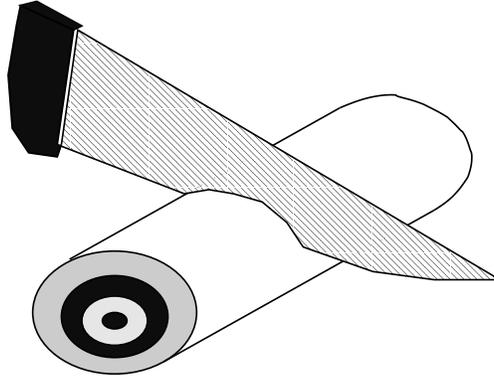


¶ 1. Tomography is imaging by sections or sectioning, through the use of a wave of energy. The device used in tomography is called a tomograph. The method is used in radiology, archeology, biology, geophysics, oceanography, materials science, astrophysics and other sciences. In most cases it is based on the mathematical procedure called tomographic reconstruction. The word was derived from the Greek word *tomos* which means “a slice.”

¶ 2. In math, a method to understand a three dimensional shape enclosed by a surface is to slice it with planes and study its level curves, those curves made at the interface of the slicing plane and the enclosing surface of the shape.

¶ 3. Imagine that your three dimensional shape is a round ball, like a tennis ball. As you slice it with by planes perpendicular to a diameter of the ball, you see that the surface of the ball meets the slicing plane on a round circle (which is just a point if the slicing plane is tangent to the ball). As you move the slicing plane along the diameter of the ball from one end to the other, you see a sequence of circles, starting with a point, then larger and larger until reaching the midpoint of the perpendicular, and then smaller and smaller until collapsing to a single point when reaching the end of the perpendicular.

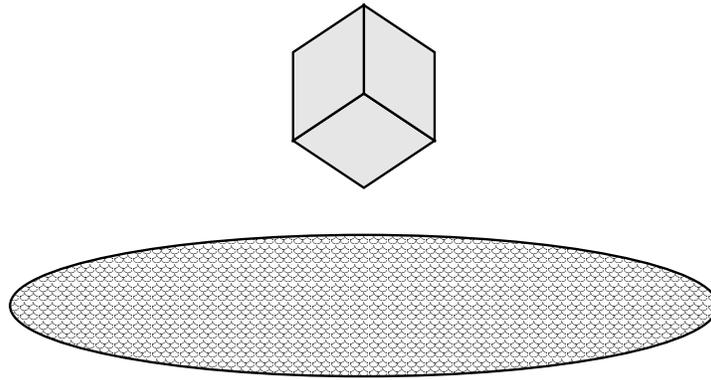
¶ 4. Imagine that you have just made a “perfect” sushi-roll. It has the shape of a perfect cylinder. Pick a sharp kitchen knife and slice it.



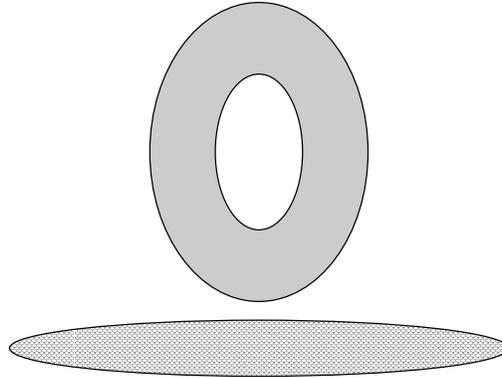
(a) If the knife is perpendicular to the roll, the slice looks like ...

(b) If the knife is not perpendicular to the roll, does the slice curve have any definite geometric shape?

¶ 5. It was not long time ago that coffee sugar was offered not in packets but in little cubes. You dip one such sugar cube into your latte, holding it by the the corner opposite to that that corner that first becomes in contact with the liquid as in the figure. Can you sketch all different geometric shapes at the interface of the surface of the cube and the surface of the coffee?

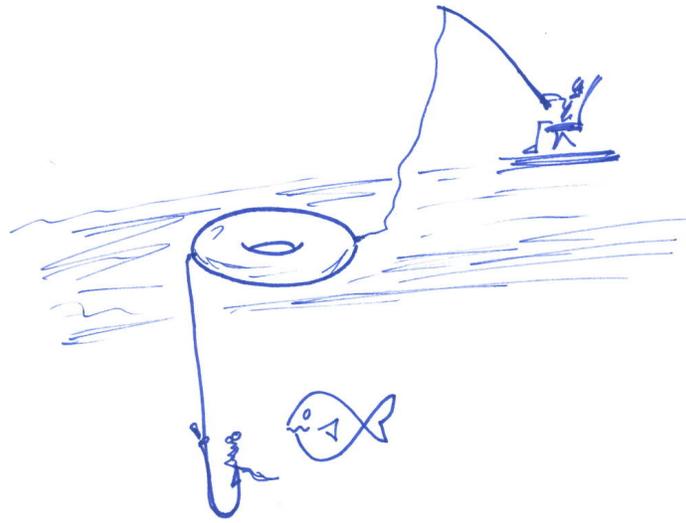


¶ 6. In the previous problem you have sweeten your coffee to your taste. Now you are craving for a donut. Those on display look a little dry, but nevertheless you order one, because you are going to dunk it!



- (a) As you dunk the donut deeper and deeper into your coffee, picture the slice curves made at the interface of the surface of the liquid and the surface of the donut. Do they change?

¶ 7. Now you go fishing. You have a fancy float in the shape of a donut (yes!).



(a) Your float is quietly resting on the water. Make a sketch of the waterline curve.

- (b) A fish comes by a takes a good bite out of your bait, making your float to become “perpendicular” to the water, as if your where dunkin’ a donut. Make sketches of the waterline curves that you observe.

### Literature

[1] Keith Kending, *Sink or Float?*, Dolciani Math Expositions. MAA 2008.