Quiz 3, Math 246, Professor David Levermore
Tuesday, 18 September 2018

Your Name:

Discussion Instructor (circle one): Sid Sharma Anqi Ye
Discussion Time (circle one): 8:00 9:00 10:00

No books, notes, calculators, or any electronic devices.
Show your reasoning for full credit. Good luck!

(1) [2] Suppose we have used the Runge-Kutta method to approximate the solution of an initial-value problem over the time interval $[4, 14]$ with 1000 uniform time steps. About how many uniform time steps do we need to reduce the global error of our approximation by a factor of $\frac{1}{81}$?

(2) [4] Consider the initial-value problem

$$\frac{\mathrm{d}u}{\mathrm{d}t} = 2u - u^2\,, \qquad u(0) = 3\,.$$

Approximate $u(.2)$ using one step of the Runge-midpoint method.
Leave your answer as an arithmetic expression.

(3) [4] Determine if the following differential forms are exact or not. (Do not solve!)

(a) [2] $(y^2 - 3xy)\,\mathrm{d}x + (xy - x^2)\,\mathrm{d}y = 0\,.$

(b) [2] $(2xy - x^2)\,\mathrm{d}x + (y^2 + x^2)\,\mathrm{d}y = 0\,.$