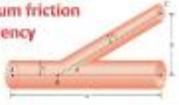
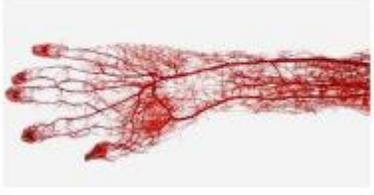
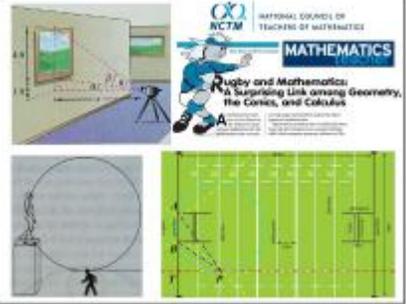
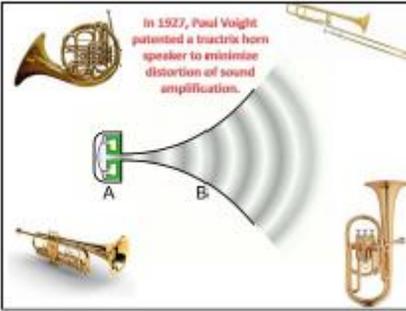


 <p>ignite</p> <p>Some of My Favorite (Math) Things By Troy Jones</p>  <p>WESTLAKE HIGH SCHOOL PCMI TLP 5 MINUTE SHORT JULY 13, 2016</p> <p>1.</p>	<p>Hi, I'm Troy. I'm a mathaholic. I feel a profound sense of reverence when I see mathematics in the real world. My daughters experience this aesthetic appreciation towards math. This has created rumors around our school that we talk about cool math during family dinner.</p>
 <p>You can optimize the branching angle so fluid flows with minimum friction and maximum efficiency</p>  <p>2.</p>	<p>I distinctly remember the first time I experienced this profound awe of math. I was an undergraduate student working on a calculus problem. Did you know that if you connect two pipes, there is an optimal angle to branch the pipes to most efficiently circulate the fluid?</p>
<p>Blood vessels generally branch at the optimal angle to maximize efficiency</p>  <p>3.</p>	<p>The footnote mentioned that these optimal angles were found in our circulatory system. I remember staring at the blood vessels in my arm and thinking "that is so cool!" I gained a deeper insight into the beauty of creation that day. I started to look at my world differently.</p>
<p>ON MONDAY in math class, Mrs. Fibonacci says,</p> <p>"YOU KNOW, you can think of almost everything as a math problem."</p> <p>"The real voyage of discovery lies not in finding new lands, but in seeing with new eyes."</p> <p>Marcus Porcius French novelist/philosopher 1871-1902</p>    <p>4.</p>	<p>I began to think deeply about simple things and began to see the world with new eyes. I experienced an amazing epiphany. As I looked for math in the real world, and thought about things over a long period of time, I began to make incredible and beautiful connections.</p>
 <p>5.</p>	<p>Optimizations problems took on a geometric solution in my mind. Did you know the best place to view a painting or statue is related to the best place to kick a conversion in rugby, and that a dynamic geometric construction of this point traces a hyperbola you can paint on a practice field?</p>

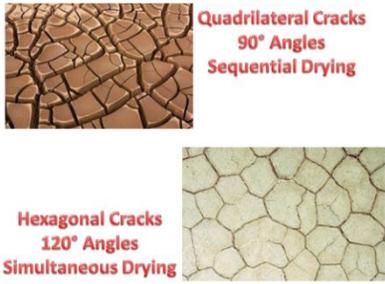
6.	<p>Fractals</p> <p>120° branches converge when the scaling factor is the golden ratio</p> <p>$x^2 + x + 1 = 0$ $x = \frac{-1 \pm \sqrt{5}}{2}$</p>	<p>Have you ever wondered why plants grow the way they do? You can model growth with a fractal by keeping the scaling factor fixed and varying the branching angle, or vice-versa. When the branching angle is 120°, the branches converge when they are scaled by the golden ratio. That is cool!</p>
7.	<p>Talus Piles of Dirt (angle of repose)</p>	<p>The angle of repose of piles of sand or talus at the bottom of a cliff is determined by many things; the size of the granular material, the smoothness of the granules, humidity, etc. Did you know that the angle of repose of salt is about 30°?</p>
8.	<p>Ridgelines Points of Concurrency Conic Sections</p> <p>Mathematics For Elementary Teachers</p>	<p>When you pour salt on various shapes, it piles up and forms ridgelines. These ridgelines have connections to a well-known point of concurrency in a triangle. Did you know that you can create all three conic sections, the parabola, ellipse, and hyperbola with salt ridgelines?</p>
9.	<p>HOW TO FOLD IT</p> <p>THE MATHEMATICS OF LIBRARIAN, ORIGAMI, AND POLYEDRA</p>	<p>A 17 year old proved that any straight-line drawing on a sheet of paper may be folded flat so that one straight scissor cut will completely cut out the shape. Did you know that the mathematics of origami is creating more efficient ways of folding maps, and the folds are related to salt ridgelines?</p>
10.	<p>Length of Bike Tracks? Travel Direction? Road Trip? Back Tire?</p> <p>Back wheel traces a tractrix curve</p>	<p>Did you know that you can look at tire tracks and determine which is the front tire and which is the back, which direction the bike traveled, and how long the frame is? If the front wheel follows a straight line like the bottom left animation, the back wheel traces out a tractrix curve.</p>

11.



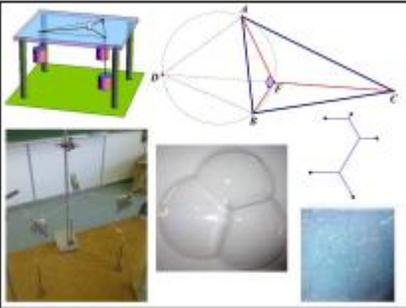
A megaphone, or truncated cone, can amplify sound, but the reflected sound waves interfere with each other and cause distortion. Paul Voight patented a better speaker horn using a tratrix curve revolved about its axis to amplify sound with minimal interference.

12.



Did you know that mud cracks differently depending on how it dries? When water recedes, mud dries in a sequential manner and the surface shrinks and cracks at 90° angles, forming quadrilaterals. When water evaporates simultaneously, the surface shrinks with equal tension in all directions, causing 120° angle cracks and a hexagonal pattern.

13.



When equal forces pull three ropes through the vertices of a triangle, the knot connecting the ropes will stabilize at the Fermat point, which is easy to construct. This point minimizes the sum of the distances to each vertex, and forms a Steiner path. We see these paths in soap bubbles.

14.



Despite the wonder and awe that my personal investigations give me, they mean nothing if I keep them to myself. My grandpa, who spent many days alone in the wilderness herding sheep, taught me that although nature is beautiful, people are more important than things.

15.



The highest prize in mathematics is the Fields Medal. It is mathematic's equivalent to the Nobel Prize. Fields medalist William Thurston, regarding mathematics, said it best; "The real satisfaction from mathematics is in learning from others and sharing with others."

16.



This is the math department at Westlake High School. These are my peeps! They understand my passion. I can't tell you how many times I have ran across or down the hall to share a cool discovery, or talk about how to help a student. I learn from them and appreciate them.

17.



In 2012 I organized a summer math camp. I invited 6 boys and 6 girls to spend a week in Park City doing challenging and interesting math. Since then we invite 16 students each summer. They interact with very passionate math teachers and famous mathematicians and guest speakers.

18.



Tom is famous for the Great Pi/e Debate video. Art is a famous mathemagician and lectures about "The Joy of Mathematics" in the "Great Courses" videos. Martin said "it's not hard being the most famous mathematician from the Isle of Mann when you're the only mathematician from the Isle of Mann."

19.



Two of the most famous mathematicians in the world, Russian mathematician Andrei Okounkov and William Thurston have spoken to the kids. Despite my lofty ambitions to help students see the beauty of math, my own daughter, Mariah who was in my class, resorted to the practical application of math. I had just finished teaching what I thought was one of my best lessons on supply and demand.

20.



I asked for a volunteer to explain in their own words what supply and demand was. After a long pause with no volunteers, I asked Mariah if she could explain. She said that if there is a high demand for a product, and not a lot of it, the prices go up. I asked if anyone could give an example. Again after a long pause there were no volunteers, so I asked Mariah if she could give an example. She said "Sure dad, my first answer was free but my next one is going to cost you."