Maths 260: Data used in Lecture 5

The following tables are used in this lecture and are provided here for your convenience.

Euler's method with various step sizes was used to approximate the solution to the IVP

$$\frac{dy}{dt} = y,\ y(0) = 1,$$

at time t=1, and the following results were obtained. The error given is the difference between the approximation and the true value of the solution, which is y(1)=e.

No. of Steps	$y(1)$	error
1	2.000000	0.718
2	2.250000	0.468
4	2.441406	0.277
8	2.565784	0.152
16	2.637928	0.0804
32	2.676990	0.0413
64	2.687345	0.0209
128	2.707739	0.0105
256	2.712992	0.00529
512	2.715632	0.00265

Looking at the same IVP with Improved Euler yields:

No. of Steps	$y(1)$	error
1	2.500000	0.218
2	2.640625	0.0777
4	2.694856	0.0234
8	2.711841	0.00644
16	2.716594	0.00169
32	2.717850	0.000432
64	2.718173	0.000109
128	2.718254	0.0000274
256	2.718275	0.00000689
512	2.718280	0.00000173

The same IVP with RK4 yields:

No. of Steps	$y(1)$	error
1	2.708333	0.00994
2	2.717346	0.000936
4	2.718210	0.0000719
8	2.718277	0.00000498
16	2.718282	0.000000328
32	2.718282	0.0000000215

These numerical results were all obtained using the function numerical.m within Matlab.