# SE Course: Numerical Methods

http://www.cs.aaue.dk/~yang/course/NMbasis/NM2010.htm
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### MM9: Euler's Method and Runge-Kutta Methods

## 1 kl.12:30-14:00, Euler's Method and Runge-Kutta Methods

- What we talked in MM8;
- Euler's Method
- Runge-Kutta Methods;
- Matlab implementations.

## 2 kl.14:10-15:40, Exercises for MM9

**Question One (Exercise 6.1.1-4, pp.178):**

Concern the differential equation

$$y' = x/y. \tag{1}$$

- Find the general solution of the differential equation;
- For the initial condition $y(0) = 3$, use the Euler's method with steps $h = 1,\ 1/2$ and $1/4$ to approximate $y(1)$;
- Use Euler's method to solve the initial-value problem $y0) = 3$ over $[0, 4]$ with $N = 10,\ 100$ and 200 steps;
- Tabulate the errors in the approximate values of $y(4)$.

**Question Two (Exercise 6.2.1, pp.185):**

Continue to concern the differential equation (1). For the initial condition $y(0) = 3$, use the corrected Euler's method with steps $h = 1,\ 1/2$ and $1/4$ to approximate $y(1)$.

**Question Three (Exercise 6.2.7, pp.185-186):**

Use the classical Runge-Kutta RK4 method with steplengths $h = 10^{-k}$ for $k = 1, 2, 3$ to solve the initial-value problem

$$y' = x + y^2$$

with $y(0) = 0$ on $[0, 1]$. Tabulate the results for $x = 0, 0.1, 0.2, \cdots, 1$ and graph the solutions.