasci/eng99/eng99062.htm
Operations Research Analyst

Operations research analysts are involved in top-level strategizing, planning, and forecasting. They use advanced techniques from mathematics, science, and engineering to make better decisions and to solve problems. These analysts help to allocate resources, measure performance, design production facilities and systems, manage the supply chain, set prices, coordinate transportation and distribution, and analyze large databases. They also have been used in wartime to effectively deploy radar, search for enemy submarines, and get supplies to where they are most needed.

**Education:** Operations research analysts must obtain the minimum requirement of a bachelor’s degree in an area such as mathematics. Most employers do prefer applicants with a master’s degree and computer programming skills. Keeping up to date with technological advances and improvements in analytical methods is essential.

**When Math Is Used:** Operations Research Analysts use math to solve a wide variety of problems. For example, it may be used by: emergency medical services to plan the deployment of ambulances, governments to analyze the flow of patients through a health care system, hospitals to design blood banking systems or schedule staff and operating rooms, police departments to devise shift schedules that minimize response time and meet budget and human resource needs, railway companies to schedule and optimize the use of rolling stock, airlines to develop pricing strategies, schedule crews and aircraft, and develop disaster recovery plans, manufacturing companies to design or increase the efficiency of production systems, oil companies to evaluate prospective oil or gas projects, forestry companies to help decide how to manage large tracts of forest land, investment firms to manage risk and optimize portfolios.

**Potential Employers:** Many operations research analysts in the Federal Government work for the Department of Defense, and others in private industry work directly or indirectly on national defense.

**Facts:** The Game theory, a part of operations research, was used to select a strategy for the Battle of Midway during World War II. The U.S. Navy was on one side of Midway Island, and the Japanese Navy on the other. We calculated our probability of winning in the four cases of our going north of the

**Math Required:** College Algebra, Trigonometry, Calculus I, II, III, Advanced Multivariable Calculus, Linear Algebra, Advanced Linear Algebra, Linear Programming

**Citations:**
http://www.princeton.edu/engineering/undergraduate/majors/requirements/

Petroleum Engineer

Petroleum engineers work in the technical profession that involves extracting oil in increasingly difficult situations as the world’s oil fields are found and depleted. Petroleum engineers search the world for reservoirs containing oil or natural gas. Once these resources are discovered, petroleum engineers work with geologists and other specialists to understand the geologic formation and properties of the rock containing the reservoir, determine the drilling methods to be used, and monitor drilling and production operations.

**Education:** Engineers typically enter the occupation with a bachelor’s degree in mathematics or an engineering specialty, but some basic research positions may require a graduate degree. Most engineering programs involve a concentration of study in an engineering specialty, along with courses in both mathematics and the physical and life sciences. Engineers offering their services directly to the public must be licensed. Continuing education to keep current with rapidly changing technology is important for engineers.

**When Math Is Used:** Improvements in mathematical computer modeling, materials and the application of statistics, probability analysis, and new technologies like horizontal drilling and enhanced oil recovery, have drastically improved the toolbox of the petroleum engineer in recent decades.

**Potential Employers:** About 37 percent of engineering jobs are found in manufacturing industries and another 28 percent in professional, scientific, and technical services, primarily in architectural, engineering, and related services. Many engineers also work in the construction, telecommunications, and wholesale trade industries. Some engineers also work for Federal, State, and local governments in highway and public works departments. Ultimately, the type of engineer determines the type of potential employer.

**Facts:** Engineering diplomas accounted for 12 of the 15 top-paying majors, with petroleum engineering earning the highest average starting salary of $83,121.

**Math Required:** College Algebra, Geometry, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Statistics

**Citations:**
http://en.wikipedia.org/wiki/Petroleum_engineering
http://www.bls.gov/oco/ocos027.htm
Physician

Physicians, or doctors, diagnose illnesses and prescribe and administer treatment for people suffering from injury or disease. Physicians examine patients, obtain medical histories, and order, perform, and interpret diagnostic tests. They counsel patients on diet, hygiene, and preventive health care. Earnings of physicians and surgeons are among the highest of any occupation, and depend on area of specialty and how long the individual has been a physician.

**Education:** Becoming a doctor requires more training than most other jobs. It usually takes at least 11 years to become a doctor: 4 years of college, 4 years of medical school, and 3 years working in a hospital. To become a doctor, you should study mathematics, biology, chemistry, physics, and English. “Professional graduate schools in business, law, and medicine think mathematics is a great major because it develops analytical skills and the ability to work in a problem solving environment. And results on admission tests for graduate and professional schools show that students majoring in mathematics receive substantially higher scores than most other majors,” William Allard & Clark Bray, Duke University, Mathematics Department.

**When Math Is Used:** Physicians use math in every day practice. For example, they use statistics and probability to interpret tests results. When a patient is treated for an illness, the probability is used to determine which type of treatment to use, if any. “Evidence-based medicine, the use of statistical models to guide diagnoses and treatment, is already changing how doctors practice.” - Ian Ayres

**Potential Employers:** Approximately 15 percent of physicians are self-employed. About half of wage–and-salary physicians and surgeons work in offices of physicians, and 18 percent are employed by hospitals. Others practice in Federal, State, and local governments, including colleges, universities, and professional schools; private colleges, universities, and professional schools; and outpatient care centers.

**Facts:** Anesthesiologists focus on the care of surgical patients and pain relief. They are responsible for maintenance of the patient’s vital life functions—heart rate, body temperature, blood pressure, breathing—during surgery. They also work outside of the operating room, providing pain relief in the intensive care unit, during labor and delivery, and for those who suffer from chronic pain. Anesthesiology is the specialty where individuals can receive the highest salary as a physician.

**Math Required:** College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Statistics and Probability

**Citations:**
http://www.bls.gov/oco/ocos074.htm
http://www.bls.gov/k12/help06.htm
http://www.darton.edu/programs/scimath/programs/p-prephya.php
http://www.math.cornell.edu/Courses/FSM/biology.html
http://www.math.cornell.edu/Courses/FSM/biology.html

Psychometrician

A psychometrician is a person who practices the science of measurement, or psychometrics. The term psychometrics refers to the measurement of an individual’s psychological attributes, including the knowledge, skills, and abilities a professional might need to work in a particular job or profession. Also, psychometricians write exams such as the MCAT, LSAT, GMAT, SAT, ACT, and Advance Placement test.

**Education:** The minimum requirements for the position of a psychometrician are a Master's degree in educational measurement, industrial/organizational psychology, mathematics, or related area with relevant experience and training. A Ph.D. in a relevant field is highly desirable.

**When Math Is Used:** Psychometricians use the concepts of percentages, means, medians, distributions, correlation, and multiple regressions in their careers.

**Potential Employers:** Typically, many psychometricians work for testing organizations. They initially determine the abilities, skills and knowledge needed to do the job and create the specifications of the test. They then write test questions and determine the passing score. They may also perform data analyses on the test results as well as conducting validity and reliability studies. College Board, the company that writes the SAT and Advance Placement tests, employ psychometricians.

**Facts:** There is a great demand for psychometricians. “It’s a good day to be a psychometrician,” Gary Cook, an education researcher at the University of Wisconsin, said. “There’s a limited set of people who are qualified.”

**Math Required:** Statistics and Probability, College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations, Analysis

**Citations:**
http://www.timeoutfromtesting.org/0518_article_testtaking.php
http://diplomaguide.com/articles/Psychometrician_Career_Summary.html
http://www.timeoutfromtesting.org/0518_article_testtaking.php
https://www.excelsior.edu/Excelsior_College/About/Employment/
Purchasing Agent

Purchasing agents are in charge of all buying for their company. They buy the raw materials, goods, and services their company needs to maintain operations. Purchasing agents, or buyers as they are sometimes called, see that their company has a sufficient supply of the materials it needs to operate. However, agents must avoid tying up too much of the company’s money in supplies. Their job is to balance quality with cost to ensure that the best purchases are made. It is vital that purchasers stay up to date on overall market conditions and price trends that affect what they are buying. They use the latest pricing information available on the Internet to compute the price of items, the cost of handling and transportation for those items, and the cost of time spent by workers who unload the stock and fill out shipping paperwork.

Education:  Most employers require their purchasing agents to have a degree in business, mathematics, economics, engineering or a related field (Bachelor’s degree or higher), but a purchasing agent with a Master’s degree will have additional opportunities. Many certification programs are also available, such as the CPM, CPP, and CPE.

When Math Is Used:  The problem solving skills and analytical skills used in mathematics are an essential part of a career as a purchasing manager. Purchasing managers find that they are called on to solve problems, handle details, and coordinate many activities during intense work periods. They must also be comfortable handling complex data and have the ability to see the data from numerous perspectives.

Potential Employers:  It is good to know that this field is very competitive, so it wouldn’t hurt to gain any competitive advantage available to you, such as a Master’s degree.

Math Required:  College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Numerical Analysis & Differential Equations, Probability and Statistics

http://swz.salary.com/salarywizard/layouthtmls/swzl_comprerult
http://www.ehow.com/how_5737292_become-purchasing-agent.html

Quantitative Financial Market Analyst

A quantitative financial market analyst is a person who works in finance using numerical or quantitative techniques.

Education:  Quantitative financial market analysts often come from mathematics or physics backgrounds rather than finance related fields, and they are a major source of employment for people with physics and mathematics Ph.D’s.

When Math Is Used:  A typical problem for a numerically oriented quantitative analyst would be to develop a model for pricing and managing a complex derivative product.

Potential Employers:  Quantitative financial market analysts work in the financial markets, specifically in the banking industry to support trading and sales functions.

Facts:  Harry Markowitz’s 1952 Ph.D thesis “Portfolio Selection” was one of the first papers to formally adapt mathematical concepts to finance.

Math Required:  College Algebra, Trigonometry, Calculus I and II, Linear Algebra, Differential Equations

http://www.payscale.com/research/US/Job=Quantitative_Analyst/Salary
http://www.indeed.com/salary/Quantitative-Analyst.html
http://www.math.uci.edu/undergraduate/major.php
Statistics

Statistics is the scientific application of mathematical principles to the collection, analysis, and presentation of numerical data. Statisticians apply their mathematical and statistical knowledge to the design of surveys and experiments; the collection, processing, and analysis of data; and the interpretation of the experiment and survey results. Opinion polls, statements of accuracy on scales and other measuring devices, and information about average earnings in an occupation are all usually the work of statisticians.

**Education:** A master's degree in statistics or mathematics is the minimum educational requirement, but research and academic jobs generally require a Ph.D.; Federal Government jobs require at least a bachelor’s degree.

**When Math Is Used:** Statistics is the scientific application of mathematical principles to the collection, analysis, and presentation of numerical data. Statisticians apply their mathematical and statistical knowledge to the design of surveys and experiments; the collection, processing, and analysis of data; and the interpretation of the experiment and survey results.

**Potential Employers:** About 20 percent of jobs are in the Federal Government, where statisticians are concentrated in the Departments of Commerce, Agriculture, and Health and Human Services. Another 10 percent are found in State and local governments, including State colleges and universities. Most of the remaining jobs are in private industry, especially in scientific research and development services, insurance carriers, and pharmaceutical and medicine manufacturing.

**Facts:** Statisticians are hired by professional sports teams to analyze teams and players and to determine the probability a particular play be executed successfully. Statistician was named as the number three best job in The Best and Worst Jobs in the United States in 2009.

**Math Required:** College Algebra, Trigonometry, Calculus I, II, III, Linear Algebra, Ordinary Differential Equations, Theory of Analysis, Mathematical Models

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Stockbroker

A stockbroker invests in the stock market for individuals or corporations. Only members of the stock exchange can conduct transactions, so whenever individuals or corporations want to buy or sell stocks they must go through a brokerage house. Stockbrokers often advise and counsel their clients on appropriate investments. Brokers explain the workings of the stock exchange to their clients and gather information from them about their needs and financial ability, and then determine the best investments for them.

**Education:** The job market for a stockbroker prefers that you have a college degree in a related field such as mathematics or business. Stock brokers have to be duly licensed by passing the General Securities Representative Examination and by posting a bond. Brokerage firms usually take their applicants into a four-month intensive on-the-job training to prepare their employees for the licensure exam. Aside from the general licensure exam, most states also require the Uniform Agents State Law examination.

**When Math Is Used:** Stockbrokers use math all the time from simple things like how many shares of XYZ can a client buy with $10,000 if the commission is $55, to advanced calculation when helping a client plan for retirement factoring in current assets, expected returns, inflation, taxes, and living expenses. A stockbroker also uses math to evaluate stocks and mutual funds. Items such as PE Ratio, Alpha, and Beta can indicate if a stock has become overpriced relative to its peers and the level of risk associated with certain funds. It is important that stockbrokers understand how these calculations are determined so that they will better understand what the results mean and how changes in variables are likely to effect the given results.

**Potential Employers:** Although stockbrokers are employed by firms in all parts of the country, about 1 in 10 jobs were located in New York City, including the majority of those in investment banking. Because of their close relationship to stock exchanges and large banking operations, most of the major investment banks in the United States are based in New York City.

**Facts:** Part of being a stockbroker is the need to communicate really well. If you are a shy type then you can forget about your dreams of becoming a stockbroker. A stockbroker is typically highly confident and needs to communicate with buyers and sellers and with fellow brokers.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Mathematical Economics, Game Theory, Statistics for Economists

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Citations:
http://swz.salary.com/salarywizard/layouthtmls/swz1_compresult
http://articles.directorym.com/Stock_Broker-a861753.html#8075208
http://www.bls.gov/oes/current/oes41303.htm
http://wiki.answers.com/Q/How_do_stockbrokers_use_math
Technical Writer
A technical writer is a professional writer who designs, writes, creates, maintains, and updates technical documentation—including online help, user guides, white papers, design specifications, system manuals, and other documents. A technical writer produces technical documentation for technical, business, and consumer audiences.

**Education:** A college degree generally is required for a position as a writer. Good facility with computers and communications equipment is necessary in order to stay in touch with sources, editors, and other writers while working on assignments, whether from home, an office, or while traveling. Increasingly, technical writing requires a degree in, or some knowledge about, a specialized field—for example, mathematics, engineering, or business.

**When Math Is Used:** When a technical writer specializes in technical writing for math, they will use their math skills every day. They will use their mathematical knowledge to design, write, create, and maintain technical documentation.

**Potential Employers:** Technical writers work for book, magazine, or newspaper publishers, or they may be employed in other industries. Technical writers who work for the federal government write the pamphlets that are published by the Government Printing Office. These pamphlets cover many different fields, including the activities of various government agencies and the developments in research in such areas as medicine, education, agriculture, and aerospace. Some technical writers work for colleges or universities or for the publishers of professional journals. Others work for advertising agencies.

**Facts:** Many technical writers work as freelance writers. Freelance writers are self-employed and sell their work to publishers, corporations, manufacturing firms, and advertising agencies. They are paid by the job or by the hour. Sometimes they are hired to do specific jobs such as writing about a new high-tech product or advancement.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I, II, III, Linear Algebra, Differential Equations

**Citations:**

Urban Planner
Urban planners develop long- and short-term plans for the use of land and the growth of urban, suburban, and rural communities and the region in which they are located. They help local officials by recommending locations for roads, schools, and other infrastructure and suggesting zoning regulations for private property. This work includes forecasting the future needs of the population.

**Education:** Most entry-level jobs in Federal, State, and local governments require a master’s degree from an accredited program in urban or regional planning or a related field. A bachelor’s degree in mathematics, economics, geography, political science, or environmental design is especially good preparation.

**When Math Is Used:** Urban designers use math as they design the arrangement, appearance, and functionality of towns and cities, and in particular, the shaping and uses of safe public space. Also, urban designers use mathematical models to forecast the future needs of a group of people.

**Potential Employers:** About 68 percent are employed by local governments. Companies involved with architectural, engineering, and related services, as well as management, scientific, and technical consulting services, employ an increasing proportion of planners in the private sector. Others are employed in State government agencies dealing with housing, transportation, or environmental protection and a small number work for the Federal Government.

**Facts:** Although contemporary professional use of the term ‘urban design’ dates from the mid-20th century, urban design as such has been practiced throughout history. Ancient examples of carefully planned and designed cities exist in Asia, India, Africa, Europe and the Americas, and are particularly well-known within Classical Chinese, Roman and Greek cultures.

**Math Required:** College Algebra, Trigonometry, Geometry, Calculus I and II, Number Theory, Analysis, Statistics

**Citations:**
- http://www.washington.edu/students/gencat/academic/urban_des.html

(Career profiles courtesy of WeUseMath.org)