

MATH 209 QUIZ 3 - Version A  
February 18, 2014

Name: ANSWERS

**Instructions:** Use your own scrap paper. Write your answers as decimals in the space provided. Do not show calculations on this page.

1. State the equation in theorem 3.2:  $f(x+\Delta x) \approx f(x) + f'(x + \frac{\Delta x}{2}) \Delta x$

2. Consider the ODE  $\frac{dy}{dx} = x^2 + 2 + e^y$ ,  $y(0) = 0$ . Theorem 3.1 was used to obtain  $y(0.1) \approx 0.3$ . Use this fact, and theorem 3.2 to approximate  $y(0.2)$ .

$y(0.2) \approx$  0.672 (use three decimal places for the answer).

3. Consider the same ODE and initial condition from problem 2:  $\frac{dy}{dx} = x^2 + 2 + e^y$ ,  $y(0) = 0$ . Use Euler's method with step size 2 to approximate  $y(0.2)$ . Fill out the table below with the appropriate numbers, rounding to three decimal places each step.

$x$	$y$	$y'$
0	0	3
0.1	0.3	3.360
0.2	0.636	XXXX

$\Rightarrow y(0.2) \approx$  0.636

4. Repeat problem 3, but this time, use the *modified* Euler's method.

$x$	$y$	$y'$	$x_{1/2}$	$y_{1/2}$	$y'_{1/2}$
0	0	3	0.05	0.15	3.164
0.1	0.316	3.382	0.15	0.485	3.647
0.2	0.681	XXXX	XXXX	XXXX	XXXX

$\Rightarrow y(0.2) \approx$  0.681

**Bonus:** Below, draw the *stability graph* for  $\frac{dy}{dx} = y(y-3)$ , complete with stability arrows and smiley faces to show stability as done in class. Label the axes, steady states, and inflection points on the graph.

