

Calculus w/ Algebra

8 December 2022

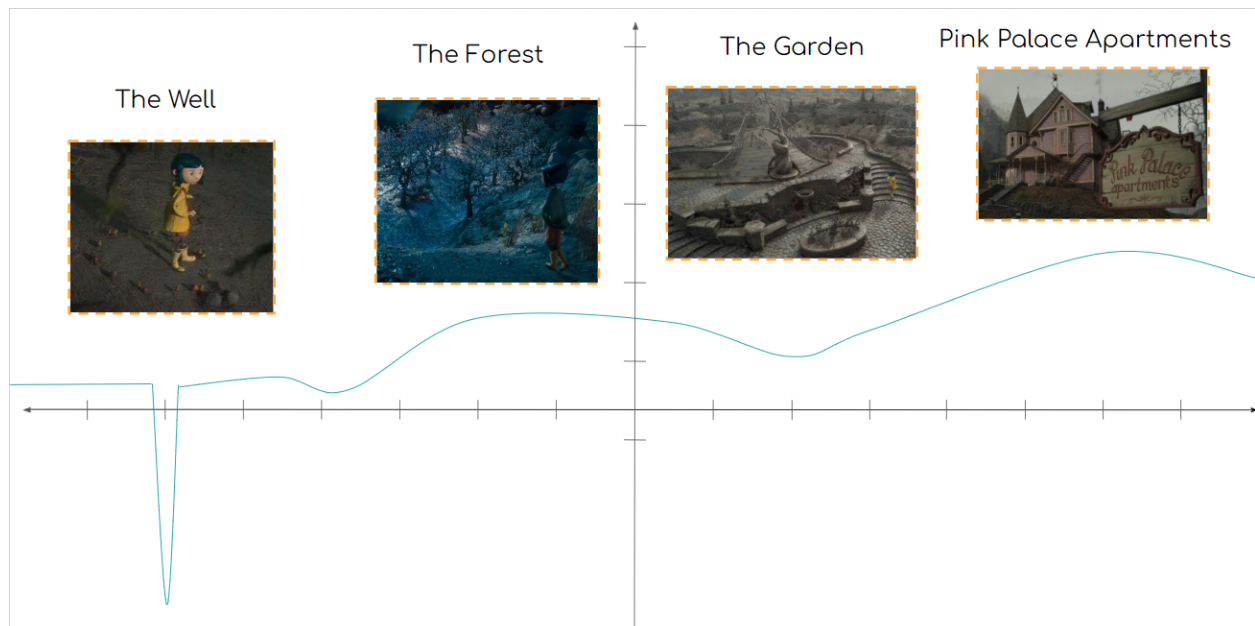
The Changing Extremas in *Coraline*

According to the Extreme Value Theorem, a function attains an absolute maximum value $f(c)$ and an absolute minimum value $f(d)$ at some numbers. It's important to note that the function must be continuous on a closed interval. There are points on a graph called global, or absolute, maximums and minimums. The absolute maximum is the biggest point in general while the absolute minimum is the smallest. There are also local, or relative, maximums and minimums. These points are only the biggest or smallest amongst nearby points. It is possible for an absolute maximum or minimum to also be the local maximum or minimum as well. Using a real-world example, the absolute maximum is Mt. Everest while the global minimum is the bottom of the Mariana Trench. The local points would be a local hill or the bottom of a river. Determining the extremas in *Coraline* is a bit different.

Coraline is the film adaptation of a novella of the same name that was theatrically released in 2009. Laika Studios' years of hard work paid off as their first film was nominated for an Oscar. It utilizes stop-motion animation and can be described as a dark fantasy horror. As the viewer, we follow Coraline who's moved into the Pink Palace Apartments. She discovers an odd door which holds a tunnel to the Other World, an escape from the dreariness of everyday life. The Other Mother lives here and showers Coraline with attention and love, however, she and this world are not as good as they seem. I can recall loving *Coraline* as a kid, its art style and creativity fascinated me. I was only really scared of one part of the film: the beginning. The music, the creation of Coraline's doll, and the metal hand forced me to cover my face and turn the volume down. Despite this, there were many scenes that I would watch over and over again: the scrumptious dinner, beautiful garden, and Miss Forcible and Miss Spink's show are a few

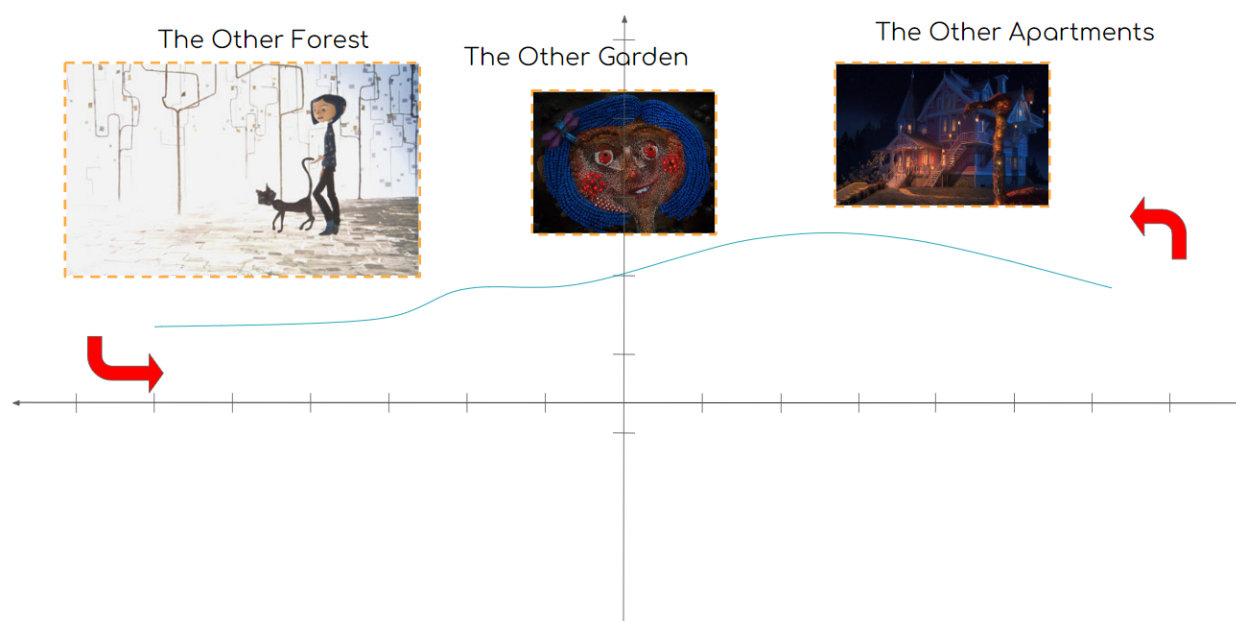
examples. Regardless, looking at *Coraline* -a world devoid of laws and principles- in a math-related lens will be difficult.

I have identified three different parts of *Coraline* which we can use to establish maximums and minimums. First, we will take a look at the ‘normal’ world, which is more realistic and is supposedly like our own. This is before Coraline learns about the Other World, which will be what we observe next. Determining what are absolute and local points is a bit more difficult-you could even make the argument that none exist at all! Finally, we will take a look at the Other World before Coraline leaves forever. At this point there is almost nothing left but Coraline, the Other Mother and her web, and the door. It is best to start with the easiest graph first.

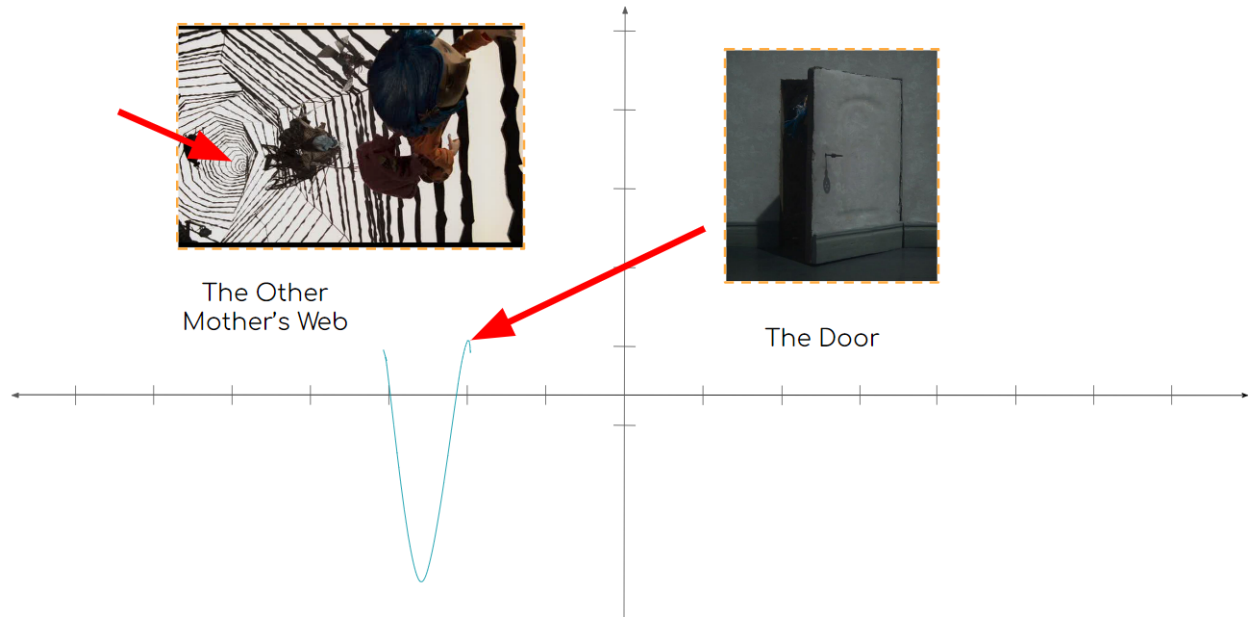


This is my graph of the normal world, as you can see, I have identified a few key features that will help us. As this world is like our own, the absolute minimum and maximum values remain the same, the bottom of the Mariana Trench and Mt. Everest respectively. Narrowing down our graph to what is nearby Coraline’s house, we have our local points. The local minimum is the old well. This was a very easy choice, especially when taking what the film says

about the well into account. One character says, “It’s supposed to be so deep, if you fell to the bottom and looked up, you’d see a sky full of stars in the middle of the day.” Coraline soon shows us how deep it is by dropping a pebble which takes a rather long time to reach the bottom. Even when it hits the water, the sound is very faint. The local maximum would be the top of the Pink Palace Apartments. The area seems to be very hilly with steep declines and tall trees, but this building sits atop a hill and the other notable features seem to be below it. Having established that, let’s move on to our next graph.



This is the graph we will be using to estimate the Extremas of the Other World, please note that determining these will be much more confusing and up for debate. Please note the two red arrows, these show that no matter how far you walk in the forest, you will end up back at the Pink Palace Apartments. This world is limited and nothing else exists beyond what the Other Mother thought Coraline would like. This means that Mt. Everest and other parts of the world do not exist. The absolute maximum remains the same: the tip of the Pink Palace Apartments and this is also the local maximum. The absolute and local minimum would be the forest because the well does not exist either. We can now move on to our last graph.



As you can see, this graph is much smaller than the others. There are only two notable features: the Other Mother's Web and the door. Again, our local maximums and minimums are also the absolute maximums and minimums. The maximums would be the door, which Coraline had to climb up to. The minimums would be the very bottom of the web. Nothing else exists beyond these points. This may have seemed like a relatively easy exercise, but I want to reiterate another point: the Other World does not really exist. As we have seen from the graphs getting smaller and smaller, this place can be easily changed and nothing but the door is permanent. Nevertheless, I enjoyed trying to create accurate graphs and implementing math with a good movie from my childhood.