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Analysis for Project 2

For our project, we decided to use cubic splines. We think that the cubic spline method is best because it is a less sporadic estimate of the curve than the other options. The other options don't present enough accuracy in general.

Of the three methods, the Bezier curves and Lagrange are the methods that require root-finding. Since we are using the cubic splines method, we do not need to use a root-finding routine for our project. Since splines does not require a root finding method, the natural starting points are not worth noting.

By changing one of the function values, we changed the entire function. Since we only changed one, it still looks a little similar to the original curve but the spline we generate does change significantly. Also, as the graph approaches the changed function value, it becomes more and more different than the original surface, obviously excluding the shared given data points. We found that even changing one value can affect the output, and thus the errors for the changed function value are larger.

Our program gets pretty close to the original graph. However, the parabola and circular arc are both visually quite a bit off from our graph. The -cos(x-0.2) is visually the closest to our results, and therefore our results are better estimates than the other two functions. Also, only using five points to interpolate the test shapes is much less accurate than using twenty points, but it still completes the job.

The error was calculated to judge the original and the derivative. Generally, our error was small for these functions, but definitely smaller with the more accurate representations of the reflector shape. So although the parabola and the circular arc are good guesses, the cosine function is the standard by which we measure by. We also noticed that the bound error for the derivatives was usually larger than the bound error for the function values, which makes sense in regards to the accuracy of spline functions. See attached code for exact values.

The derivatives that the code produces are very accurate. For both the parabola and circular arc, the derivatives calculated by the computer are off at first, then get very close to the actual derivatives calculated by hand.