First, a bit of a primer on some mathematical terms might be in order. Addition is an example of a “commutative” operation, because $a + b$ equals $b + a$. Subtraction is an example of a “non-commutative” operation, because generally, $a - b$ does not equal $b - a$.

Mathematics, in general, is the study of patterns, and, frequently, such patterns are described via systems of equations, Vancliff explains. For instance, systems of polynomial-style equations and their solutions play a critical role in almost every scientific field, including elementary-particle physics, quantum mechanics, robotics, crystallography and more.

“One of the goals of the study of AS-regular algebras and their modules is to use geometric techniques to find certain modules of the AS-regular algebra, and then to use those modules to find the solutions to the original system of equations,” she said.

“Typically, mathematical physicists translate the quantum physics into algebraic problems, and then an algebraist picks up the problem at that stage. In my case, I work on techniques that solve types of equations, in
She taught high school math in London for a year after graduating from Warwick, then moved to Seattle and began work on a Ph.D. in mathematics with the intention to focus on applied math. During her first year, while taking a mandatory graduate algebra class, she was introduced to the notion of a module over a ring.

“I immediately recognized it as a generalization of the idea of matrices acting on a vector space, which is a pervasive topic throughout all of the applied sciences,” Vancliff said. “So a light bulb lit up in my brain, and I fell in love with algebra.”

Her interests were mainly in physics applications, so Vancliff was drawn to study modules over non-commutative rings. At that time, the study of modules over commutative rings had been ongoing for decades due to the use of geometric techniques. In a bit of perfect timing, Vancliff began her graduate studies just as a new movement had started in the world of algebra that pushed the study of non-commutative rings and their modules via geometric techniques. This new subject became known as non-commutative algebraic geometry.

“This was an entirely new subject, and I was fortunate to enter it at its inception,” she said. “There were many open problems ripe for the picking and many that were accessible to junior researchers such as myself. This meant that I was able to make groundbreaking contributions to the subject while I was still a student, simply because the subject was so new. I found it to be very exciting.”

Vancliff says that she was fortunate that her Ph.D. advisor at the University of Washington, S.P. Smith, took his responsibilities very seriously.

“Not only does he have a rare gift for being able to explain mathematics and its intricate beauty, but he also devoted time to teaching me how to write research publications and funded my participation at conferences and workshops,” Vancliff said. “He actively encouraged me to network and interact with famous mathematicians, and those opportunities proved to be invaluable to me throughout my career.”

Vancliff earned her Ph.D. in 1993, and then worked for two years as a visiting assistant professor at the University of Southern California in Los Angeles. From there, she moved to Belgium and worked for a year as a researcher at the University of Antwerp, before spending two years at the University of Oregon in Eugene. In 1997, Vancliff had a conversation with a colleague in Oregon which led to a significant career decision. The colleague had family living in Fort Worth and was familiar with the North Texas region.

“He felt very strongly that I would be happy working at UT Arlington and living in the DFW area, so he encouraged me to apply to UT Arlington,” Vancliff said. “I investigated UT Arlington online and found a vibrant, growing university.”

When she interviewed in 1998, she found that the department was strong in applied mathematics and less so in algebra, which Vancliff took as a “positive challenge.” She joined the faculty as an assistant professor starting that fall.

“The department has changed much in the past 15 years, and its research has grown in strength, with many of the current faculty earning research grants,” she said. Her own research has been continuously funded since her arrival.

Vancliff is working with her graduate students on several projects. She and third-year doctoral student Richard Chandler are looking at the point schemes and line schemes of a family of algebras and trying to understand the algebras’ underlying structure. Chandler first met Vancliff as an undergraduate in her Abstract Algebra class in 2010. He earned a B.A. in Mathematics with a teaching certification in May 2011 and entered the Ph.D. program that fall. He wants to go into academia after earning his doctoral degree.

“Dr. Vancliff is an amazing mentor,” Chandler said. “She has very high standards for all of her students, but they are always reasonable. She doesn’t expect perfection, but she does expect that you put 100 percent into all aspects of your work.”

Padmini Veerapani studied under Vancliff and earned a Ph.D. in May 2013. She’s now an assistant professor of math at Tennessee Technological University in Cookeville, Tenn.

“Dr. Vancliff emphasized a level of detail and thoroughness during my years under her supervision that is allowing me now to successfully handle all my responsibilities as a faculty member,” Veerapani said.

In addition to her research and teaching, Vancliff is the organizer of the long-running DFW Algebraic Geometry, Algebra and Number Theory (AGANT) seminar series, which brings together researchers and students from academia and industry in the Metroplex and beyond and features national and international speakers. She also created the department’s Graduate Forum, which helps junior Ph.D. students by letting them talk with faculty mentors and senior doctoral students.

“It is very fulfilling and satisfying to share my knowledge with my students and see them enjoy the material as much as I do,” Vancliff said. “When they see the connections that I see and share with me their delight in finding new connections, I can see how much they have grown mathematically, and that is a joy to witness. It is particularly exciting to see them continue a research path after graduation, especially in academia where they can continue this sharing of knowledge with the next generation of students.”

Vancliff says that helping and sharing her knowledge with others, working as part of a team, and using the technical expertise she has acquired to solve problems are all rewarding aspects of her job as a researcher and educator.

“I very much enjoy that my work at UTA entails all these components, both individually and in combination,” she said. “I also find that my success at earning research grants renews my energy, not only in the research arena, but in all aspects of my job. I consider myself very fortunate to be able to work in my chosen career, and in the supportive environment of UTA.”

Michaela is a remarkably tenacious researcher. [She] has the mathematical drive and vision to delve into very abstract concepts and find hidden connections.”

— Thomas Cassidy

Bucknell University professor of mathematics