

1. Careers that use Math (10-15 minutes)

Brain-storm! Try to cover the board. Students will start with really basic things like cashiers, teachers, engineers, architects. Careers that they might not think about include: actuary, meteorologists, computer game designer, cryptologist, software developer, careers where there is modeling. We're encouraged to talk to the kids about career paths we've thought about, how we picked math, where we got support along the way, what sort of training goes into some of these career paths.

Surfaces: only two dimensions instead of one or three.

If you live in a surface you are completely flat. Examples(fake): plane, sphere, annulus, and mobius band, bubbles

2. The Mobius Band and Annulus (10-15 minutes)

Form pairs. Each pair makes a mobius band and an annulus. Draw around the mobius band with a marker. Contrast what happened across the two. What happens if you were embedded inside the paper instead of on top of it? Take another strip of paper. Draw a figure on one side, and then trace out the same picture on the other side (try to bleed through so it looks the same... he should look like he's embedded.) Make a little representation of you on a circle. Do the same thing with another character. Take your character on a journey around the mobius band and the annulus. What do you see?

A path is orientation-reversing if you travel around and find yourself mirror-reversed, where the mirror is in line with the unglued edge.

Does the sphere have any orientation-reversing paths?

3. The Torus (20 minutes)

The torus is the surface of a donut. We make a torus by gluing the top and bottom edges together and the right and left edges together. Draw the gluing square for the torus, and draw out how we get from it to the donut shape. I'm getting a few styrofoam donuts and a ball.

Tick-tack-toe on the torus. This helps students get used to the idea of the glueing square.

Just like we did with the mobius band, let's see what happens if your friend stays at a point and you travel off in a straight line. First try going in the horizontal direction. Look at slope 2 and slope 5, or choose your own favorite slope. What do you see? With a rational slope you'll return to the place you started. If you choose an irrational slope, you'll densely cover the torus, but you'll never return to your start. How many times will you wrap around the torus if you have slope 1000?

4. Wake up: Donut snack + string handcuffs (10 min)

5. The Klein Bottle (20 min)

Draw the glueing rectangle and the model. Have them make models out

of socks. Cut the model it falls into two mobius bands. Does the klein bottle have an orientation preserving path?

6. (Optional) Distinguishing surfaces(10 min)

How can you tell the sphere from the torus? Have the students play with the models. Give them string to explore the "hole". How can you tell a klein bottle from a torus? What other surfaces are there?