



Network engineer, researcher specialized in control theory, member of the Académie Française, strategic advisor, cryptologist... Mathematics leads to everything and often to the areas one least imagines.

Women in Mathematics...

> Why Not You ?

exhibition in 16 portraits



> The exhibition and brochure were realised with the support of the Ministry of Education, The Ministry of Research, the CNRS, the Secretariat for the Rights of Women and the University of Reims. Distributed by the University of Reims:
e-mail: femmes.maths@univ-reims.fr
Issue price: 5 euros



- > Portraits **5 to 35**
- > Programmes of study **36**
- > The association “femmes et mathématiques” (Women in Mathematics) **37**
- > Glossary **38 to 39**

This brochure summarizes the exhibition. Inside, you will find the faces and the text appearing on the exhibition panels, as well as information.

The interviews and photography sessions were all conducted at the end of 2000 and the beginning of 2001.



The exhibition

made up of 9 easily-transportable, ready-to-hang, laminated panels measuring 70 cm X 100 cm with eyelets to facilitate installation.

+ If you are interested in obtaining the exhibition or would just like more detailed information about it, please contact us by e-mail at: femmes.maths@univ-reims.fr

Women in Mathematics...

> Why Not You ?

exhibition in 16 portraits

A fascinating exhibition at your disposal

The exhibition “Women in Mathematics... Why Not You?” was conceived by the association *Femmes et mathématiques* (Women and Mathematics) and inaugurated in May 2001. It was awarded the Irène-Joliot-Curie Prize by the French Ministry of Research in November of the same year. Its objective is to arouse an interest in the subject among young people. For this reason, the exhibition has been shown in schools, colleges, universities and teacher-training institutions.

Through 16 individual portraits of women, each of whom has led a different career since completing her studies in mathematics, the exhibition aims to:

- + highlight the wealth of career possibilities that mathematics can offer ;
- + combat the ever-pervasive stereotypes associated with mathematics ;
- + give young people, boys and girls alike, the courage to take up mathematics by providing them with accessible role models.

The women who agreed to participate in this exhibition live and work in different parts of France. They occupy positions in a wide variety of fields : cryptology, aeronautics, banking, industry, bio-genetics, educational research, computer science, strategic consulting, research, telecommunications, and public health. The sheer variety of career opportunities is not specific to mathematics alone : every branch of science currently offers a similar range of possibilities.

The glossary at the back includes a definition of words and acronyms used throughout the text, particularly those pertaining to the academic and educational qualifications necessary for some professions. If in doubt, don't be afraid to use it!

ACADEMICIAN

> Michèle Vergne

CNRS researcher

laboratoire de Polytechnique

Member of the Academy of Sciences

[my opinion]
Don't let yourself be impressed by people who seem brighter, faster and more talented. Take your time and choose your own road. You may surpass more than one of them !

[And women ?]
Women may have a chance when they apply for a position where several candidates will be selected, but it is much rarer for a woman to be chosen to fill a single high level position.

✦ **The birth of my daughter proved highly beneficial for me.** For a year, my research had been leading nowhere. I felt like I was treading water. With the birth of my daughter a new life began. I went through a tremendous revival and I began working with another woman. Our collaboration lasted for five years and during that time we established a new field of research. It was then that my career really took off.

✦ **An academician yes, but not a star.** In mathematics, a star is someone who totally identifies with a particular work, area of knowledge, or a school. Someone who can say "That's my work". Generally, it's a man. Precious few women have that approach, and I am certainly not one of them.

✦ **Research is not necessarily about being "top of the class".** Far from the romantic perception, a researcher is someone who advances in small steps behind someone who has sign-posted the road ahead... of course the researcher may surpass that someone on the way! The real trick is to become the best in a very limited field and the one essential quality needed to get there is perseverance. Being brilliant is fine, you get there faster. But brilliance doesn't necessarily mean that you go further. For example, I don't consider myself to be brilliant. I think the secret is to create your own world for yourself and then work and work to build it... without fear of ridicule!

> **Born into a family with no scientific background,** Michèle Vergne developed a passion for mathematics in school thanks to a teacher who encouraged her to pursue her studies. After taking her Preparatory Classes in Paris, she moved on to the Ecole Normale Supérieure de Jeunes Filles. It was during her time there that the school's director advised her to take a research position at the CNRS (the French National Research Centre) to complete her doctoral thesis. Unsure that she had found her rightful place and initially disorientated, particularly in a social context, it would take several years for her to find her research subject, her place and her vocation in the world of mathematics. **The ten years that she spent travelling between Paris and the prestigious Massachusetts Institute of Technology proved to be highly fruitful in terms of research, encounters, congresses, and publications...** In 1997, she was appointed to the Academy of Sciences where she sits in the mathematics section with some sixty other colleagues - all of them male.

The Academy of Sciences? A world I never imagined I would belong to!

> Pascale Bernillon

Bio-mathematician

Director of research and studies at the
EDF-GDF Medical Research department

+ Public health also relies on mathematics.

Doctors, for example, need mathematical and statistical tools to extrapolate the results from animal experiments and apply them to human populations. Alternatively, under certain hypotheses, they can be used to predict the propagation of a disease within a population: what impact, for example, will the vaccination of every six-year-old child have on the incidence of the disease 20 years from now? Pharmaceutical and cosmetics companies also have large bio-statistical departments which evaluate the effectiveness and potential toxicity of new drugs.

+ Between research and medical surveillance. I study the impact of the various activities of EDF and GDF on the health of the French population: thermal and nuclear power stations, high voltage lines, atmospheric pollution... I bring a scientific perspective to important issues such as the repercussions on local populations of the choice of one particular site for a thermal power station over another.

+ At the crossroads of science. I regularly work with doctors and engineers... We also cooperate with external research laboratories, participate in numerous conferences and organize seminars. This enables me to work in a business environment whilst retaining a link with the world of academic research.

> Pascale Bernillon received her DEUG and Licence in mathematics in Lyon. The question was, what do you do next when you like mathematics but you don't see yourself doing "just that"? For the next three years, she trained as an actuary in a school specializing in the calculation and assessment of risks. Statistics and probability fascinated her. Demographics too. But the many openings in the banking and insurance sector did not appeal to her... As a result, she took a post-graduate DEA course in bio-mathematics at the University of Paris (VI). Her dissertation focused on the demographic repercussions of AIDS. She found the work fascinating and it led her to do her doctoral thesis at the epidemiology lab of the Institut National pour la Santé et la Recherche Médicale (the National Health and Medical Research Institute).

[And women?]

In the field of bio-mathematics and health, women are as numerous as men. Although in upper management positions...

[In my opinion]

Discover all the professions and trades that use mathematics to do... something different.

I enjoy
being able to
offer a scientific
opinion on the
current problems
of society and to
see how decisions
are taken.

> Anne Bouverot

Telecommunications engineer

Technical Sales Director of Global One*

+ **Women wanted urgently...** The telecom sector is one which is recruiting heavily and that's going to continue in the years to come. We're looking to create mixed teams made up of engineers of different nationalities and cultures. And not just men either! The problem is, we find there's a dire lack of female candidates. I systematically receive all the women who apply, but often none do so.

+ **Numerous ways in.** Naturally, we recruit young people from the top universities, but we also hire employees with degrees in telecommunications or the computer science from the less prestigious engineering colleges and universities. We are also interested in people with a more business / finance-oriented profile. The ideal is to have a good technical level together with strong human and inter-relational qualities. And, absolutely essential, good everyday IT skills - to be able to send and receive messages, to use word processors and spreadsheet...

*GLOBAL ONE is a global telecommunications operator which offers a range of telecom services (internet, complex telephone systems, mobile interconnections) to multinational companies around the world. This France Telecom subsidiary, which has its headquarters in the USA, employs around 4,000 people.

> After completing her Preparatory Classes, Anne Bouverot entered the Ecole Normale Supérieure. Drawn by the new information technologies, she joined the State Telecommunications Corps. After gaining experience as an engineer for France Telecom, she went to the United States for two years where she took a marketing job with Global One — now a France Telecom subsidiary. On her return to Paris, Anne Bouverot was promoted and made Technical Sales Director of Global One. Heading an international team of 80 people based in Paris, Washington, Hong Kong, and Frankfurt, she is one of the few women to sit on the company's board of directors.

[my advice]

The world is going global : make sure that you can get by in English !

Make the most of Europe and study abroad : it will help you get your first job.

As a general rule, we would love to recruit more women... if only they would apply for the jobs !

> Catherine Bonnet

Researcher

INRIA of Rocquencourt
Control theory

[Mathematics]
Because it seems to have no immediate practical repercussions, mathematics is often associated with pleasure, and as a woman, there is no reason to reject that pleasure.

[In my opinion]
Don't have any fears about career openings, there are numerous possibilities.

If you enjoy mathematics don't hesitate, you'll merely be continuing the pleasure.

+ What does being a control theory specialist mean? It means finding a programme that enables a machine - a system - to adopt a given pattern of behaviour. One sector of mathematical research in this field aims to develop methods to control complex systems. For example, in aviation, a plane's automatic pilot, or in the automotive sector, automatic transmissions...

+ Wide-ranging research focused on solving precise problems... Our role is to formalize the problems encountered by industry at a theoretical level. We work on feasibility studies without the constraints of immediate profitability.

+ Putting automation to work to create cleaner cars. After spending three years working to simplify a helicopter model at Aérospatiale, I am currently collaborating with Renault to reduce the emissions of their vehicles. In the context of increasingly strict European norms, the manufacturer effectively wants to develop an engine control calculator which will considerably reduce the emission of pollutant gases into the atmosphere.

[And women?]
More women in mathematics could mean a different world. Women, for example, are probably more involved in environmental research than in the military sector!

> Catherine Bonnet studied at the University of Marseilles. Originally thinking of a career as a teacher, she obtained a DEUG and a Licence in mathematics. After developing an interest in industry she branched out and obtained a Maîtrise and a DEA in applied mathematics. As part of her thesis, she spent a three-year internship with Aérospatiale. From there, she joined INRIA where she is currently a researcher in control theory.

I spent 3 years working on the rotor blades for the Dauphin helicopter and I found it thrilling.

Researcher in mathematics and molecular biology

at the IHES

+ **Molecular biology has everything to inspire a mathematician!** Studying it requires a high degree of sophistication in logic. One finds remarkable, extremely complex structural patterns everywhere which speak volumes to the trained mind of the mathematician. Among some of the more amusing examples, palindromes can be found in certain strings of DNA and the icosahedral symmetries of certain viruses.

+ **The limits imposed by biology do not prevent mathematicians from opening new windows in the world of mathematics.** Biological structures and the demands inherent in biotechnology oblige us to work on real, verifiable, controllable objects. Mathematics needs to adapt to this limitation. At the same time, ideas from biological structures can suggest new approaches in fundamental mathematics.

+ **What if we were to reconsider DNA in a more dynamic light?** In molecular biology, the gene presents itself in two ways: one side is static and combinatorial, showing the gene as a word composed of four letters. The other is dynamic in which the gene contributes to the dynamics of the cell and at the same time works to control that dynamic. For the moment, there is no language in mathematics to express this. The development of such a language could enable us to link the combinatorial and the dynamic systems.

[And women?]

In order for us to be considered as mathematicians first and foremost, as opposed to just women, there need to be more of us. It would also be good in terms of educating the men!

> Born in Milan, Alessandra Carbone showed an early fascination for mathematics. After attending school in Milan, she spent a year in Angola before returning to Italy. It was at that point that she decided to become involved in the new information technologies, specifically, artificial intelligence and mathematical logic. With a university degree under her belt, Alessandra Carbone enrolled in the specialized School of Logic in Siena. After obtaining her doctorate in mathematics at the City University of New York, she occupied postdoctoral positions at the University of Paris (VII), and in Vienna, Austria. She then became a lecturer at the University of Paris (XII). Between 2000 and 2001, while on leave from Paris (XII) for a stay at the Institut des Hautes Etudes Scientifiques (the Advanced Scientific Research Institute) she co-organized a new multi-disciplinary scientific programme situated on the frontier between mathematics and molecular biology.

[In my opinion]

Go towards that which surprises you the most: in research, the important thing is to find a subject that you find exciting. A field which is full of the unexpected and the new.

In genetics, there is a real demand for creative mathematicians. The jobs are there for the taking.

> Gautami Bhowmik

Teaching Scientist

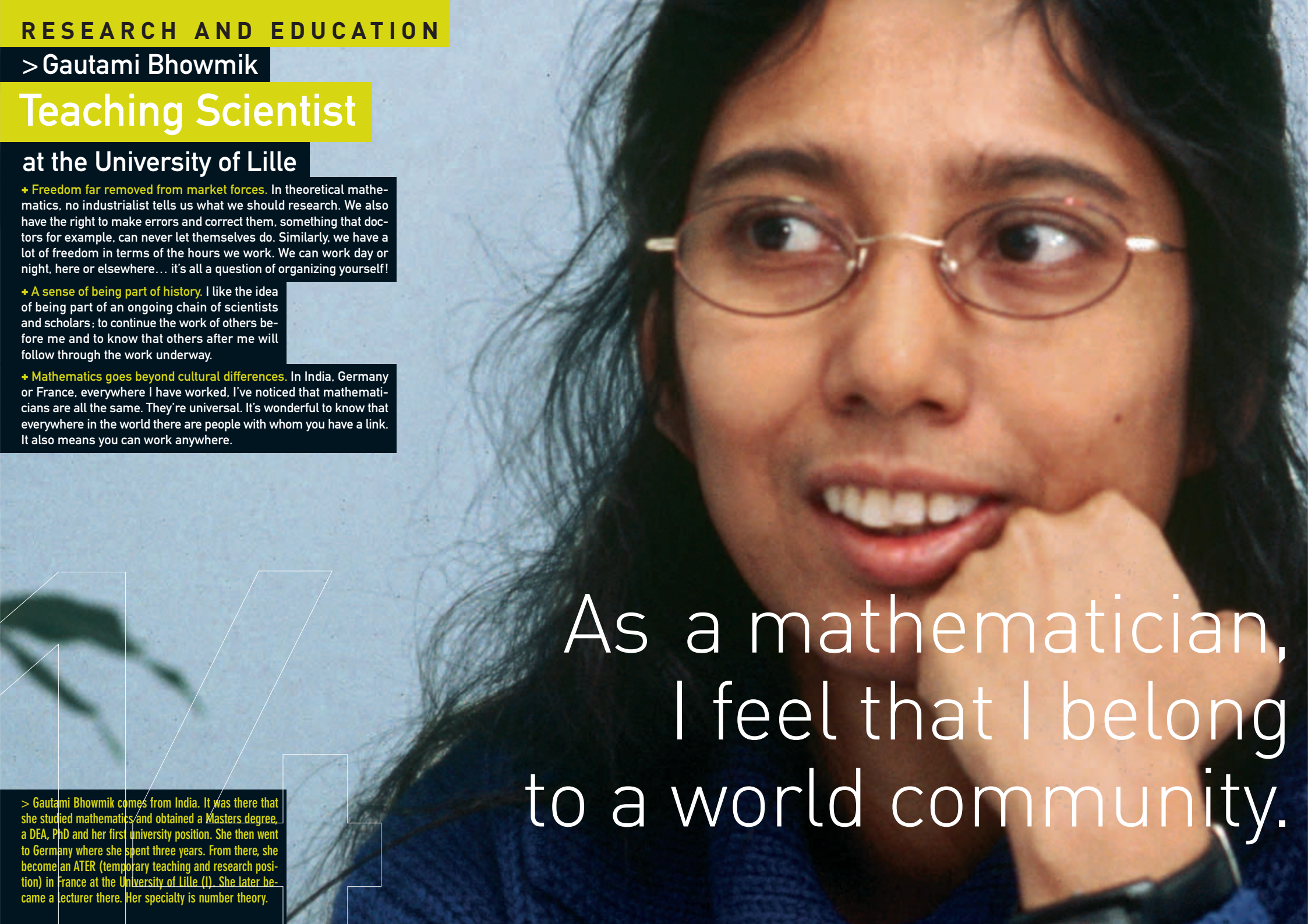
at the University of Lille

+ **Freedom far removed from market forces.** In theoretical mathematics, no industrialist tells us what we should research. We also have the right to make errors and correct them, something that doctors for example, can never let themselves do. Similarly, we have a lot of freedom in terms of the hours we work. We can work day or night, here or elsewhere... it's all a question of organizing yourself!

+ **A sense of being part of history.** I like the idea of being part of an ongoing chain of scientists and scholars; to continue the work of others before me and to know that others after me will follow through the work underway.

+ **Mathematics goes beyond cultural differences.** In India, Germany or France, everywhere I have worked, I've noticed that mathematicians are all the same. They're universal. It's wonderful to know that everywhere in the world there are people with whom you have a link. It also means you can work anywhere.

> Gautami Bhowmik comes from India. It was there that she studied mathematics and obtained a Masters degree, a DEA, PhD and her first university position. She then went to Germany where she spent three years. From there, she became an ATER (temporary teaching and research position) in France at the University of Lille (1). She later became a lecturer there. Her specialty is number theory.

A close-up portrait of Gautami Bhowmik, a woman with dark hair and glasses, smiling and resting her chin on her hand. The background is a soft, out-of-focus blue.

As a mathematician,
I feel that I belong
to a world community.

RESEARCH

> Eva Bayer Fluckiger

Research Director


CNRS - University of Besançon

+ **The two sources of research.** One of the motivations behind research stems from human curiosity which pushes Mankind to try to solve enigmas. A famous example is the problem posed by Goldbach: "Can all even numbers be the sum of two prime numbers?" It may seem simple, but it's been 400 years that we've been looking and we still haven't found an answer! Another reason for research is to be able to find answers to the problems that are posed to mathematicians. These answers can have all kinds of applications. If we go back to the prime numbers again, this abstract concept is of great use, notably in the functioning of (smart) bank cards.

+ **A life of intellectual adventure.** Research is meaningless when it brings nothing new. As with any adventure into the unknown, there is always an element of risk... But what immense satisfaction when we find what we're searching for!

+ **It's better to stand on from the crowd!** Even though, as mathematicians, we exchange a great deal, research remains a discipline for the individual. In our search for new perspectives, and other ways of understanding the world, the fact that one is different is an advantage.

> Born in Hungary under the Communist regime, Eva Bayer was chosen at an early age to be part of a group of budding mathematicians who were tutored in problem-solving by the country's scientific elite. A passionate enthusiast at 14-15, she was already adamant that she would do mathematical research. At 15, her father was invited to Geneva by the UN for a 6-year tour of duty. As a result, she was educated in Switzerland at high-school and university level. During her second year at university, she married and earned a living as a stand-in teacher and private tutor. After completing her thesis in Geneva, Eva Bayer spent much of the next following years travelling to Germany, the USA, and France... She got her first permanent post as a CNRS researcher at the University of Besançon where she is currently research director.



Mathematical research in France second only to that of the U.S., would deserve greater recognition among the general public.

Institute Director

Professor of Mathematics

The Mathematical Research Institute
at the University of Rennes

+ Every day, virtual and real-time meetings with researchers from all over the world working on the same subject.

+ Every week, an informal seminar brings a dozen or so people together. It is a valuable opportunity to listen to other researchers as they talk of their work. It also provides a truly fruitful way to learn about subjects you are not familiar with.

+ Conferences and other research trips, lots of them! This semester - which has been a relatively quiet one - I have travelled to Tunisia, Russia, Niger, as well as all over France. Soon, I will be going to Germany and the United States! Beyond the professional enrichment that these trips bring, the wonderful thing about them is that they allow you to travel other than just as a mere tourist. We meet with people from different cultures, discuss with them, get to see from the inside how they live...

[In my opinion]

Shed all your pre-conceived ideas: you can be an engineer in a wide variety of fields, indeed, there are areas which can interest women just as much as or even more than men.

> Originally from Paris, Marie-Françoise Roy completed her Preparatory Classes and enrolled at the Ecole Normale Supérieure de Jeunes Filles de Sèvres. After completing her university studies, she was made an assistant lecturer then lecturer at the University of Paris Nord / Villetaneuse, before transferring to the University of Niamey in Niger. After two years there, she returned to France to continue her career at the University of Rennes. As a professor and director of the Mathematical Research Institute (130 people), Marie-Françoise Roy's administrative and scientific responsibilities keep on expanding.

[Maths]

For a researcher, mathematics is a subject which interests, captivates, even obsesses the researcher. By nature, the researcher wants to find an answer. It's a real need, a hunger.

[And women ?]

That show-off, "I can pee further than my neighbour" mentality is fairly common among men. Men are generally more competitive than women.

What interests me is the human aspect of mathematics: teamwork, opinion and ideas sharing.

Computer network engineer

at the CPR*

[In my opinion]
At one moment or another, you need to branch out to enter the job market. But, the later the better. It's preferable to have at least a Licence to enter a good engineering school.

[And women ?]
Currently, in the IT sector, people are trying to attract more women to their teams for numerous reasons. It's a great asset being a woman !

✦ With my poor little Maîtrise, I had the impression that I didn't know how to do anything. I needed to find work. I decided to find a company that would be willing to train me as a computer engineer.

✦ It was awful. I'd never touched a mouse in my life ! For my first interview, I played on my motivation. I knew I needed to say, "easy to adapt" and "dynamic". So I did, and I did it convincingly.

✦ Mathematics is the golden key which opens the door into the world of computer science. Mastering mathematics impresses people. It impresses my hairdresser and it impresses companies. People say to themselves, if we show this person something, they'll know how to do it. And I truly believe that ! Mathematics is the core of information technology, the basis of all computer science.

*The CPR (La Compagnie Parisienne de Réescmpte) is a business bank specialising in fund management, the gold market and on-line broking.

It came as a surprise to discover that at various levels of studies, mathematics open numerous doors.

> After earning her Baccalauréat in Bastia, Aude Poizat studied mathematics at Lyon where she obtained her DEUG and her Licence in applied mathematics. She then took a maîtrise in applied mathematics. Twice eligible for the CAPES post-graduate teaching certificate, she managed to obtain a Masters in computer science in a few months at the INSA in Lyon. She also secured her first job as a network engineer in a service company. Her first assignment is with CPR, the major business bank.

+ **My biggest surprise was no longer understanding everything.** Before, I was able to attack an exercise by using a general approach to solve the problem at hand. In research, this is no longer the case at all. One is obliged, especially at the outset, to use results without having fully understood their proofs since it is impossible to know everything.

+ **Certain things are neither true nor false.** There are mathematical results, conjectures, which you cannot prove. And which turn out to be false. As a result, we work with a certain degree of doubt. But there's confidence as well. Confidence in what others have done or explained to us.

+ **Mathematics is definitely not an area where certainty reigns.** The world of mathematics is not as perfect as all that. In school we learn a relatively old and static version of mathematics. That's not the case with research. It's far more dynamic with fewer absolute truths.

[And women ?]

A university career is perfectly compatible with family life and children. You can take your time and climb the ladder at your own pace.

> Originally from Bordeaux, Anne Queguiner spent her childhood in Marseilles where she took her Preparatory Classes. Accepted by Ecole Polytechnique (engineering school) and three Ecoles Normales Supérieures, she chose a university career, enrolled at the Ecole Normale Supérieure in Paris, and completed her doctoral thesis in Besançon. On qualifying, she was hired as a lecturer at the University of Paris XIII. She remains there to this day.

[In my opinion]

Want to look at mathematics in a different light ? Want to enjoy mathematics ? Interested in research ? Here are a few associations that you can join :

Mathematics en Jeans : play at being a researcher, brainstorm with other young people on themes offered by mathematicians who regularly follow your work : <http://www.mathenjeans.free.fr>

Animath : mathematics for the fun of it, in clubs, workshops or competitions : <http://www.animath.fr>.

I'm inclined to say that at high school I didn't really study mathematics as such.

> Mireille Campana

Technical Director

of the IT and Network Services Department
French Foreign Ministry

✦ **An art as old as history itself.** Cryptology is nothing other than the ancient science of concealing and unmasking data. A rudimentary science for a long time, cryptology took on a new importance during the Second World War as it found itself confronted with vast amounts of information that needed to be processed. To meet this challenge, automation became essential. As a result, the discipline passed into the field of mathematics where it made use of ever more sophisticated algebraic techniques.

✦ **An exciting profession where everybody is chasing everyone else.** Given that it is so dynamic, cryptology is an ideal profession for curious minds. It is a field where deadlines are short and things change quickly. So much so that in just two or three years we not only have to build a system, we need to have it up and running.

> Originally from Dijon, Mireille Campana took her Preparatory Classes at this city and enrolled in the Ecole Normale Supérieure. She then obtained a Masters degree in mathematics from the University of Paris (VII), and then her "agrégation", before opting to enter the Ecole Nationale Supérieure de Télécommunications. After spending ten years at the helm of the research and cryptology department of France Telecom, she took up the N°2 position for IT system security in the central services of the Prime Minister's Office. She then transferred to the French Foreign Ministry where she is currently technical director of the IT and Network Services Department (the department employs 300 people, half of whom are stationed abroad).

[In my opinion]

Study mathematics even if you don't want to be a mathematician: you can always transfer to other areas even if they seem to have little to do with mathematics.

[And women ?]

Military men are traditionally the kind of males who open doors for women, offer them bouquets of flowers... and exile them to the end of the table during meetings. When I found myself with a colonel under my orders, he had a hard time dealing with it...

I can almost say that I fell into cryptology by chance... even though, I always was, and still am, an avid reader of spy novels!

Business strategy consultant for companies

[In my opinion]
You don't need to be a genius
in mathematics to have a great
career. With a reasonable level,
applied mathematics is quite
within reach... provided
that you work
hard!

I need
to move,
change
horizons,
and meet
different
people.

+ **The consulting business.** Typically, our role is to build a five-year strategic vision for a company: what that company hopes to accomplish in the future, what it would like to become. The work consists of listening to people and bringing them to appreciate what is at stake so that we can diagnose the company's strengths and weaknesses, the threats it may face, and the opportunities to seize. We construct and draft the company's image in collaboration with the main actors of the company. We then propose the projects needed to achieve it. The only thing left for us to do then is to take a back seat wherever possible so that the company can appropriate and implement the vision we have built together.

+ **And the role of mathematics in all that?** Professionally, mathematics has helped to structure my mind in a highly disciplined way. It has provided me with a methodology and a capacity to work and it has given me a variety of analytical tools. In addition, a university education has given me, among other things, a general culture enabling me to communicate with the various people I meet with. For example, I can hold my own if a financial director talks to me about balance sheets or income statements.

> Despite a loathing for physics, Sigrid Ortmans developed an early attraction for mathematics when she was at school in Beaune. Deciding against studying pure mathematics at university level, she opted for applied mathematics and social sciences at the University of Paris-Dauphine, where she obtained her Maîtrise and then her DEA. She has been a strategic advisor in a private consultancy for three years now.

Ecole Normale Supérieure, Lyon

[And women ?]
Women are terribly self-critical... despite the fact that their results are at least equal to those of men !

[In my opinion]
Only listen to what motivates you. Personally, during my final year in high-school, my teacher laughed at me when I said I was preparing the Mathematics entrance exam for a top university.

+ In theory, I teach 4 hours a week. In practice, it takes up half of my time. Aside from preparing my lectures, I also do other things for the students. I organize a seminar to which I bring in specialists from all over France. I am also setting up a school for young researchers, bringing together some 100 people, etc... I also travel a great deal!

+ It's amazing what you can do with mathematics! You can study mathematics without having to go all the way to the thesis level. At practically every stage of your university course you have the possibility of branching out or finding a job.

+ The important thing is to always keep several ideas in mind. For a competitive exam, such as the CAPES for teaching, or the entrance exam for engineering schools, it goes without saying that a lot of people are not going to be accepted. As such, think about what you would like to do in the event that you don't get in. Imagine various futures for yourself. And rest assured, if it interests you, there are always jobs in computer science at all levels.

Mathematics is a door which opens up innumerable professional possibilities.

> Natacha Portier passed her Baccalauréat in Nice then took her Preparatory Classes at the Lycée Fénelon in Paris. Despite passing the engineering entrance examination, she preferred to orient herself towards research. She obtained a Licence and a Maîtrise in pure and applied mathematics at the University of Paris (VII). She then took her DEA and completed her doctoral thesis at the University of Lyon I. After a post-doctorate year in Liège, Belgium, she worked as part of the ENS team in Lyon for twelve months before being made a lecturer at the same institution.

> Claire Tutenuit-Hocquard

Engineer National Corps of Mining Engineers

Director of Strategic Development
Matra-Marconi-Space

✦ I have worked in a variety of fields... all traditionally dominated by males. At the Industry Ministry, I was responsible for the administration of the substratum of the Paris region: quarries and drilling, etc. At the Compagnie Générale des Eaux, among other things, I managed a subsidiary which made concrete pipes. And at Matra Defence Space, where I spent many exciting years, I was first a representative in the USA, before leading a large project team for a cruise missile and finally becoming strategic director of the group's space subsidiary.

✦ As a woman, it's not easy rising to the level of Operational Director. When you're a woman, taking charge of a project is fine. Defining strategy, that's okay too. But when you get close to operational management, things get complicated: in these predominantly-male sectors, the consensus to entrust responsibility to a woman doesn't come naturally. It will come little by little since these sectors have much to gain from the arrival of women in high positions: in France, having a good background in mathematics is one of the keys to entering industry, irrespective of whether you're a man or a woman. It's up to women to play the game!

[And women?]

Industry is currently one of the privileged sectors where you can alter the course of things and make the world a better place. Why leave it to men for the sole reason that you have to be good at mathematics?

> Born in Algeria, where she lived until the age of four, Claire Hocquard spent the rest of her childhood in the French provinces and then in Paris. After completing her Preparatory Classes at the Lycée Louis Le Grand in Paris, she enrolled at the Ecole Normale Supérieure in Paris. After passing the Agrégation in mathematics she graduated in political sciences. She then joined the National Corps of Mining Engineers. After a few years at the French Industry Ministry, and the Compagnie Générale des Eaux, Claire Hocquard moved to Matra-Marconi-Space. She left in 2000.

The ability to question and to discuss is one of the keys to success: it is a valuable asset as a woman leader.

Professor of Mathematics and Vice President for Research

The Université of Lille (III)

+ **Like a mini-government.** The elected president forms his/her administrative team which usually includes 3 vice presidents. I am one of them. The vice president assists the president on a variety of issues which can range from security and building repairs, to resolving a dispute between two professors...

+ **Director of Research.** It's a prestigious job because I am in charge of all the university's research policy. In practice, with my team of ten, we establish a complete research programme, which then becomes the object of a four-year contract with the State.

+ **Marriage, Mathematics and Mesopotamia.** As an econometrist, a discipline half way between mathematics and economics, I work on extremely theoretical mathematics. But I also do research involving applied mathematics for the pleasure of it. The link between unemployment and divorce, for example, or archaeological data from Mesopotamia...

+ **A few areas where statistics are used:** Social affairs, economics and finance, marketing, health care, polling, banking, insurance...

> Originally from Brussels, Laurence Broze studied mathematics in Belgium up to thesis level. She was an assistant research director in Brussels for four years before becoming a lecturer and a professor at Lille (III). Ten years ago, she created GREMARS, a research laboratory devoted to applied mathematics and economic sciences. This year, Laurence Broze was appointed vice president in charge of research at the University of Lille (III). There are few women in France in such a high academic position.

[In my opinion]
"If you want to do economics, do mathematics first! It's a field which needs people with a high degree of competence in mathematics."

I am proud to
be vice president
of my university.

Professor of Mathematics

The University of Clermont-Ferrand

[In my opinion]

When the time comes to decide on the subject you want to specialize in, ask yourself the following question: "Why do I think such and such a road is not for me?"

[And women ?]

In the field of mathematics, men tend to be neutral. The rule is to remain in the background, to promote your work and not yourself. That's not easy for a woman to do, because in this male-dominated world, a woman immediately stands out.

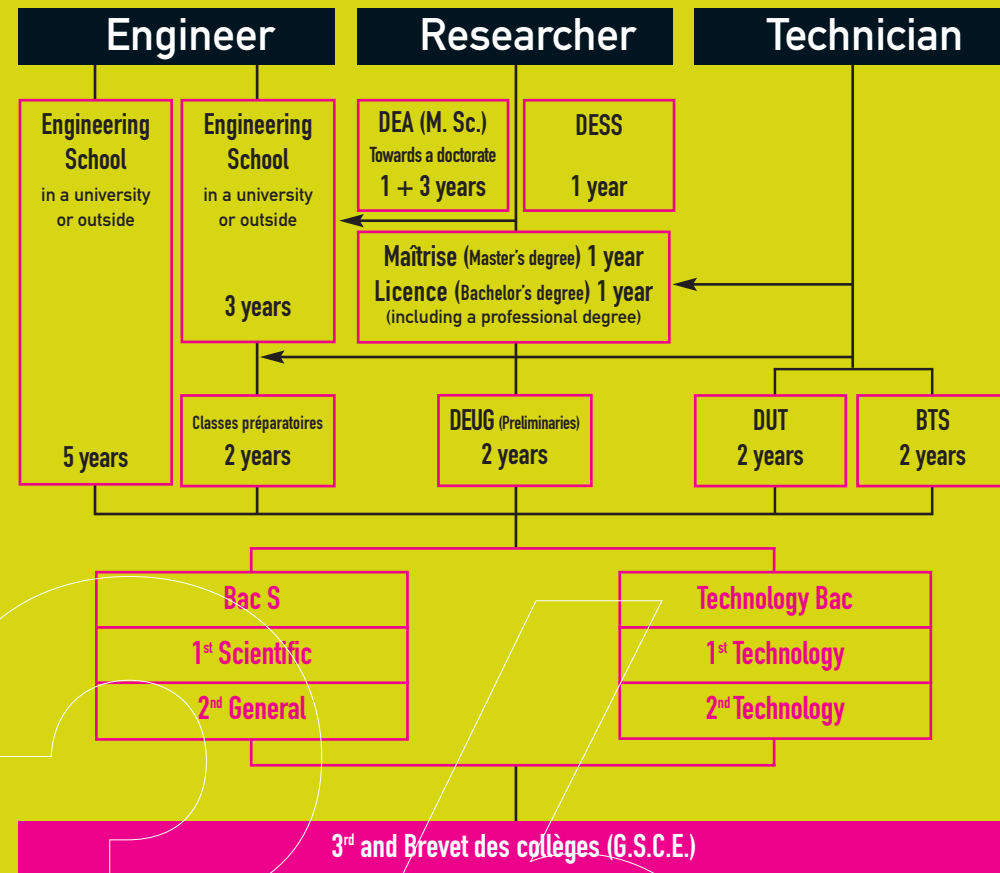
+ **The language of the initiated, a secret garden.** Subconsciously, I think I also chose mathematics because it offered a refuge behind its highly specific language. That particularity goes far beyond language though. It permeates the thoughts and personality of every mathematician. It is one of the signs of our belonging to a world preserved by what is almost a secret language. Still, there is a price we have to pay in that it is sometimes difficult to communicate the joys of our work to others. Mathematics doesn't easily lend itself to explanation in everyday language.

+ **An area of freedom.** Our world is a little like a magic kingdom that offers us a great deal of freedom. Being a mathematical researcher means having the luxury to be able to think things out and structure your thoughts. You can do it with your hands in your pockets as you're strolling down the street purely because of the power of the symbols that mathematicians carry in their heads. I enjoy having a hold over an intangible world that I have made my own.

Mathematics is
a wonderful language
which has always
fascinated me in that
it is continually evolving.

> Initially oriented towards higher mathematics at an engineering school, Sylvie Paycha did not adhere to the competitive spirit inherent in that sector so she opted to pursue her studies at university instead, ultimately receiving a Licence and a Maîtrise. She also passed her Agrégation, a competitive exam for secondary level teaching. After teaching in a college for a year, she decided to focus on research because of the greater intellectual stimulation it offered. After passing her DEA, Sylvie Paycha went to Germany to complete her doctoral thesis. On her return to France, she was made a lecturer at Strasbourg University. She has been a Professor at the University of Clermont-Ferrand for five years now.

How does one join a scientific or technical profession ?



Women and Mathematics

> a brief description

Created in 1987 by a group of women mathematics teachers and researchers, the association *femmes et mathématiques* (Women and Mathematics) currently numbers some 200 members.

Among its many objectives, the association aims to:

- + encourage girls to develop an interest in scientific and technical studies;
- + promote women in the world of science, particularly in the domain of mathematics;
- + establish itself as a forum and meeting place for female mathematicians;
- + cooperate with other associations with similar objectives, in France and abroad.

Each year, the association organizes a forum for young women mathematicians, numerous scientific fairs in different universities in France, and specialized conferences followed by debates that cover a wide variety of themes. Through its members, the association plays a role in numerous seminars and committees in France and abroad. It is particularly active among secondary school students too. The association also publishes its own journal, *femmes & math* (Women and Mathematics).

In 2001, the association logged several significant achievements:

- + The exhibition "Women in Mathematics... Why Not You?" which is the object of this brochure.
- + The publication of two collective works:
 - "Rencontres entre artistes et mathématiciennes – Toutes un peu les autres." (Encounters between Artists and Female Mathematicians – Each a Little Bit the Other) – L'Harmattan – May 2001
 - "Du côté des mathématiciennes" (From the Woman Mathematician's Perspective) – Aléas – April 2002
- + A special issue of the journal *femmes & math*: "Des femmes dans les mathématiques contemporaines" (Women in Contemporary Mathematics) – July 2001

Association *femmes & mathématiques*/Institut Henri Poincaré
11 rue Pierre et Marie Curie 75231 Paris Cedex 05
Tel/fax: +331 44 27 64 20

e-mail: fetm@ihp.jussieu.fr
Web site: <http://www.femmes-et-maths.fr/fm/>

> Feel free to contact us!

GLOSSARY

[Actuaire]

An actuary; a statistician who computes insurance risks, premiums and depreciation. (Le Petit Robert dictionary).

[Agrégation]

Competitive civil service examination for secondary education teaching positions taken after finishing five years of post-Baccalauréat studies. There are specific exams corresponding to practically every subject taught in schools and colleges.

[ATER] (Attaché Temporaire d'Enseignement et de Recherche)

A non-permanent higher-education position usually held for one or two years before and/or after completing a thesis while waiting for a permanent teaching or research position.

[Baccalauréat (Bac)]

Entrance examination to the French university system, taken at the end of secondary school.

[Brevet des collèges]

National examination taken by secondary students three years before the Baccalauréat.

[CAPES]

(Certificat d'Aptitude Professionnelle à l'Enseignement du Second Degré) Competitive civil service examination for secondary education teaching positions taken after finishing four years of post-Baccalauréat studies. There are specific CAPES exams corresponding to practically every subject taught in schools and colleges.

[Classes Préparatoires Scientifiques]

A two-year course of scientific Preparatory Classes taken in *lycées* after completing the high-school Baccalauréat, to prepare students for the entrance competitive exams to engineering schools or university-level colleges (Ecoles Normales Supérieures – see the entry for ENS). Even though the designations have been modified, the terms “Math Sup” (higher mathematics) and “Math Spé” (specialized mathematics) are still widely used to differentiate the first and second year.

[CNRS]

(Centre National de la Recherche Scientifique) France's National Scientific Research Centre is a public institution grouping together independent laboratories and university laboratories. There are only two levels in the sphere of research: research director or researcher. To qualify for a researcher's position, a candidate must be at the level of a doctorate.

[Cryptology]

Cryptology uses algebraic geometry, arithmetic and numeration... essentially in the field of IT systems. Much used in the telecommunications world for secure data transmission, especially by Internet, cryptology most frequently offers job possibilities in the civil service

(Ministry of Foreign Affairs, Telecommunications, Defence...) but also in private firms like Thomson or Bull.

[DEA]

(Diplôme d'Etudes Approfondies) A one-year preparatory course taken after a Maîtrise which may lead to a doctoral thesis.

[DESS]

(Diplôme d'Etudes Supérieures Scientifiques) A one-year course taken in a university after a Maîtrise. Intended to offer professional training for those who have already completed four years of post-Baccalauréat studies, it is comparable to an Engineering degree.

[DEUG]

(Diplôme d'Etudes Universitaires Générales) A Two-year university-level course taken after completing the high-school Baccalauréat with an emphasis on one of several major subjects. Courses with a strong focus on mathematics lead to a Science and Technology DEUG with one of two distinctions: either a MIAS (Mathematics, Computer Science and Applications to Sciences) or a MASS (Mathematics Applied to Social Sciences).

[Director of Research]: see CNRS

[Doctorate]: see Thesis

[ENS] (Ecoles Normales Supérieures)

State education institutions recruiting trainee teaching candidates after they have completed their classes préparatoires. Selection is determined by a competitive entrance examination. These institutions are basically a stepping stone to the competitive examinations for senior secondary education or higher education teaching positions. Numerous Teaching scientist follow this way.

[Epidemiology]

The study of the relationship between diseases and the effects of various factors (lifestyle, environment, social conditions, personal characteristics) that are liable to exert an influence on the frequency, distribution and development of the disease in question. (Le Petit Robert dictionary).

[Higher Education]

Post-Baccalauréat education, as opposed to secondary education.

[Icosahedron]

A solid with 12 equal faces, each face being made up of an equilateral triangle.

[IHES]

L'Institut des Hautes Etudes Scientifiques (The Institute of Advanced Scientific Study) is a prestigious body specialising in advanced research in mathematics and theoretical physics. It offers scholars of exceptional intellectual calibre a place where they can devote themselves entirely to their research

and receive visitors so that they may work together. As Marcel Boiteux, the Institute's latest director so aptly said: "IHES is not just a centre of influence, it is both a hive of activity and a monastery where fundamental work germinates and comes to fruition in the calm." In 2000, out of 207 visiting researchers, only 16 were women. The 5 permanent members of the IHES are all men.

[INRIA]

L'INRIA (The National Information Technology and Automation Research Institute) is a public institution with a scientific and technological focus. Its mission is to encourage industrial research. The Institute brings together scientists from all sectors, be it public or private, French-based or from abroad. It works in a variety of areas, including aeronautics, the automotive sector, computer science, the oil industry, the steel industry, and the healthcare sector. www.inria.fr

[INSA]

(Institut National des Sciences Appliquées) France's National Institute of Applied Sciences is an engineering school with campuses in Lyon, Rennes, and Toulouse. It offers five-year post-Baccalauréat courses. Selection is made by application and not by competitive examination.

[Licence]

A one-year course taken after completion of a two-year DEUG. Similar to a Bachelor's degree, Licences are awarded in mathematics, Computer Science etc.

[Maîtrise]

A one-year course equivalent to an Master's degree which can be taken after obtaining a Licence. In mathematics, there are two specialist areas: pure mathematics and applied mathematics.

[MASS / MIAS]: see DEUG

[Mastaire, Mastère, Master]

A one-year course (equivalent to a D.Eng.) which can be taken after obtaining a Maîtrise. Originally intended as a qualification for chartered engineers, it now represents a diploma representing five years of post-Baccalauréat study.

[Math Sup, Math Spé]: see Classes Préparatoires Scientifiques.

[Palindrome]

A word or number that can be read the same way from left to right as from right to left, for example “pop” or “2002”.

[PhD]

A term used throughout the English-speaking world to denote a doctorate. See thesis.

[Post Doc, Post-Doctorate]

A non-permanent research position occupied after obtaining a doctorate.

[Professeur]

In French, the word “professeur” is a generic term covering the gamut of teaching positions from nursery school all the way to the university level. In a university context, see the entry for lecturer-researcher. For secondary education, see the entries for Agrégation and CAPES.

[Researcher]: see CNRS

[Teaching scientist]

Higher education teaching professionals recruited after completion of a doctorate. They are also involved in research. The position has two levels: Lecturer and Professor.

[Thesis]

A body of research-based work usually lasting three years. Performed after obtaining a DEA, the doctoral thesis is intended to advance an original point of view. Its completion generally leads to a doctorate (equivalent to eight years of post-Baccalauréat study).

[University]

An institution of higher learning that is accessible after completing the high-school Baccalauréat.

Two web sites offer more detailed up-to-date information:

www.onisep.fr / www.education.gouv.fr

There is also the information leaflet: **Mathematics at University. What Job Opportunities?**

Infosup. N°189 / January-February 2001.

> Editorial concept: Pascale Garreau

Photographs: Fabienne Giboudeaux

Graphic design: Atalante / Paris

Impression: Hemmerlé Paris

ISSN: 1271-3546

Supplement to the journal *femmes & math*