

MATH 170C ASSIGNMENT 1

- (1) (§8.2, 3) Compute $x(0.1)$ by solving the differential equation

$$\begin{cases} x' = -tx^2 \\ x(0) = 2 \end{cases}$$

with one step of the Taylor-series method of order 2.

- (2) (§8.2,4) Using the ordinary differential equation

$$\begin{cases} x' = x^2 + xe^t \\ x(0) = 1 \end{cases}$$

and one step of the Taylor-series method of order 3, calculate $x(0.01)$.

- (3) (§8.2, 7) If the Taylor-series method is used to solve an initial-value problem involving the differential equation

$$x' = \cos(tx)$$

what are the formulas for x'' , x''' , and $x^{(4)}$.

- (4) (§8.3, 1) Write out the second-order Runge–Kutta formulas when $\alpha = 2/3$.

- (5) (§8.3, 4) Derive the following method,

$$x(t+h) = x(t) + \frac{1}{3}hf(t, x(t)) + \frac{2}{3}hf\left(t + \frac{h}{2}, x(t) + \frac{h}{2}f(t, x(t))\right)$$

by performing Richardson's extrapolation on Euler's method using step sizes h and $h/2$.

Hint: Assume the error term is Ch^2 .