

## 1 Introduction

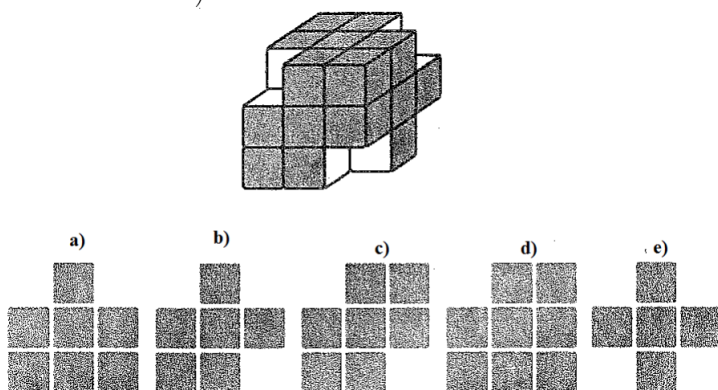
Today, we are going to talk about how we can view 3-D things with a 2-D object: paper! First, let's talk about what 3-Dimensions means.

## 2 Nets

How would you create a cube from a piece of paper? A pyramid? A cone? Draw out the nets below (after watching the net of a cube demonstration).

Challenge: What do you think the net of a sphere looks like?

Next, consider the following: Srikar has a cube that is made up of 27 smaller cubes, and he paints all sides of the larger cube black. He then removes 4 of the smaller cubes from the corners, as shown below. While the paint is wet, he presses each of the new faces onto a piece of paper. Which of the following stamps can Srikar make? There may be more than one.



## 3 Mobius Strips

The Mobius Strip is a fascinating object because it is unlike any other shape we know. If we put an ant on a mobius strip, it could crawl along the length of the loop and return to its original starting point, having traversed both "sides" of the strip without ever crossing an edge. Now, we'll start by actually constructing our very own Mobius Strips!

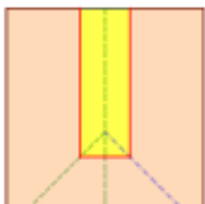
1. Take the 2 ends of the strip, twist it once, and tape the 2 sides together. How many sides does the Mobius Strip have? Hint: try tracing the side of the Mobius Strip with your pencil to see where you end up.
2. What do you predict you will get after you cut the Mobius Strip in half?
3. Now, cut the Mobius Strip in half. What actually happened? Discuss why this might have happened.

4. Now, cut this new strip in half. What happened this time?

## 4 Fold and Cut

So there's this saying that you can fold a piece of paper so that ANY letter can be made with a single cut. I (Jeremy) don't think that's true. Prove me wrong!

Here's an example:

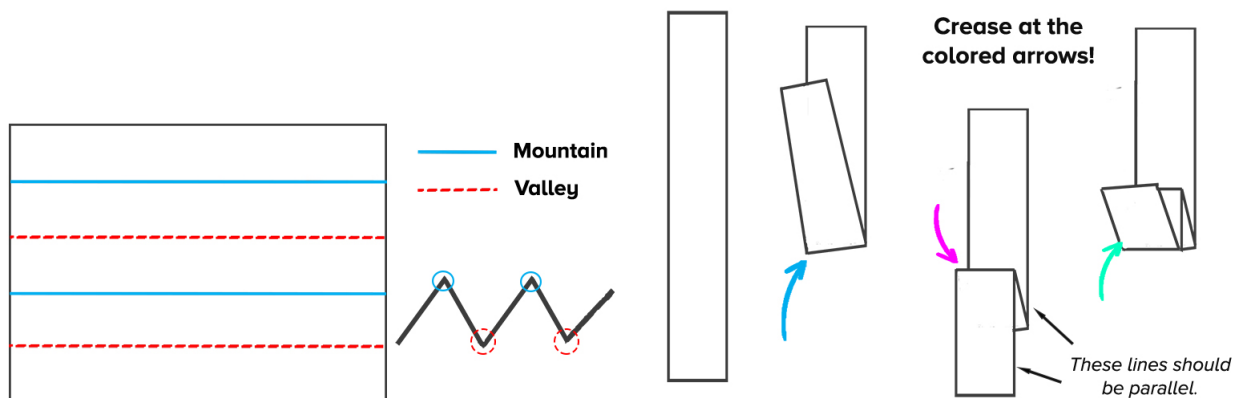


A trick is drawing the letter on each side of the paper and folding until only one straight line remains. Try these letters: C, I, L, T, V, X

Got the hang of it? Here's some tougher ones: A, N, S, P, O, Z

## 5 Bonus: Miura Fold

The Miura Fold was invented by a guy in Japan. The problem was that satellites had a lot of solar panels, but not a lot of space on the space ship to store the solar panels. The solar panels had to be packed together, but they also needed some way to rebuild them in outer space. The Miura Fold solves this by folding the solar panels together in a special way so they can be easily unfolded in outer space! Here are the instructions:



Try opening it back and forth! You can also try changing how many folds you make and the angle of the smaller sections to see what changes. There are more origami designs inspired by the Miura fold to expand and contract. They are called tessalation origami.