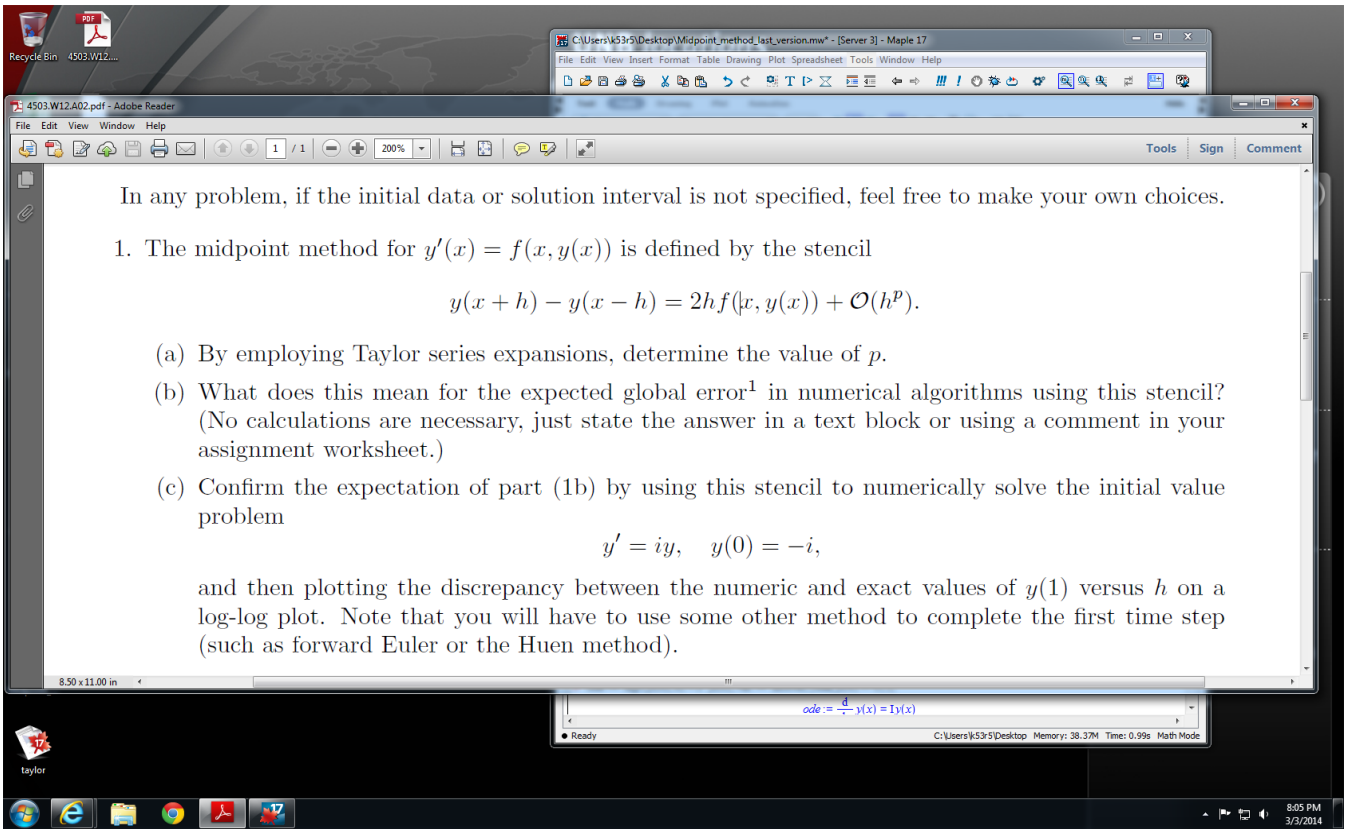
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In any problem, if the initial data or solution interval is not specified, feel free to make your own choices.
1. The midpoint method for $y'(x) = f(x, y(x))$ is defined by the stencil
$$y(x+h) - y(x-h) = 2hf(x, y(x)) + \mathcal{O}(h^p).$$
(a) By employing Taylor series expansions, determine the value of p.
(b) What does this mean for the expected global error[1] in numerical algorithms using this stencil? (No calculations are necessary, just state the answer in a text block or using a comment in your assignment worksheet.)
(c) Confirm the expectation of part (1b) by using this stencil to numerically solve the initial value problem
$$y' = iy, \quad y(0) = -i,$$
and then plotting the discrepancy between the numeric and exact values of $y(1)$ versus h on a log-log plot. Note that you will have to use some other method to complete the first time step (such as forward Euler or the Huen method).
8.50 x 11.00 in
ode := d/dx y(x) = I y(x)
Ready
C:\Users\k53r5\Desktop Memory: 38.37M Time: 0.99s Math Mode
taylor
8:05 PM
3/3/2014