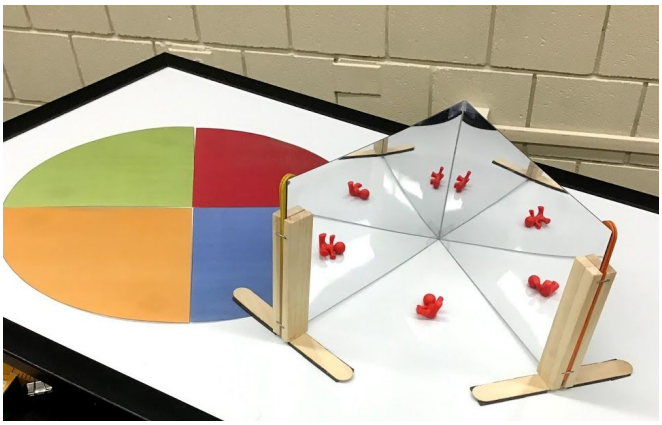
Math Club 1. Lesson # 18. **March 03, 2019**

MirrorLand

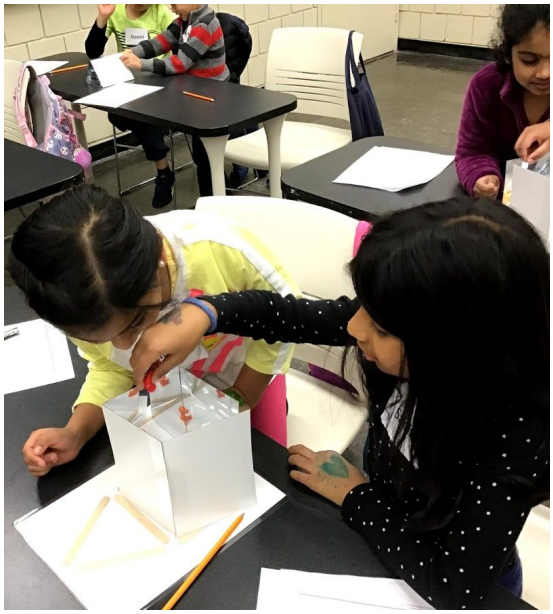
Let us remember what we did last time: we have a circle with each of its 4 sectors are colored differently. How can we make it look like a circle with only 2 distinct colors? We can simply put a mirror on it along the middle line so that only blue and orange sectors are visible. How about a circle with only one color? For this, we would need 2 mirrors. We can put the 2 circles around one of the sectors, flanking it from both sides: we can put the mirrors at a right angle to each other, so that they meet at the center of the circle. But is this the only way to get a circle with one color? What if we made the angle between the mirrors smaller? Do we still have a circle of one color?

Now we have a different problem: can we make an animal turn into 4 animal using a foldable mirror?



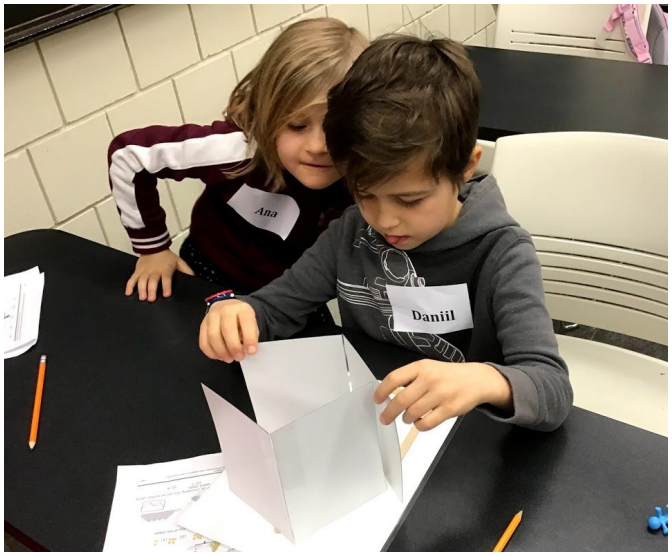
Where should we put the mirror and how open should we make it to turn a single animal into 4? Can we make even more animals than just 4? What should we do to the mirror to have more animals? Make the opening smaller or larger? It looks like the closer we put the 2 mirror flaps, the more animals we will see. What if we will make the as tiny as possible?

Correct! We will get as many animals as possible.



Who knows how kaleidoscopes work? Let us make a square-shaped tube out of 2 of our foldable mirrors.
Let us then put an animal inside the tube and see how many images of the animal we will get.
Can you count the total number of animal you will see inside the tube?

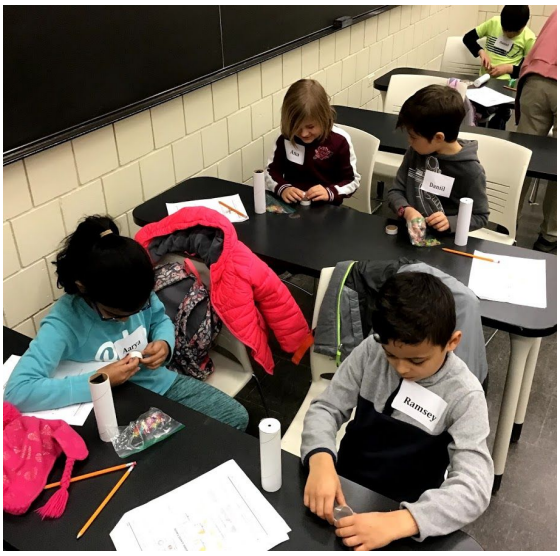
The “real” animal will reflect once at each of the 4 mirrors. That is already 5 animals. But then each animal will again reflect at each of the mirrors except the mirror it is already on. And this will happen many-many times. So is possible to count how many animals we will see even if there is just one “real” animal inside the tube?

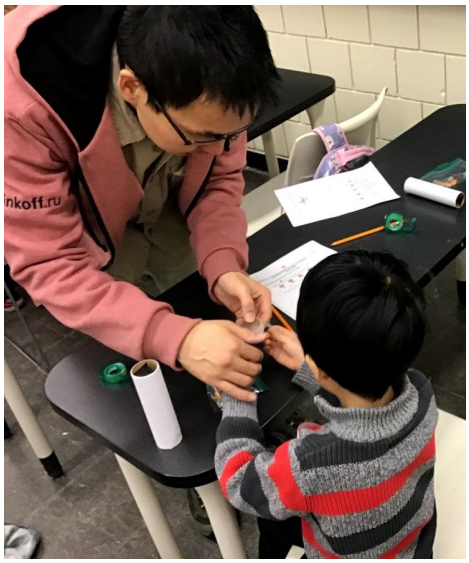


Let us now make an actual kaleidoscope! We will do it in 2 stages:

- Prepare the tube and insert the mirror prism. Take your long tube and close one of its ends using your disk with a small hole. Make sure you tape the disk using a clear tape without blocking the small hole in the middle. Now take your 3 sided mirror pyramid and insert into the tube through the open side.

- Take the short tube and tape it closed using the clear disk. Make sure you don't tape directly over the clear disk, and only tape it around the rim. Pour some beads into the tube and tape it closed with the cloudy disk on the other side. Make sure the short tube is now closed on both sides with the beads locked inside. Connect this short tube's clear side to the open side of the long tube with scotch tape.





Once the 2 tubes are joined, you can look through the small hole on the side of the long tube against some light. The image inside should look similar to the photo below.

Finally, try turning the tube while looking through its hole, and see how the beads topple over and the image changes in front of your eyes.

See you next week!