Ay190 – Worksheet 10
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Problem 1

Using the Forward Euler method and 100 points, we get the results

Iterations	z_1	ϕ_1
1	0.139995919541	$7.56727111528e-10$
2	0.139995918784	$-1.38777878078e-16$

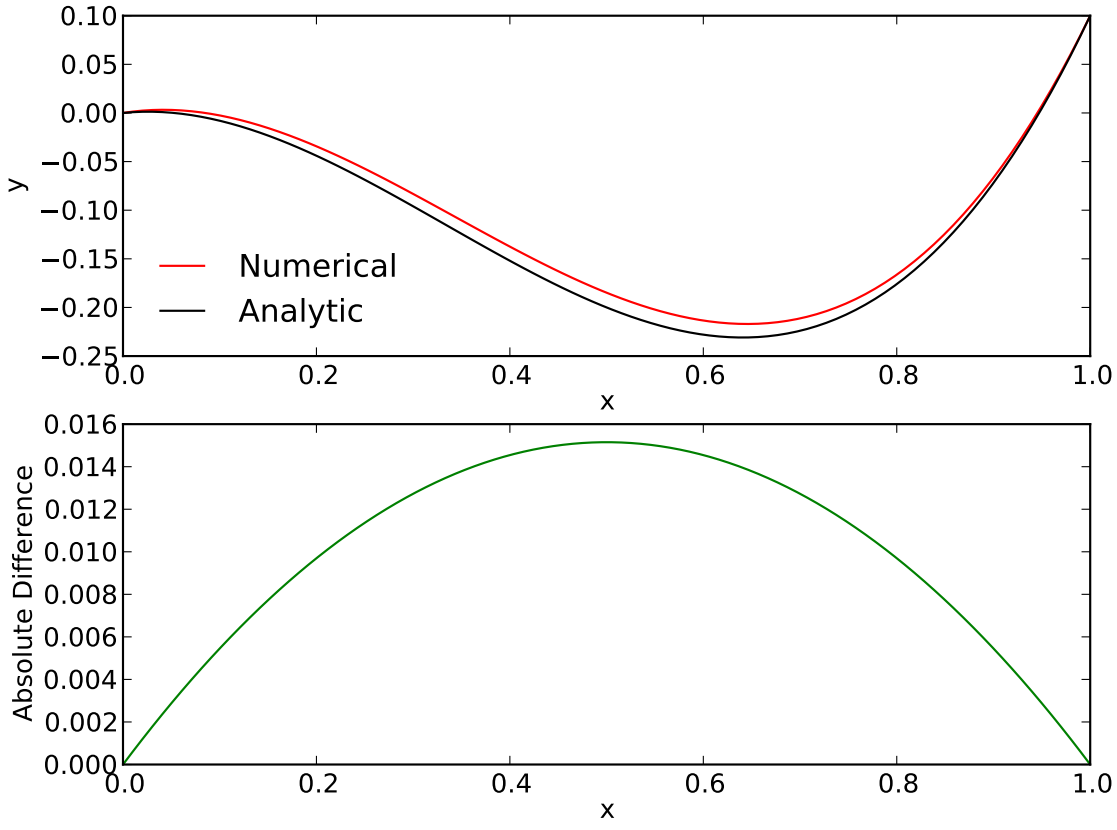

Figure 1: Plot of the numerical and analytic solutions to the BVP using Forward Euler, along with a plot of the absolute difference between them, using 100 grid points.

Using the RK2 method and 100 points, we get the results

Iterations	z_1	ϕ_1
1	0.109496466815	$-3.19267806637e-10$
2	0.109496467133	$-5.55111512313e-17$

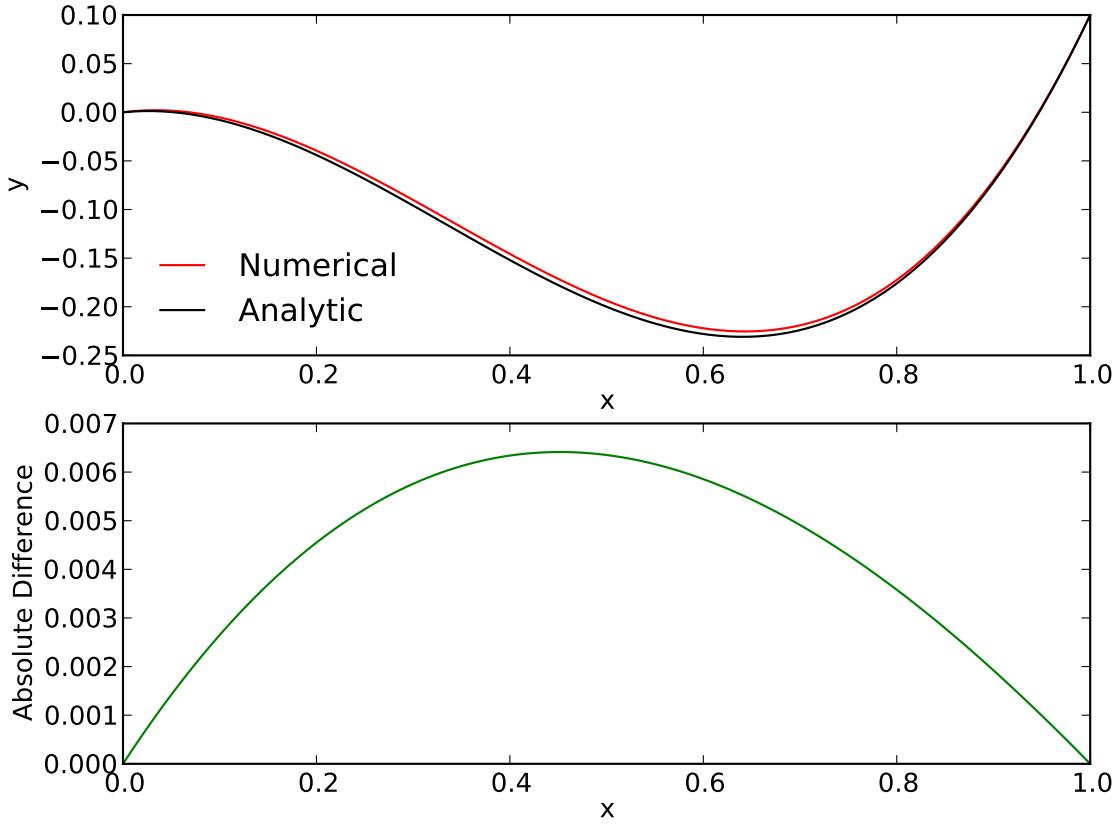

Figure 2: Plot of the numerical and analytic solutions to the BVP using RK2, along with a plot of the absolute difference between them, using 100 grid points.

By changing the number of points used from 100 to 1000, and therefore decreasing the step size, the plots of the numerical and analytic solutions become basically visually indistinguishable. Furthermore, one can see from the difference plots that the differences decreased by a factor of 10, for a factor of 10 decrease in step size.

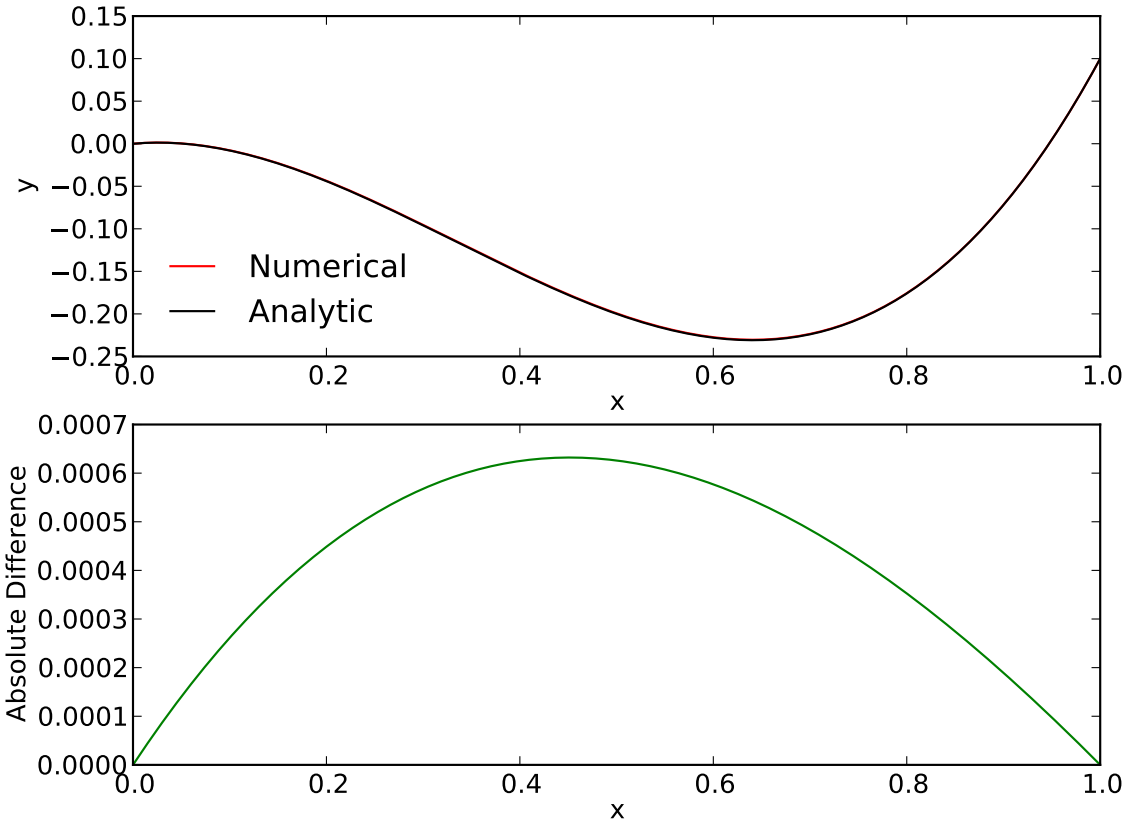

Figure 3: Plot of the numerical and analytic solutions to the BVP using RK2, along with a plot of the absolute difference between them, using 1000 grid points.