Problem 4: Analyzing π(x)

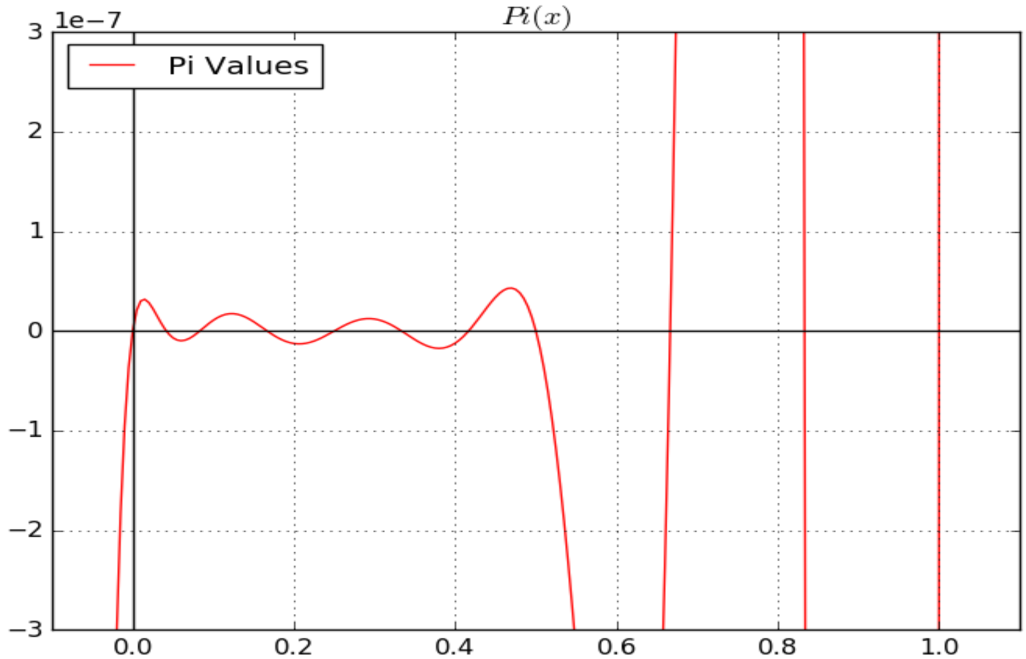

Figure1. A zoomed-in plot of π(x) that uses the nodes from problem 3.

Similarly to the $L_6(x)$ plot that uses the nodes from problem 3, the left half (x <= 0.5)behaves very well and the right does not. This is as well due to the spacing of the nodes. The closer the nodes, the better the curve behaves.

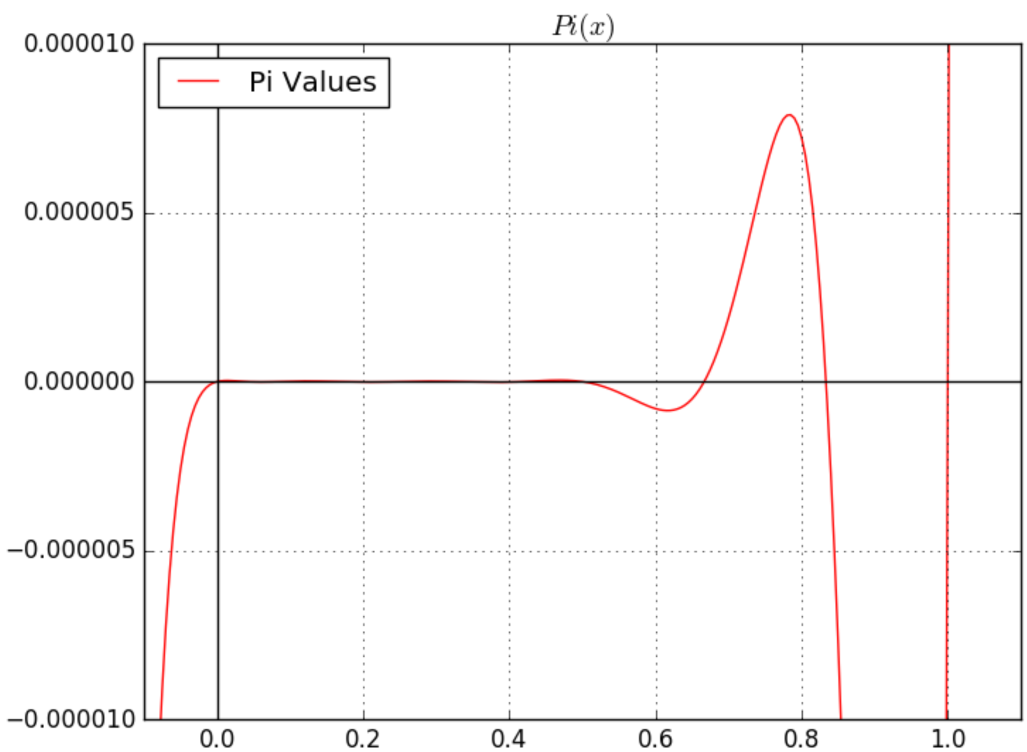

Figure 2. Zoomed-out curve from Figure 1.

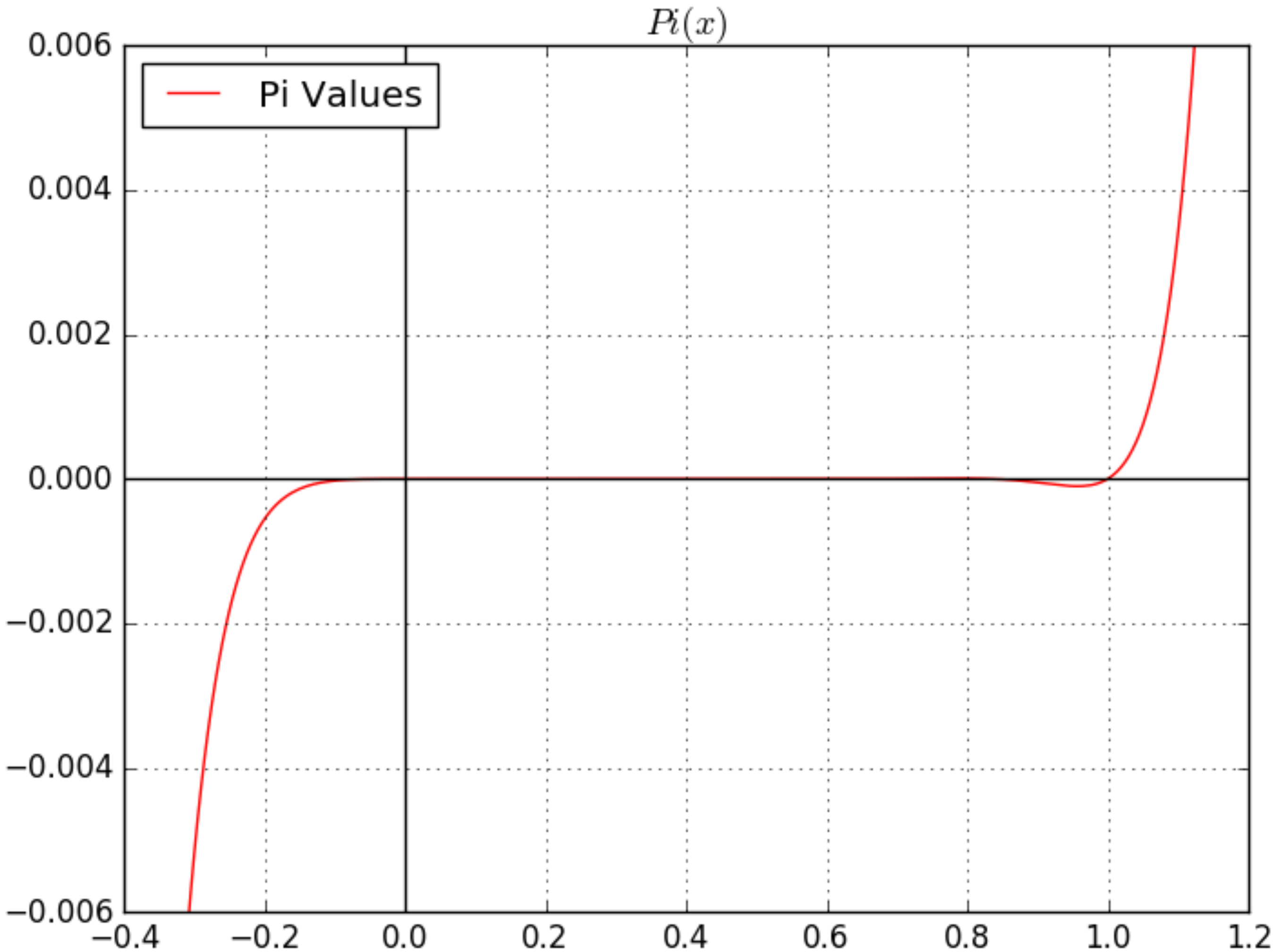

Figure 3. Same curve as in Figure 1 but showing the behavior when x is beyond the interval bounded by the nodes.

One thing noticeable when comparing $L_6(x)$ and $\pi(x)$ is that in order for us to see the similarity in the curves we have to really zoom-in for $\pi(x)$.

When we try to get the values outside of the interval of nodes the curve explodes to positive infinity when greater than 1 as $L_6(x)$ does. But when trying to evaluate with x less than 0 the curve, contrary to $L_6(x)$ is goes to negative infinity. In conclusion, we can say that in order to get a correct approximation we have to keep the nodes closer together and in between 0 and 1. Any other value would produce big errors.

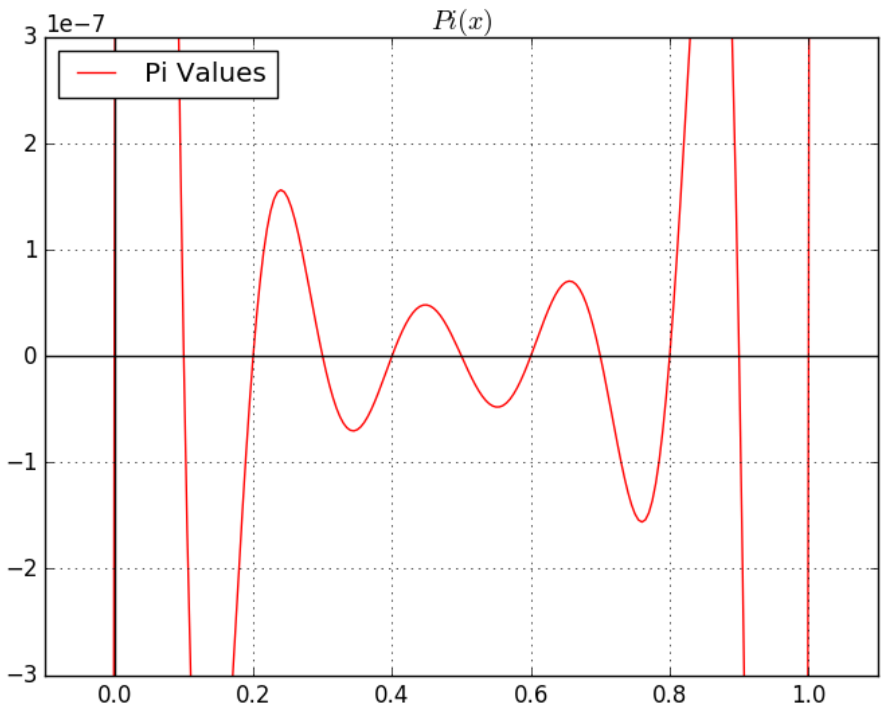

Figure 4. Zoomed-in plot of π(x) that uses nodes from 0.0 to 1.0 at intervals of 0.1.

In figure 4 we see a plot of π(x) that uses the nodes from 0.0 to 1.0, at intervals of 0.1. The center region of the curve is close to zero and the farther away you go the more it deviates. Starting at 0.5 the curve deviates symmetrically to both the left (x<0.5) and to the right(x>0,5).

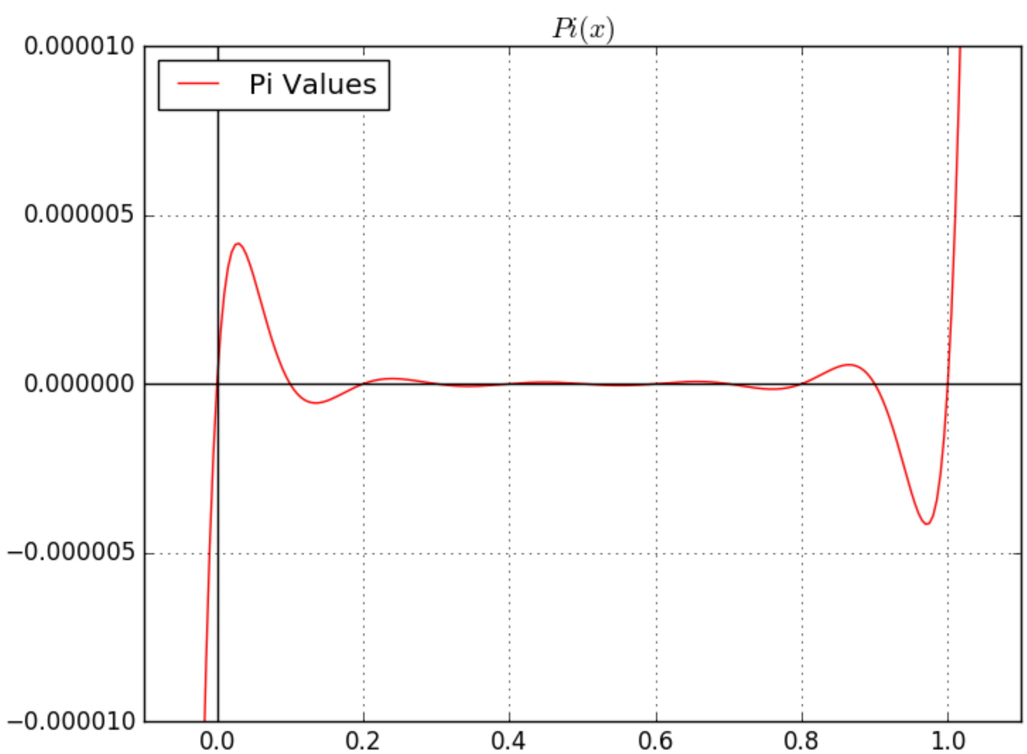

Figure 5. Zoomed-out plot of Figure 4.

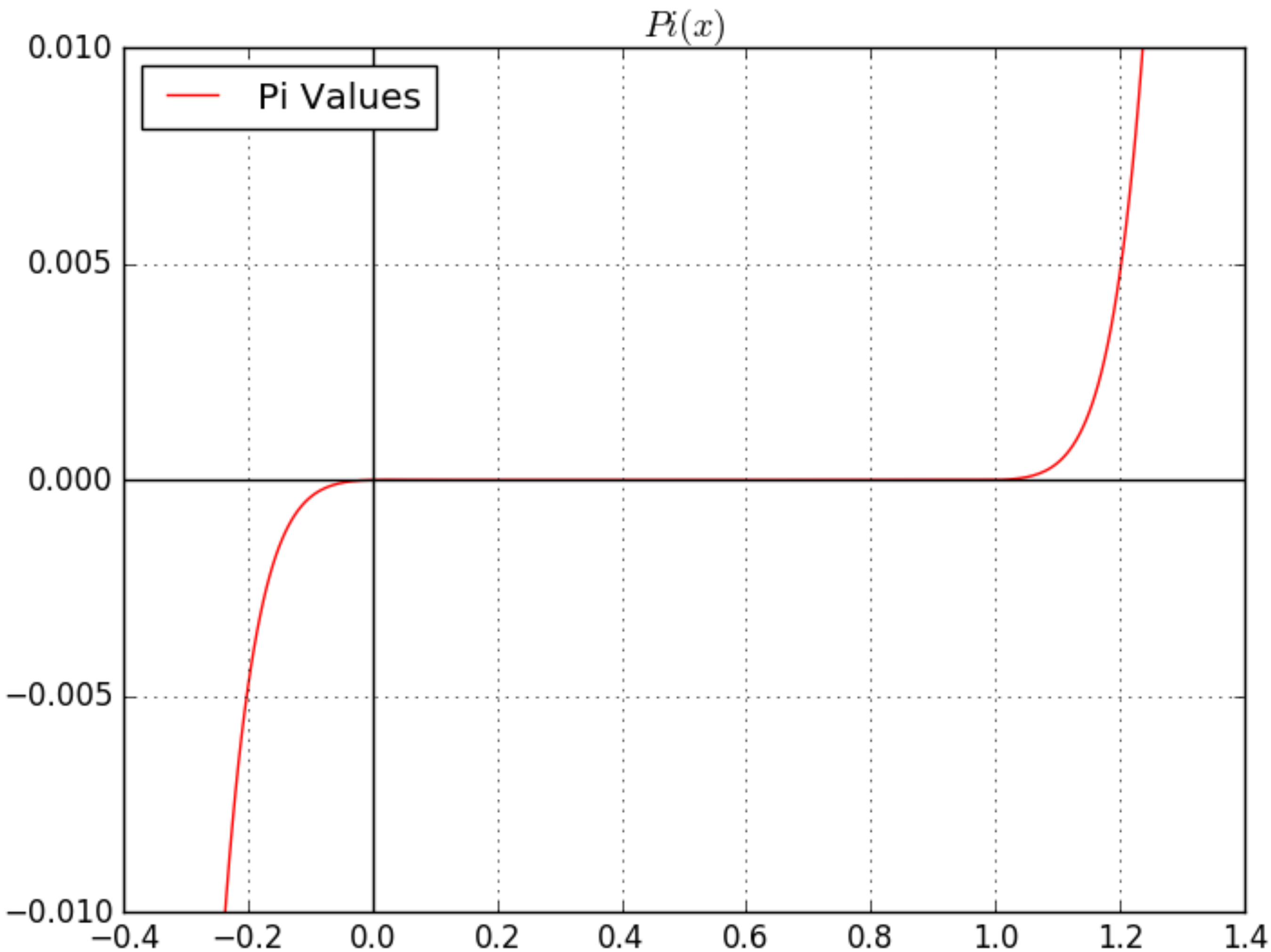

Figure 6. Same curve as in Figure 4 but showing the behavior when x is beyond the interval bounded by the nodes.

This curve in comparison to the $L_6(x)$ that uses the second set of nodes from (0.0 to 1.0, at intervals of 0.1), behaves much better and as expected. Since the nodes are located at the same distance, the farther away you get from the center the more it deviates.