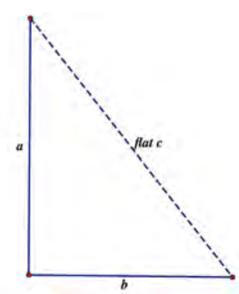
Dr. Sarah's Greenwaldian String/Yarn Experiment

David X. Cohen, head writer and executive producer of *Futurama*, who has a master's degree in theoretical computer science, invited me to film a 25-minute interactive mathematics feature for *Bender's Big Score*. As a surprise, Cohen included a ''Greenwaldian theorem" on a blackboard in the *Futurama* film itself. While I was certainly not the first to discover the spherical equation, I was thrilled to have my name up in the lights of the show.

- On a ball, we mark three vertices of a spherical triangle from the north pole to the equator and over a bit. Lay some string/yarn from the North pole down to the equator. Pull it tightly and then cut off length a. Place it on the table vertically.

- Lay string from point 1 on the equator to point 2 on the equator. Pull it tightly and then cut off length b. Place it on the table horizontally.

- Create a flat right triangle, with sides a and b pulled tightly (you'll need some extra hands). Be sure that the angle is a right angle and then measure out the hypotenuse and cut new string to represent c_{flat}.



- Did you already know that any hypotenuse c of a flat right triangle satisfies the **Pythagorean theorem** $a^2 + b^2 = c^2_{\text{flat}}$? Circle one of the following:

  yes I had heard that before   no this is the first time I've heard about that

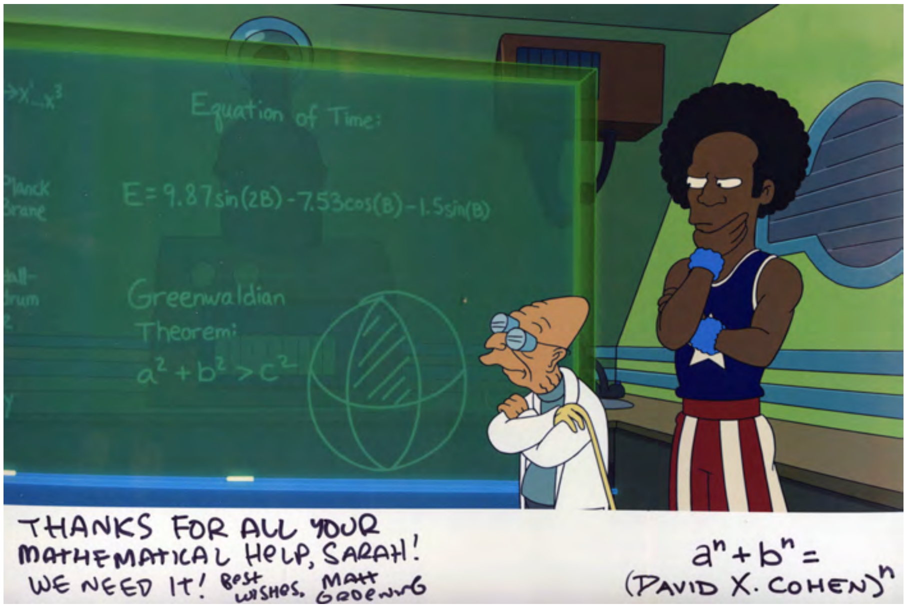
- Put c_{flat} back on the ball to compare it to c_{ball} (between the North Pole and point 2) and then circle one of the following:

  c_{flat} is too long so $a^2 + b^2 = c^2_{\text{flat}} > c^2_{\text{ball}}$

  c_{flat} is just right so $a^2 + b^2 = c^2_{\text{flat}} = c^2_{\text{ball}}$

  c_{flat} is too short so $a^2 + b^2 = c^2_{\text{flat}} < c^2_{\text{ball}}$

- Next compare your work with the Greenwaldian theorem



Why does the Pythagorean theorem hold in flat space? Check it out!
A Pythagorean water wheel demo is at
`https://www.youtube.com/watch?v=CAkMUdeB06o`

Because a^2 is the area of the square that has side lengths a, this amazing water wheel demo shows the Pythagorean theorem in action in a flat space:

The Pythagorean theorem was named for Greek mathematician and philosopher Pythagoras of Samos and it tells us how to travel between two points if we know the horizontal and vertical distances. We have evidence of the Pythagorean theorem dating back to Babylonian times. A question facing us today is whether the Pythagorean theorem holds in our universe.