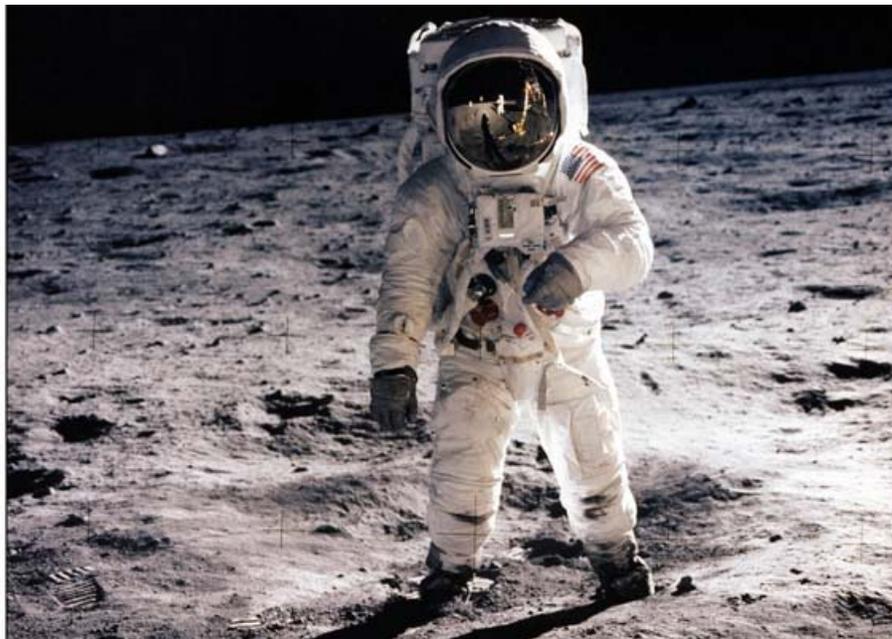


Exciting careers abound with a math degree

BY ARVIND GUPTA, SPECIAL TO THE VANCOUVER SUN APRIL 14, 2009



This picture taken 20 July, 1969, shows astronaut Edwin E. Aldrin Jr. walking on the surface of the moon. In addition to incredible physical and mental endurance, space exploration requires sophisticated geometric, spatial and other mathematical skills.

Photograph by: ..., NASA/AFP/Getty Images

One question I often get asked is, "What careers could I have with a math degree?" In this year's CareerCast "JobsRated.com" survey of 200 occupations, the top three jobs were mathematician, actuary, and statistician. And, in a sign of what the future holds, five of the next seven top jobs all require strong mathematical skills. These rankings, developed by analyzing a large number of factors including working conditions, competitiveness, hiring outlook and physical exertion, underscore the transformation underway in our society to one in which the generation and application of knowledge are increasingly highly-prized. Those with quantitative skills will increasingly be in a position to garner the best careers leading to the highest rate of job satisfaction.

But if you're under the impression that jobs that use mathematics are the ones that are dry and dull, you'll be surprised to discover the vast array of opportunities available. Consider these interesting options:

Astronaut

In addition to incredible physical and mental endurance, space exploration requires sophisticated geometric, spatial and other mathematical skills. Who can forget those nail-biting moments in the film Apollo 13 when Tom Hanks and mission control at NASA were frantically making the calculations and adjustments to get the crippled spaceship back to Earth?

Baseball analyst

Major league baseball teams often hire mathematicians known as sabermetricians to develop statistical analyses of player records to optimize the resources available to the team. Sabermetricians advise coaches on the best possible batting orders and game strategies based on models of players' strengths, pitcher tendencies and other quantifiable factors.

Climatologist

Interpreting the rich sources of data that make up weather patterns and climate trends is a critical field for understanding the world we live in, and how it is likely to change in the future. This is a field with

far-reaching connections to the environment, agriculture, oceanography, and even archeology, in which geochronologists date archeological sites and reconstruct past climates.

Criminologist

Mathematics provides a host of powerful tools for understanding and fighting crime. This ranges from quantifying the reasons that people become criminals in the first place to understanding how neighbourhood design can encourage or discourage criminal activity. Criminology professors Paul and Patricia Brantingham at SFU work with the School of Computing Science and the mathematical modellers at the Interdisciplinary Research in the Mathematical and Computational Sciences Centre to maintain a repository of past and current crime data to answer questions and identify patterns in crime around Vancouver and other real and simulated urban environments.

Cryptographer

Cryptographers build or break codes for applications in defence, Internet security, and financial transactions. In the Second World War, Alan Turing and his fellow British mathematicians developed mathematical technology that broke the Nazi code using the famous Enigma machine, thus playing a major role in the outcome of the war and also laying the foundations for modern computing.

Video Game Designer

Do you or your children line up at Future Shop in the wee hours, eagerly awaiting the release of the latest gaming platform? Computer-based animation for video games combines mathematics, computer science, art, physics and biomechanics. It is all those calculations that make the movement of characters, explosions, smoke and any substance required to ooze seem so real.

City Planner

Achieving a balance between urban esthetics, public safety, transportation, building and renewal in our cities is the job of city planners. Using software and complex calculations, these behind-the-scenes folks work with elected officials on the best ways to improve upon, and build, our cities. Using forecasting — you guessed it, more math — planners shed light on future population growth in different areas of a city, which guides the development of transit services, community centres and other essential infrastructure.

Playwright/Actor/Entertainer

Entertainment is laced with mathematics on the screen and behind the scenes, from the mathematicians who consult for the show *Numb3rs*, to CBC TV host Jennifer Gardy, Bill Nye the Science Guy, and the stars of *Mythbusters*. A phenomenal example: John Mighton, Canadian playwright, author, mathematician, and educator, has written several math-themed plays. He was in the movie *Good Will Hunting* with Robin Williams and Matt Damon. And lately his acclaimed program *Jump Math* has shown that all kids can do mathematics. Of science and art, Mighton has said, "If the two worlds communicated more, we'd have much richer art and science as a result."

Pyrotechnics expert

Blowing things up can be fun and exciting, but it requires a high degree of precision and accuracy. From fireworks displays, to the controlled demolition of buildings, to special effects for movie stunts, lives hang in the balance of the calculations made before the fuses are lit.

Transportation designer

Transportation design is a part of the growing field of industrial and commercial design, which combines art and engineering to enhance the form and the function of the objects and machines that we use in our everyday lives. Designing efficient and elegant cars, airplanes, and other modes of transportation requires great creativity, as well as a strong grasp of the numbers and logic of physics.

And this is just the tip of the iceberg. The ability to reason about our world by logically analysing information and then making the decision that has the best chance of giving an optimal result is not limited to any one profession. So the next time your child asks you "Why should I study math?" find out what he wants to do when he grows up, and point out how he'll need the very skills mathematics brings to the job. I know that this list of jobs will continue to grow.

Dr. Arvind Gupta is a father of three, a mathematician and scientific director of MITACS, a national research network focused on connecting university-based math researchers with companies and other organizations to solve real-world challenges. For more information on MITACS, visit www.mitacs.ca.

Math tips for parents

Students entering Grade 10 in September 2009 will be the last to enrol in the current mathematics courses in British Columbia. The three math streams now offered are Principles of Math, Applications of Math, and Essentials of Math.

Whichever path your child chooses will either limit or open his options after high school.

Principles of Math 10 to 12 allows for the most options, providing the prerequisite math skills for most post-secondary programs with a goal to develop the formalism students will need to continue on with the study of calculus. Applications of Math 10 to 12 aims to prepare students for non-calculus based post-secondary programs of study such as certificate programs, diploma programs, continuing education programs, trades programs, technical programs, and some university programs.

Essentials of Mathematics 10 to 12 provides students with the necessary numeracy skills and concepts to be successful in their daily lives, business, industry, and government. It is very important to sit with your child and think carefully about which stream makes the most sense.

Students entering Grade 10 in B.C. in September 2010 or later will be choosing from three new pathways developed by the Western and Northern Canadian Protocol for Collaboration in Basic Education. Alberta, British Columbia, Manitoba, Northwest Territories, Nunavut, Saskatchewan and Yukon together developed the Common Curriculum Framework for Grades 10-12 Mathematics: Western and Northern Canadian Protocol (WNCP).

The seven ministries of education collaborated with teachers, administrators, parents, business representatives, post-secondary educators and others to develop the framework. The purpose was to develop consistent student outcomes across the WNCP jurisdictions and to enable easier transfer for students moving from one area to another.

The three new mathematics pathways are Pre-calculus 11 to 12, Foundations of Math 11 to 12 and Apprenticeship and Workplace Mathematics 10 to 12. Grade 10 students will need to choose between two courses: Foundations of Math and Pre-calculus 10, which will lead to either pathway in Grade 11; and Apprenticeship and Workplace Mathematics 10.

The Pre-calculus pathway leads to entry into post-secondary programs that require the study of theoretical calculus. Topics include algebra and number, measurement, relations and functions, trigonometry, and permutations, combinations and binomial theorem. The Foundations of Mathematics pathway leads to post-secondary studies in programs that do not require theoretical calculus. Topics include financial mathematics, geometry, measurement, number, logical reasoning, relations and functions, statistics and probability.

The Apprenticeship and Workplace Mathematics pathway leads to entry into the majority of trades and direct entry into the workforce. Topics include algebra, geometry, measurement, number, statistics and probability.

According to the 2008 Common Curriculum Framework, all three of the pathways provide students with mathematical understandings and critical-thinking skills, and when deciding between the options,

students should consider their interests, both present and future. And don't forget to research the admission requirements for the different post-secondary programs, as they vary by institution.

If your child will be entering Grade 10 after September 2010, it is very important that you become familiar with the changes to the B.C. high school math curriculum. Discuss the possibilities and limits with your child's teachers and guidance counselors. And ask hard questions. It will take some time for everyone to become familiar with these changes. You can find full details at www.bced.gov.bc.ca/irp/irp_math.htm.

Dr. Gupta answers your math questions

Patrick O'Connor

Great answers to the questions about math in this series. I too have noticed many people have problems with basic math in grocery stores. I have seen many puzzled looks as consumers struggle with basic concepts like converting pounds into kilograms. Also, there is confusion about pints and ounces and what item is the better price. What do you suggest to help families better understand the practical math needed for interest rates, saving money on groceries, and other real life situations?

Hi Patrick,

I think the key to understanding the math we need everyday is to use it and apply it repeatedly and practically. Ounces, milliliters, pounds and grams - how do you make sense of it? For elementary-aged children, they need to have a hands-on understanding of different quantities. For example, using a measuring cup and two of the same water glasses, ask them to fill one glass with 8 ounces of water and the other with 250 milliliters of water and ask what they observe. They will see that 8 fluid ounces and 250 ml are the same! You can then stretch this concept to ask how many millimeters four ounces would be, and so on. The same could be done with a kitchen scale and measuring the same quantity of dried beans using both grams and pounds. Use flyers or a trip to the grocery store with a clipboard to compare prices and measures to determine the best buy. Is peanut butter in bulk a better buy than the jar of Skippy? Even more motivating, give the child a set amount of money to buy some favorite foods from the bulk section so that he can calculate the best buys and take the most treats home! For interest rates, spend some time looking at different bank accounts online. Make it personal by allowing your child to "invest" his paper route money with you for different rates of return and see what happens to it after a few months.

Louis Chang

I really enjoy this math series and feel I was meant to read it. I will be returning to university in January. I only have high school math and that was 20 years ago! I can barely get thru addition and subtraction to my great shame. University is so expensive and so is retraining to upgrade my skills. What would you do if you were in my position? Help! I am starting from scratch and on an extremely tight budget. I do not know where to begin. Thanks.

Dear Louis,

Firstly, know that you are not alone! But the good news is that unlike when you were in high school, there are countless free, online tools available with the click of a button. When you encounter a difficult topic in one of your courses, go online and try the video and voiced-over whiteboard lessons on sites like freemathhelp.com, or through a search on YouTube or MathaTube. Other sites like math.com or coolmath.com have detailed text lessons using examples to guide you through a new concept.

To build your confidence before January, I would recommend taking a refresher course through continuing education in your school district or your local community college. If your future classes do not offer an online supplement, try to find similar online course support materials provided by another Canadian institution. For example, the UBC Math Department has a great online supplement for its first year calculus class.

Many courses provide a teaching assistant or open office hours to students. Don't be shy about using both of these resources to help you understand difficult concepts. All the best!

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