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| California State University Northridge | College of Engineering and Computer Science Mechanical Engineering Department Mechanical Engineering 501A Seminar in Engineering Analysis |
| | Fall 2017 Number: 15966 Instructor: Larry Caretto |

November 22 Homework Problem

Consider the following differential equation: $\frac{dy}{dx} = \frac{2\sqrt{y - \ln x}}{x} + \frac{1}{x}$ with the initial condition that $y = 0$ at $x = 1$.

Verify that the exact solution is $y = (\ln x)^2 + \ln x$.

Compute the numerical solution of this equation from the initial condition to a final point at $x = 1.8$. Find the difference between the numerical and exact solution at the final point. Do the numerical solutions and find the error at the final point ($x = 1.8$) for each of the following method/step-size combinations.

- Euler's method with $h = 0.1$
- Heun's method with $h = 0.2$
- Fourth-order Runge-Kutta method with $h = 0.4$
- Fourth-order Runge-Kutta method with $h = 0.1$