Be a Math Major?
More Information:

Web page: http://www.cwru.edu/artsci/math/math.html

Chair: James Alexander (jca10)

Freshman Advisor: Chris Butler (cxb10)
An invitation

As Chair of the Mathematics Department, I invite you to consider majoring in Mathematics, as a single or double major. In response to this, you should ponder three questions:
1. What does it take to be a math major? 2. What is it like being a math major? 3. What will I get out of being a math major? Let me examine these in reverse order.

If you contemplate a career that involves analytic reasoning, a mathematics degree opens many doors. You can continue on to graduate school in mathematics or related areas, or professional schools. Law and medical schools are happy to consider a math major, especially if you have broadened your education with courses in other areas. People with bachelors degrees in mathematics are sought after by many types of companies. Although firms may not have positions explicitly labeled “mathematician,” mathematicians, with their analytic abilities and skills, naturally fit into many job descriptions. In addition to firms engaged in engineering and computer activities, others that actively recruit mathematicians are in areas of finance, banking, business consulting, science, to name a few. The current US Secretary of Defense is a math major. You might take a look at the web site http://www.maa.org/careers/index.html where you will find a wide variety of first-person accounts of experiences of math majors.

Unlike some majors which give you little flexibility in your schedule, a mathematics major offers considerable flexibility, both within mathematics courses and those of other departments. Many of our majors are double majors. Recent graduates have double-majored in physics, music, computer science, history, philosophy, biology and English. In addition to preparing you for a career, a math major allows you to broaden yourself and indulge other interests.

Many people, having seen only elementary and high-school mathematics, believe it is an unchanging field, with no new developments. On the contrary, mathematics is continually evolving in exciting new directions, and you can experience some of them as a math major here at CWRU. A few examples are explained in this brochure. On the other hand, we do not promise you an easy time. In fact, mathematics is probably one of the more intellectually challenging majors you could pick. Some courses may push you to your limits, but in the end, we would hope it would all come together and the fascination in the subject that led you to choose it as a major in the first place will be rewarded.

And this brings us to question 1 above. As with any major, to be a successful math major, you will have to have some innate skills in the subject, and be willing to work hard. If you are considering being a math major, you already have some skills and interest, and thus already have the basic prerequisite. If you have found you are good at mathematics, and find are attracted to it in more than a superficial way, you have the basics to find mathematics a rewarding major. I invite you to investigate the possibilities.

James Alexander
Chair, Department of Mathematics
“Being a math major was a great choice for me. I can appreciate the beauty of the more theoretical branches of mathematics, but studying applied math has served me well. What I’ve learned applies to every scientific or engineering field, which has given me great opportunities for my future.”

**Different Interests**

**Different Math Majors**

For each different career path or different interest there is a different Math Major.

**B.A. with Major in Math**
For students interested in going on to medical, dental or law school here is the Bachelor of Arts with a major in Math. This degree has the most flexibility. It allows you to take the other courses like biology and chemistry that you need. Also, medical admissions offices like math majors, because of their strong problem solving skills.

**B.A. with Teaching Certificate**
If your interests are in the area of teaching, we have the Bachelor of Arts, major in Mathematics, with secondary teaching certification. This is a joint program with John Carroll University.

**B.S. in Math**
If your interests are more in the area of Math or Physics and would like to go on to do graduate work in one of those areas, we have the Bachelor of Science in Mathematics. This degree is more structured than the Bachelor of Arts degree (more required courses), but it provides a solid background for advanced work.

**B.S. in Applied Math**
We also have a Bachelor of Science in applied Mathematics. This is for the student that loves mathematics buts wants a job in engineering when they graduate. This is a five year program, but at the end of the fifth year, you receive a Master degree. The Masters Degree is not in Math, but in Computer Science, Systems engineering or Operations Research.

Systems Engineering can be thought of as mathematics applied to industrial problems or any “system”. Operations Research is mathematics applied to business problems.

**B.S. in Math and Physics**
We have a new degree, a Bachelor of Math and Physics. This degree is for the few, the proud, the . . . well it is a very challenging degree. Basically, it is for the few really talented students that love both math and physics and don’t want to have to choose. The requirements are basically all the B.S. requirements in both math and physics.

As you can see whatever your interests, there is a Math major that fits.

More information:

Chris Butler (cxb10)

“As a math major, you go beyond the mathematics of high school and college calculus. You get to tackle challenging problems, grow your ability to solve them, and discover many useful techniques and remarkable results. While I have decided to pursue a Ph.D. in physics rather than mathematics, what I learned about problem solving as a Math Major has been crucially helpful.”

Neil Rubin B.S. in Mathematics, B.S. in Physics, 1998
**A BS/MS Program**

For those interested in pursuing a well-paying and exciting career that uses your mathematical skills, consider the integrated BS/MSM program that leads in 5 years to both the Bachelor of Science in Mathematics and the Master of Science in Management in Operations Research. Operations Research is a discipline in which mathematics and computers are used to solve complex problems that arise in business, economics, engineering, statistics, mathematics, computer science, and the natural sciences. The Department of Operations Research and Operations Management in the Weatherhead School of Management holds an Open House every Fall, in which the discipline, graduate programs, and career opportunities in this field are described.

More information:

Prof. Daniel Solow (dxs5)

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**Joint Mathematics-Physics Degree**

Each year there are a number of students who would like to pursue B.S.’s in both Mathematics and Physics, but they are usually forced to choose one or the other, because there is a university rule that to receive two B.S. degrees a student must have a total number of credit hours that is 30 more than the requirement for one of the degrees (e.g., 156 credits instead of 126). Because of this, the two departments have developed a new Bachelor of Science in Mathematics and Physics degree. It is anticipated that a graduate of the program would have strong prospects for employment, or for admission into graduate school in either of the two subjects.

A student would take all of the courses that are currently specifically required for the Mathematics B.S., and most of the specifically required courses for the Physics B.S. (certain labs are an exception), two approved electives from each of the two departments, a senior project, the College of Arts and Sciences distribution requirements, and a small number of open electives (the exact number depends upon advanced placement, transfer credit, etc.). Clearly the proposed program is a challenging one; in view of this the program has been designed to make it as easy as possible for a student to switch into the regular Math program or the regular Physics program.

More Information:

Prof. Michael Hurley (mgh3)
A Math Course

A Mathematics Department offers MATH 408-Introduction to Cryptology. Cryptology is the mathematical theory of secure communication. Classical cryptography, the encryption and decryption of secret messages and their analysis, had as its main purpose the secure transmission of military information and the interception of enemy communications. In the past twenty-five years, especially since the development of the internet, cryptography has become a vital tool in non-military applications such as web commerce. At the same time, the increasing power of computation and the availability of powerful computers to the general population has led to the necessity for developing more and more mathematically sophisticated techniques for secure communications.

Among the exciting developments in the field of cryptology is the idea of a public-key cryptosystem. The idea of such a system is that a user can publish the key needed for anyone to send him or her a secret message, yet no one except the user will be able to decrypt the message once it has been encrypted. This seemingly impossible idea has been successfully implemented, using powerful ideas in number theory, information theory, computational complexity, and probability. Math 408 develops these mathematical ideas, as well as recent developments such as elliptic curve cryptosystems. MATH 408 is designed to introduce students to the mathematical ideas and tools needed for keeping up with current developments in this rapidly expanding field.

Roger Buelow, B.S. Applied Mathematics 1994
M.S. Systems & Control Engineering 1995

"The top levels of even undergraduate mathematics are very challenging and the small class sizes give you a chance to gain deep understanding of both theory and application. My applied mathematics degree gave me the solid foundation I needed to tackle the math intensive discipline of systems engineering. A strong knowledge of mathematics helps me understand the engineering principles that I rely on every day in the areas of chemical, mechanical, optical, and industrial engineering, not to mention business finance and operations."

More Information:
Prof. David Singer (das5).

Cooperative Education Program (CO-OP)

Case Western Reserve University offers a Cooperative Education Program (CO-OP) which enables students to integrate their classroom studies with practice in employment positions consistent with their major fields of study. Over 600 companies in the US participate in this program. Full-time students able to work in the USA are eligible to apply.

More information:
Prof. Marshall Leitman (mxl5)
Deborah Fatica (df3)