Name:
CID:

Tutorial 9

Any marks received for the tutorial are only indicative and may be subject to moderation and scaling.

Exercise 1 (**RK methods**) — % of CW mark: 0.5

What is the Runge–Kutta method which corresponds to the Butcher table

$$\begin{array}{c|cc} \frac{1}{2}-\gamma & \frac{1}{4} & \frac{1}{4}-\gamma \\ \frac{1}{2}+\gamma & \frac{1}{4}+\gamma & \frac{1}{4} \\ \hline & \frac{1}{2} & \frac{1}{2} \end{array}, \qquad \gamma = \frac{\sqrt{3}}{6}.$$

Exercise 2 (**RK methods**) — % of CW mark: 1.0

What is the stability function of the Runge–Kutta method given by the Butcher table

$$\begin{array}{c|ccc} 0 & 0 & 0 & 0 \\ 1 & 1 & 0 & 0 \\ \frac{1}{2} & \frac{1}{4} & \frac{1}{4} & 0 \\ \hline & \frac{1}{6} & \frac{1}{6} & \frac{2}{3} \end{array}$$

Exercise 3 (**RK methods**) — % of CW mark: 1.0

What is the interval of absolute stability of the Runge–Kutta method given by the Butcher table

$$\begin{array}{c|cc} 0 & 0 & 0 \\ \frac{1}{a} & \frac{1}{a} & 0 \\ \hline & (1-a) & a \end{array}$$

Exercise 4 (**Finite differences**) — % of CW mark: 1.5
Mastery Component

Find the parameters a, b, c such that $u'(t_n) - u'_n = O(h^2)$, where $u'(t_n) \approx au_n + bu_{n-1} + cu_{n-2}$.