

**TFY4235/FYS8904**  
**Problemset 9 Spring 2015**

PAGE 1 OF 1

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**Problem 1.**

Solve the equation

$$\frac{d^2y}{dx^2} + \omega_0^2 y = 0 \quad (1)$$

numerically for different initial conditions and tabulate the solutions graphically in the  $\{y, y'\}$  plane. Do the same with the equation

$$\frac{d^2y}{dx^2} + \omega_0^2 y + \beta y^3 = 0. \quad (2)$$

Discuss the solution. Compare the behavior of the numerical solutions using explicit and implicit Euler integration.

Also solve the ODEs using the classic Runge-Kutta method. How does the precision and computational speed compare to the results obtained by the use of the explicit and implicit Euler integration.