# MAT 125B - Homework # 7

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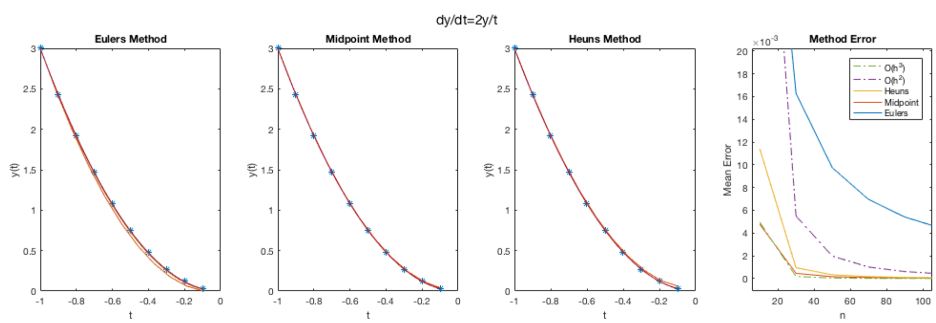
To test that the numerical computations are returning accurate numerical approximations, we test on a variety of known solutions. Moreover, by ensuring that the error does descrease according to the expected local truncation error by Taylor's theorem for each method, we can instill more confidence in the result. Consider the following initial value problems (IVP).

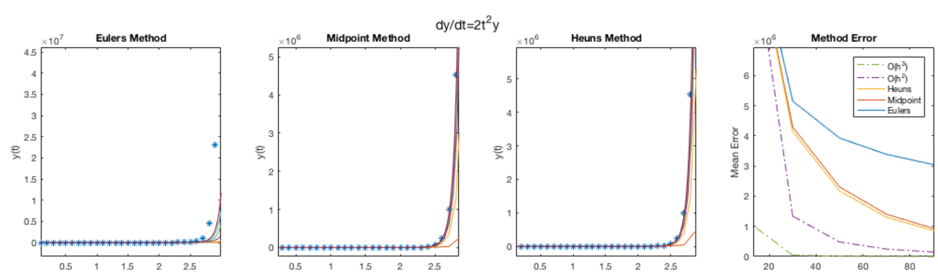
| $\mathbf{y' = f(t, y(t))}$ | $\mathbf{y(t_0) = y_0}$ | $\mathbf{y(t)}$ |
|---|---|---|
| $y' = 2y(t)/t$ | $y(-1) = 3$ | $y(t) = 3t^2$ |
| $y' = 2t^2 y(t)$ | $y(0) = 2$ | $y(t) = 2e^{2t^3/3}$ |
| $y' = y(t)^t$ | $y(-2) = 1.5874$ | $y(t) = (10 - t(t-1))^{1/(1-t)}$ |
| $y' = ty(t)^2$ | $y(-1) = 1$ | $y(t) = 2/(3 - t^2)$ |

**1.** Selection of known Initial Value Problems

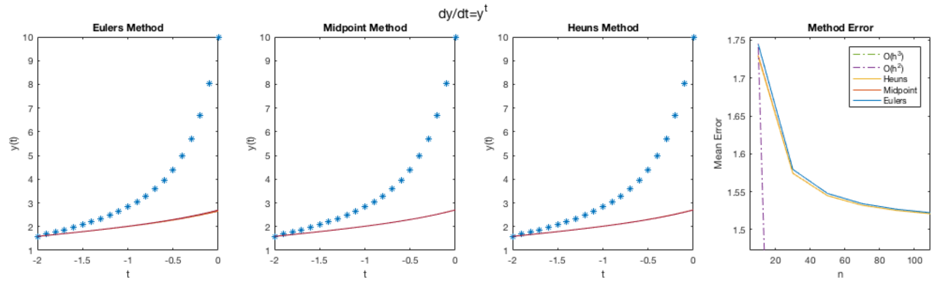
Once the known IVPs were determined we tested the accuracy of different numerical approximation including Euler's Method, the midpoint method, and Heun's Method. The Following illustrates the accuracy for the various number of intervals $n$.



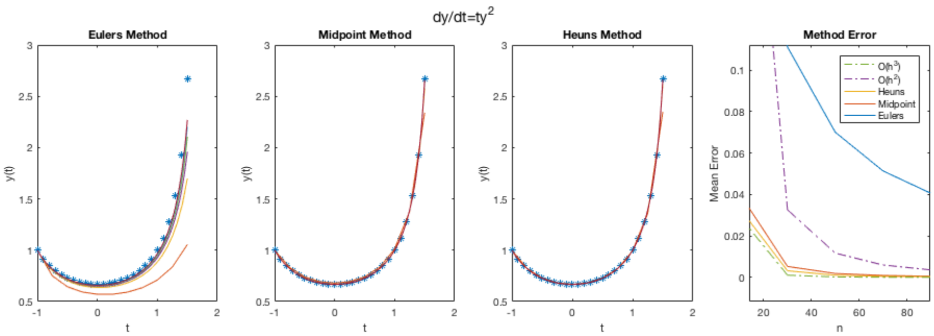

**1.** Comparison of Multiple Methods for $y' = 2y/t$




**2.** Comparison of Multiple Methods for $y' = 2t^2 y$




**3.** Comparison of Multiple Methods for $y' = y^t$




**4.** Comparison of Multiple Methods for $y' = ty^2$