From Street Fighting to Santa Claus:

Having Fun with Math and Maple™

For decades, the math software Maple™ has been a popular choice for educators who want to bring the benefits of technology to their classroom. Instructors and students use Maple to visualize concepts, investigate motivating examples, reduce the tedium and inevitable mistakes of long calculations, and explore important ideas from mathematics, science, and engineering. The Maple Application Center and MapleCloud contain thousands of Maple applications contributed by Maple users from around the world that do all these important and useful things.

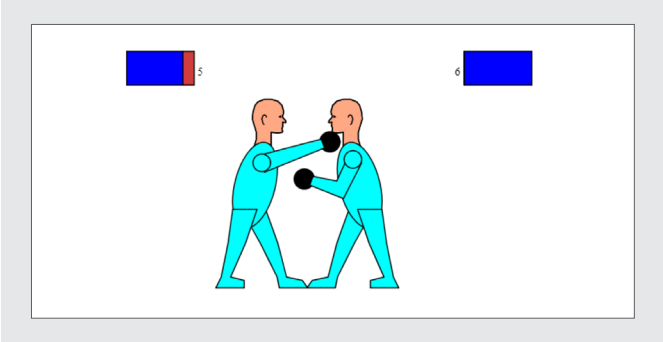
Plus, many of them are pretty darn cool.

This article presents a collection of Maple applications that are capable of engaging a student's attention, even if they have very little interest in mathematics. The applications cover a variety of mathematical topics and use Maple in many different ways. What they have in common is simply that they are all entertaining. Students know that math is important and serious and useful. When you combine Maple with creativity, you can also show them that math is fun.

Street-Fighting Math

Author: Robert Israel
Application: https://www.maplesoft.com/applications/view.aspx?SID=129226
Topics: Probability, game theory, linear programming

This application starts with a very simple, somewhat adorable, interactive street-fighting game, in which you can control the initial hit points for each player and the probabilities of scoring a hit.



It then poses the question: Given the initial hit points of the two fighters and their probabilities of scoring a hit, what is the probability that your fighter wins the round? What follows is an explanation of how to use the binomial distribution to answer this question.

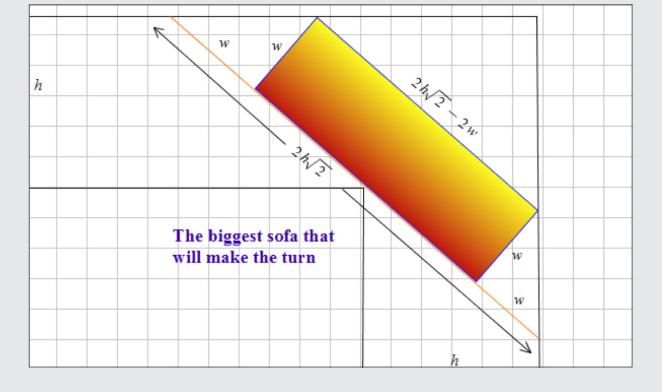
Then the author adds a new layer of complexity, introducing new moves to the game. For each possible pair of moves, there are several possible outcomes with varying probabilities. The reader can set the probabilities and play the game against the computer opponent, and examine the probabilities associated with different strategies.

Finally, the application introduces the idea of a two-person zero-sum game from game theory, and discusses optimal strategies.

“Just Move It Over There, Dear!”

Author: Jason Schattman
Application: https://www.maplesoft.com/applications/view.aspx?SID=5158
Topics: Trigonometry, geometry

In the words of the author: “My mother once asked me if I could please move her living room sofa into the guest bedroom down the hall and around the corner. Before I broke my back dragging this battleship down the hallway only to discover that it wouldn’t make the turn, I decided to take some measurements and work out the math first.”



In this application, the author starts with the simple case of a width-less sofa, applies some trigonometry and geometry to set up the equations, and uses Maple to solve for the length of the longest width-less sofa that will fit around the corner. The result is then generalized to a more traditional width-ful sofa, and the application ends with a handy rule-of thumb: if *length of the sofa* + 2 × *width of the sofa* is comfortably less than 3 × *width of the hallway*, it’s time to move furniture.

(For other excuses to use math around the home, this author also explains how he used Maple to make cream cheese frosting.)

The Monty Hall Problem

Author: Maplesoft
Application: https://maple.cloud/#doc=9468877
Topics: Probability

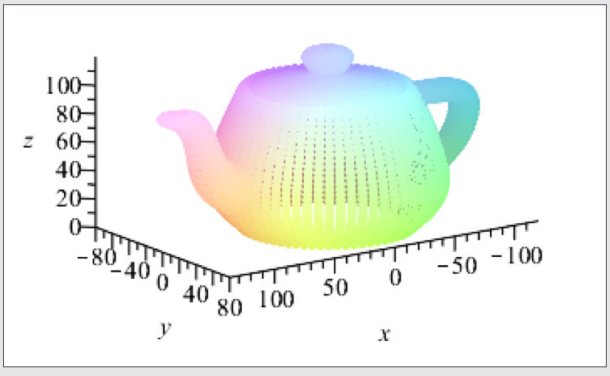
The hotly debated Monty Hall Problem has been making the rounds long before planes ever tried to take off from treadmills.

A fabulous prize has been hidden behind one of three doors. If you guess the correct door, you will win the prize. First, you select a door. The show’s host (originally the eponymous Monty Hall, from the TV game show *Let’s Make a Deal*) will then open one of the other two doors. The fabulous prize is not behind the door he opens. You are then given the opportunity to keep your choice of door, or change it to the remaining closed door. The host then opens your final selection to reveal if you’ve won the fabulous prize. Should you switch or stay? Or does it even make a difference?

This application examines the probabilities to answer the question, and then provides a simulation of the problem, which readers can try for themselves to help convince their brains that the answer is correct.

Fractal Teapot

Author: Wieslaw Kotarski and Agnieszka Lisowska
Application: https://www.maplesoft.com/applications/view.aspx?SID=1740
Topics: Chaos theory, complex analysis, computer graphics



This application demonstrates the use of fractal modeling of 3-D shapes using bicubic Bezier patches to create the famous (in computer graphics circles) Utah teapot. This particular example does not include a lot of explanation,

since the authors provide that information in a separate application, which this one references. But it uses fractals to create a teapot, so that's kind of awesome.

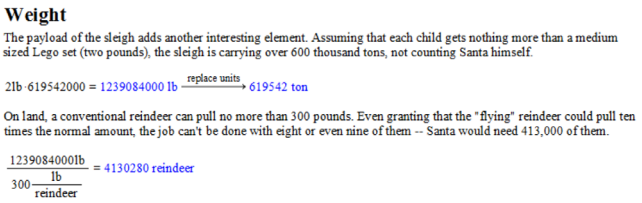
As an added bonus, you also get a teacup and a spoon to go with it.

(And if you'd rather explore fractals than build things with them, take a look at Escape-Time Fractals.)

The Physics of Santa Claus

Author: Maplesoft
Application: https://www.maplesoft.com/applications/view.aspx?SID=7049
Topics: Physics

Based on the popular article that makes the rounds every December, this application examines the physics of Santa Claus. Using census data, the article calculates the number of households in the world Santa needs to visit. It then calculates the distance traveled, the weight of the sleigh, the number of reindeer required, and finally, the speed Santa needs to travel at to meet the requirements.



Students can try out the latest population numbers, improve upon some of the simplifying of the assumptions by taking into account more details, or implement some of the rebuttal calculations available from the Snopes article on this subject. Or they can read it and laugh, and that's good too.

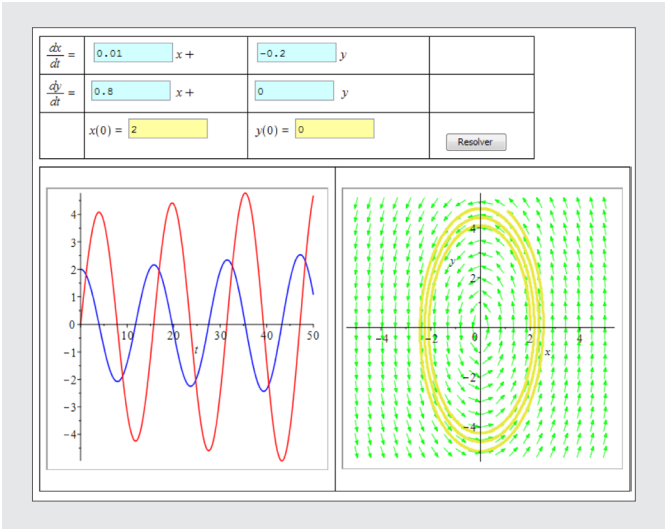
Romeo and Juliet: A Classic Tale of Love and Differential Equations

Author: Ranferi Gutierrez
Application: https://www.maplesoft.com/applications/view.aspx?SID=154451
Topics: Differential Equations

Ah, young love. So changeable. So fickle. The more she likes him, the less he likes her. The less he likes her, the less she likes him. And then the less she likes him, the more he likes her. If only there was some way to model this behavior mathematically to better understand what is going on.

Systems of coupled differential equations to the rescue!

Based on the problem first posed by Strogatz [1] and the solution by Felsager [2], this application explores the trials and tribulations of young love and differential equations. It includes interactive tools to investigate how the love story develops, and how the ending changes based on the initial conditions.



In this version of the story, Romeo and Juliet meet in a differential equation class. He is smitten, but she is focused on the course and not paying attention to him. The story progresses through medical treatment of love sickness, threats of banishment to the dreaded Friend Zone, and the careful, but probably unethical, application of love potions.

(Fortunately, since this is math and not Shakespearean tragedy, nobody dies in the end.)

This application is written in Spanish. Other entertaining differential equation applications (in English) include Richard Dawkins' Battle of the Sexes and An Epidemic Model (for Influenza or Zombies).

[1] Strogatz, Steven. "Love Affairs and Differential Equations" Mathematics Magazine 61 (February 1988): 35.

[2] McDill, J. M. and Bjorn Felsager. "The Lighter Side of Differential Equations." College Mathematics Journal 25 (November 1994): 448-452.

Conclusion

You already know that math can be fun. With the help of Maple, it's a lot easier to share some of that fun with your students. The examples shown here are taken from the thousands of applications available from the Maple Application Center and MapleCloud, and they provide just a hint of the places an interest in mathematics, Maple, and some creativity can take you.

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