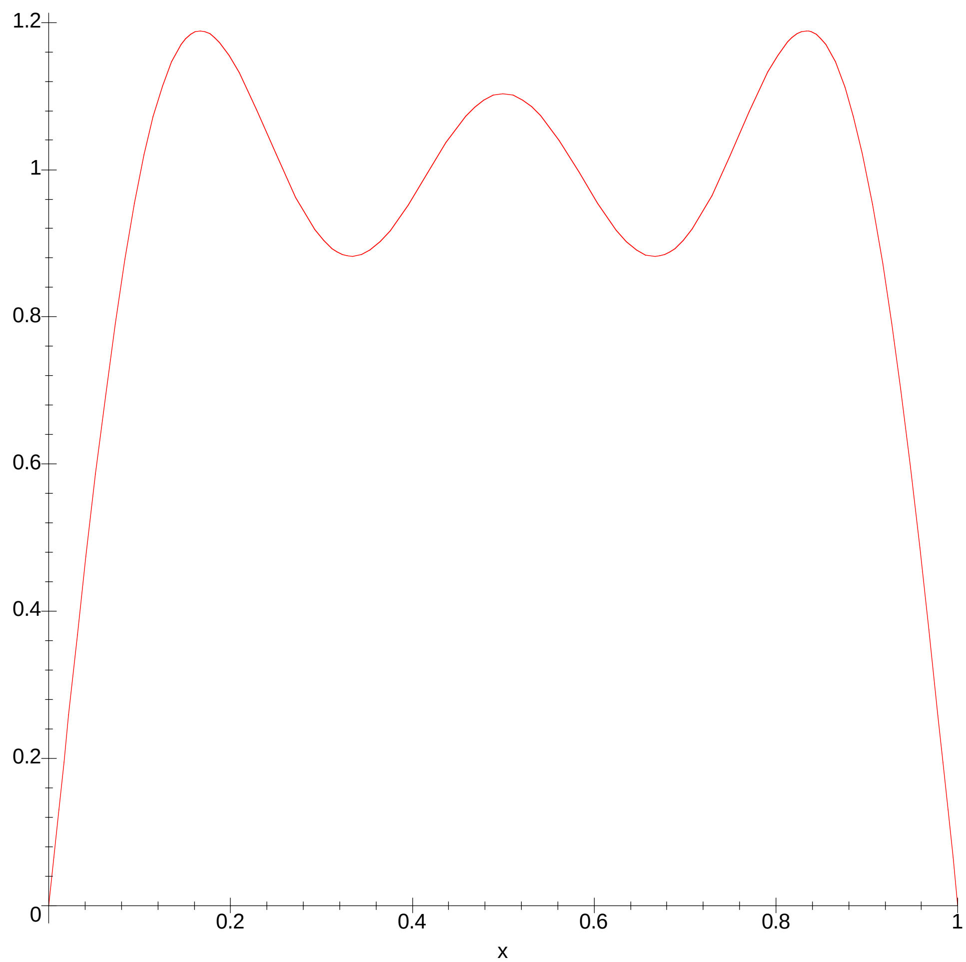
9/18/99

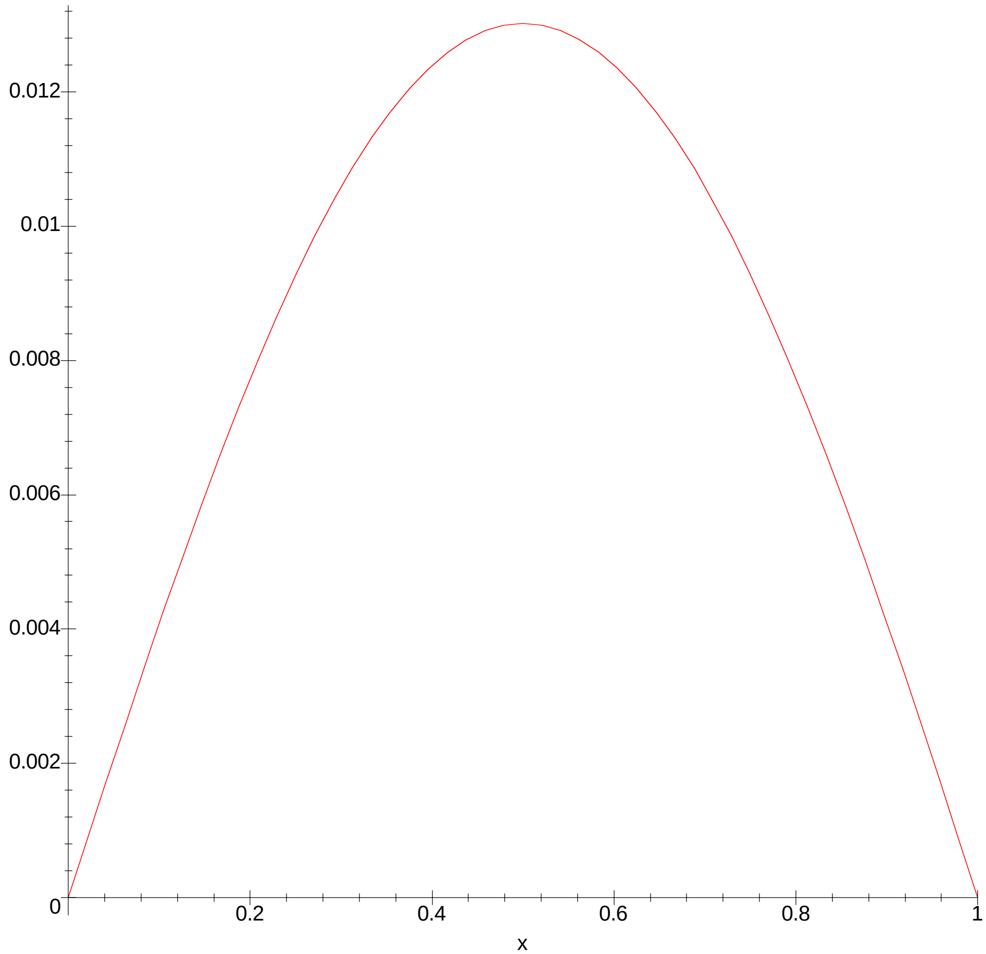
Gibbs Phenomenon Gallery

This set of pictures shows the Fourier sine series for a constant load (magnitude = 1), and the accompanying model displacement field obtained by integrating the sine series four times. Note the waviness of the first sine series, and the extreme stability of the second set. There is no visible difference between the five and ten term approximations for the model displacement, while the load series are quite different. The large "ears" at the end of each load series get worse -- sharper and higher -- as the number of terms in the series increases. What we are seeing is the smoothing effect of integration, and the Gibbs phenomenon that is part of the Fourier expansion. Note that if the boundary condition for the load agrees with the behavior of the Fourier terms at the boundaries. Gibbs' phenomenon is not observed. It results from a discrepancy between the boundary values of the eigenfunctions and the boundary behavior of the function being modeled.

Five Term Approximation



Five Term Approximation for w



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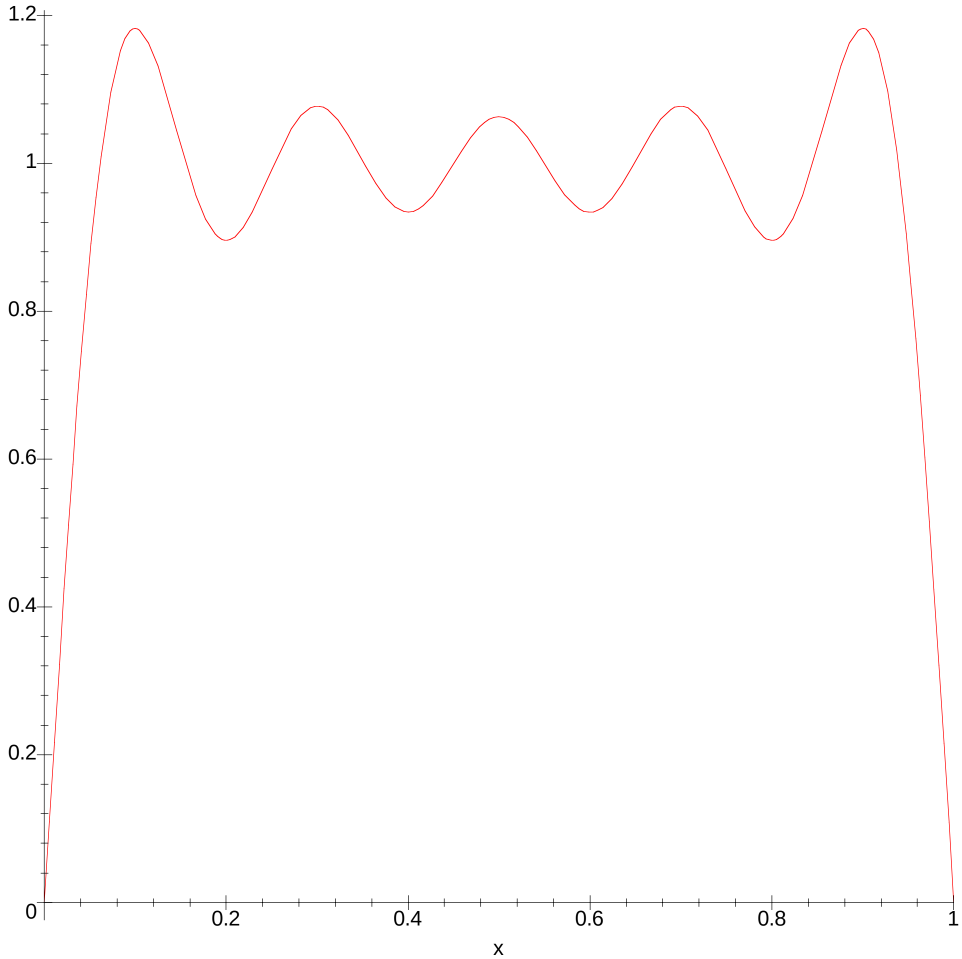
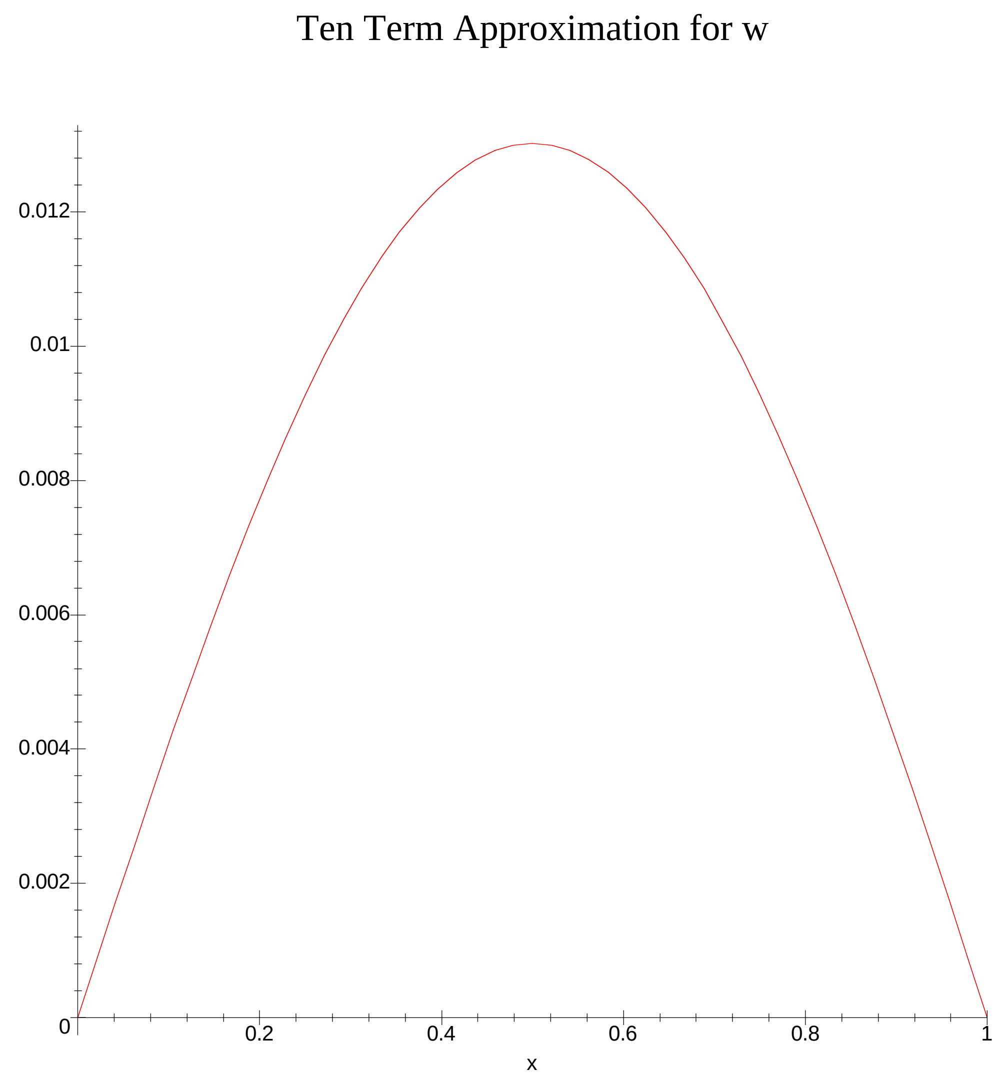
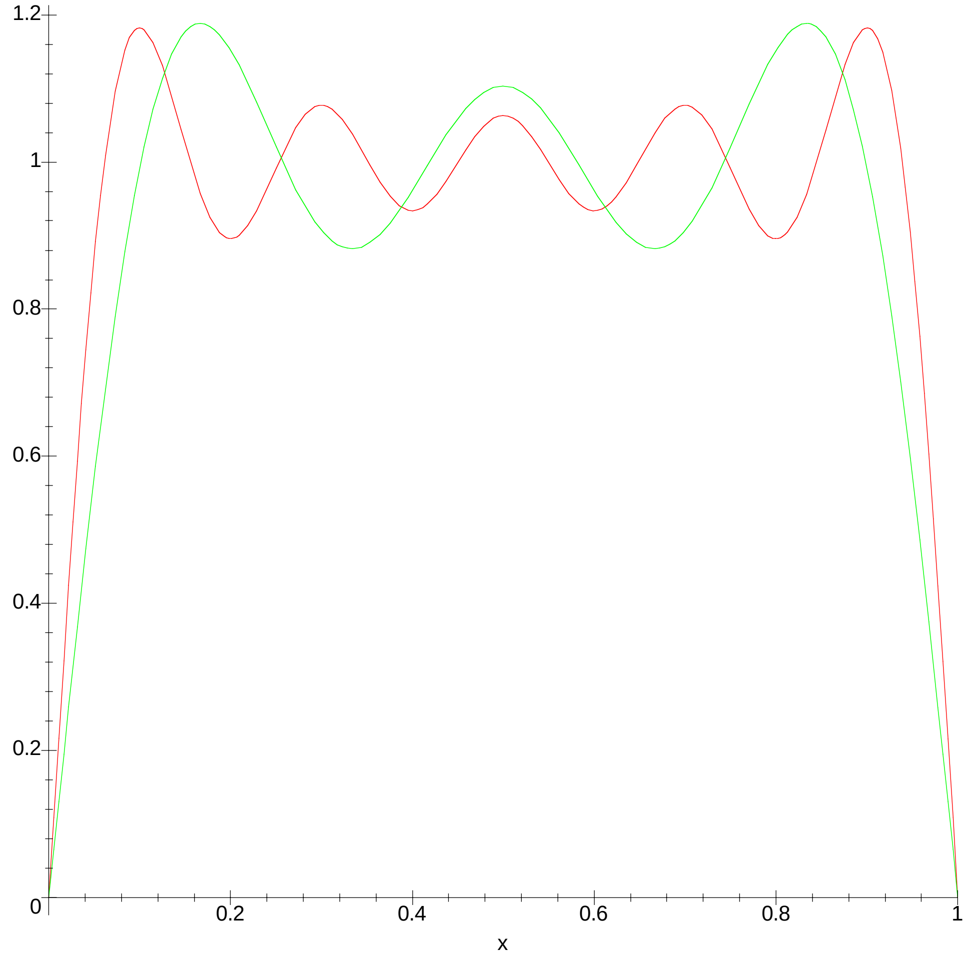
Ten Term Approximation



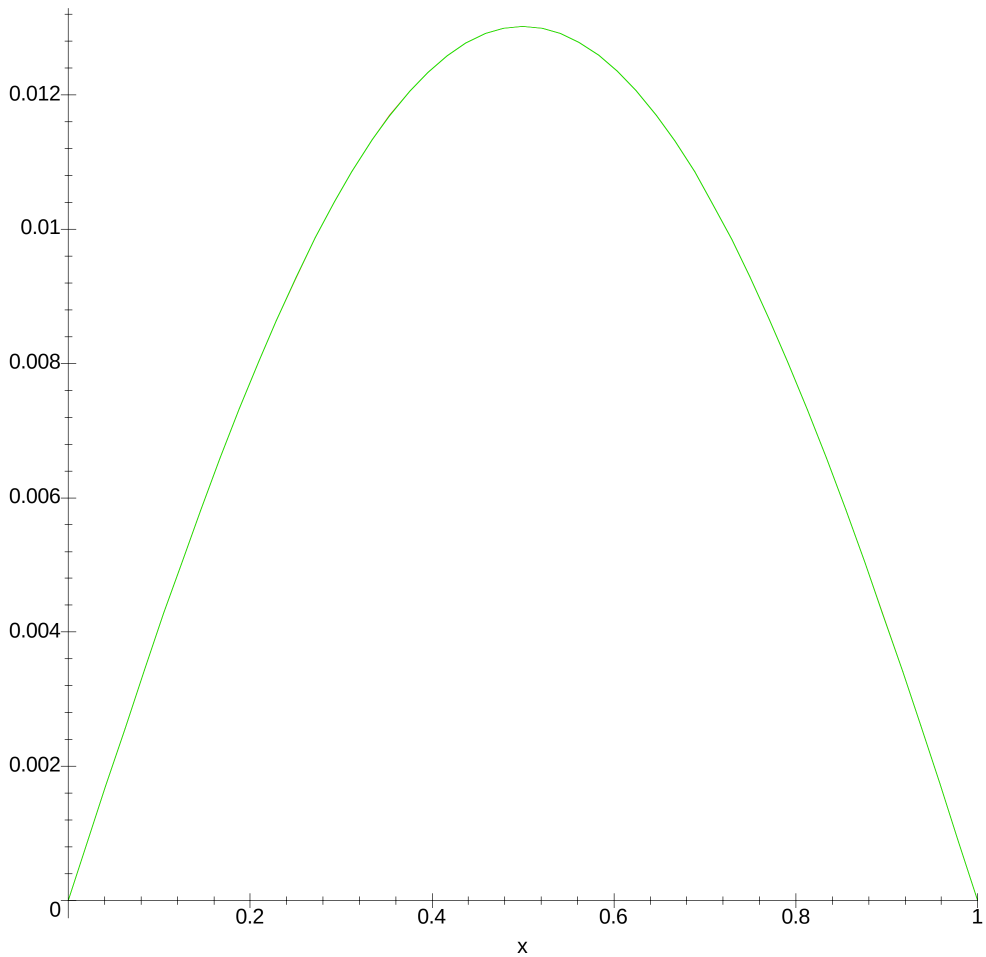


We can compare the five and ten term approximations for each, and we see that the model of the load is quite different, while the model of the response shows no visible difference. I will not show any more examples of response, because it isn't going to change any more as the number of terms increases.

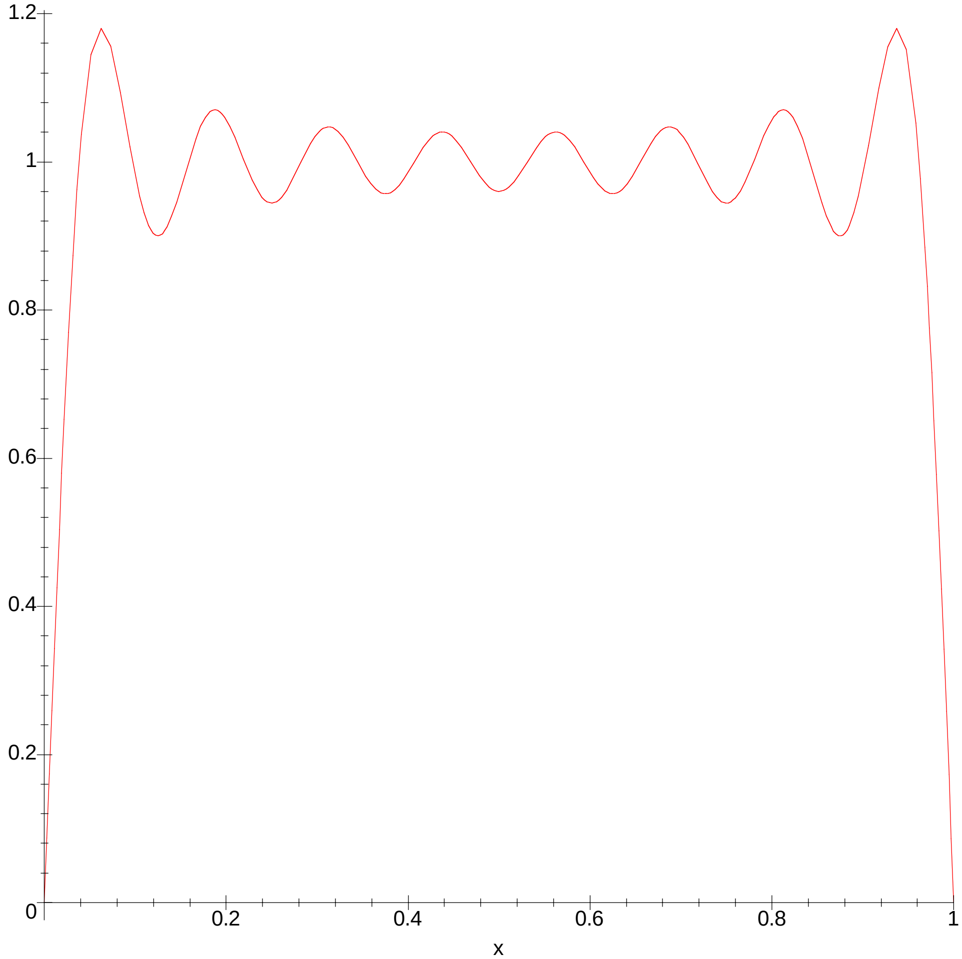
Five/Ten Term Approximation



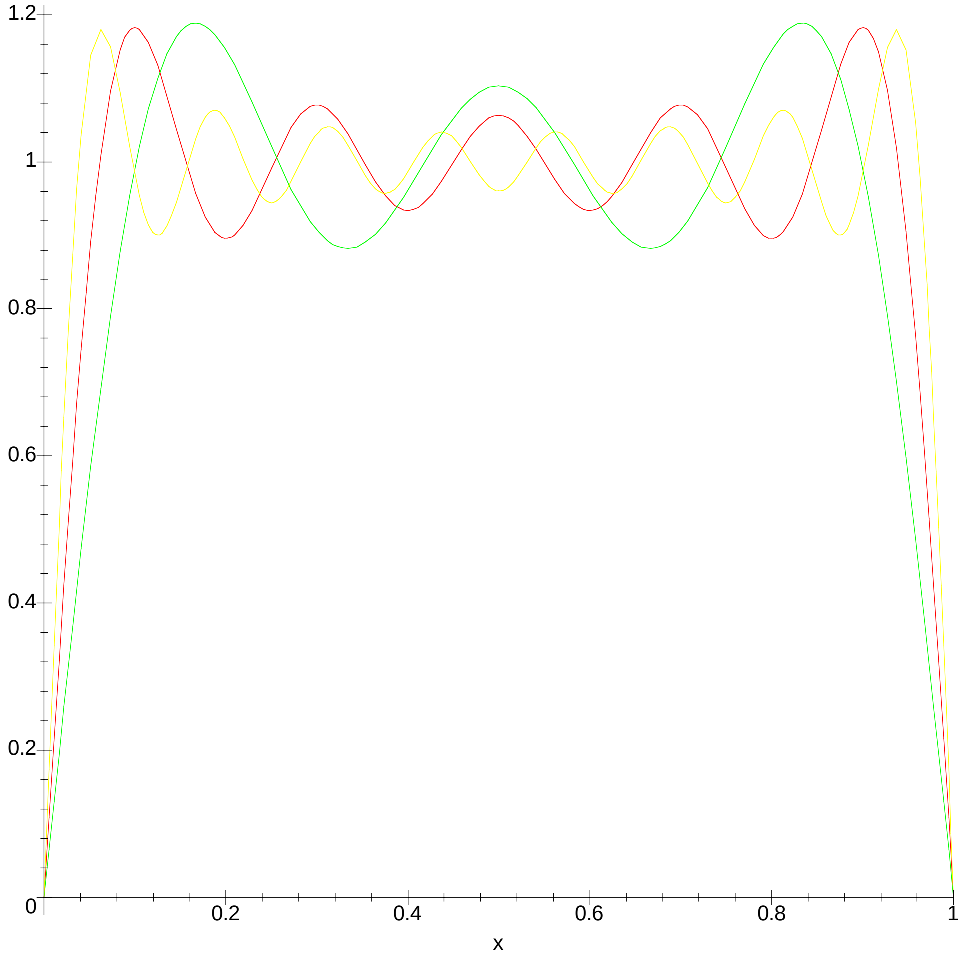
Five/Ten Term Approximation for w



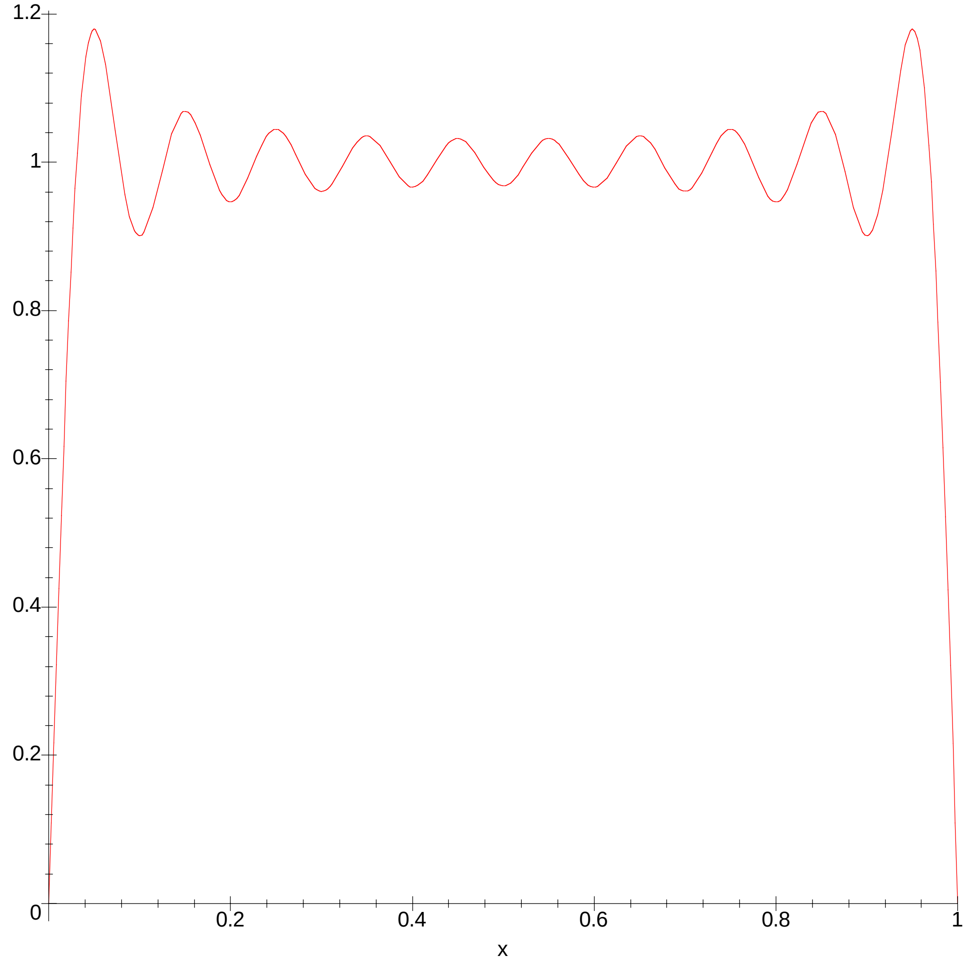
Fifteen Term Approximation



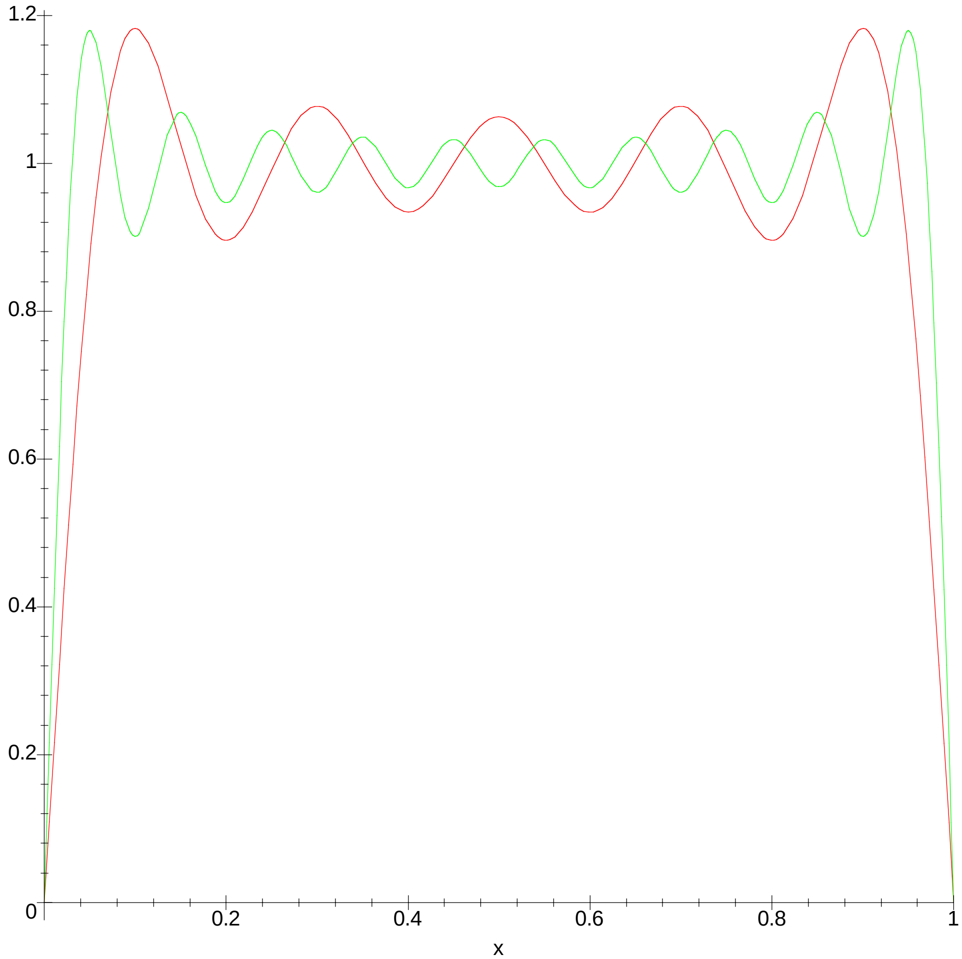
Five/Ten/Fifteen Approximation



Twenty Term Approximation



Ten/Twenty Term Approximation



We can jump right up to a 100 term approximation to better illustrate the Gibbs' phenomenon.

One Hundred Term Approximation