

Finish HW 2a (on 2.6 and 2.7) if you haven't already.

Exam 1 is Wednesday in class, more details later in lecture.

2.7: Euler's method

Given $\frac{dy}{dt} = f(t, y), y(t_0) = y_0$.

To numerically estimate the solution:

1. Choosing a step size, h .
2. Compute slope $= \frac{dy}{dt} = f(t_0, y_0)$.
3. Use tangent line approximation:
$$y_1 = y_0 + f(t_0, y_0)h.$$
4. Using y_1 and $t_1 = t_0 + h$, repeat steps 2 and 3 to get y_2 , and so on.

Briefly,

$$y_{n+1} = y_n + f(t_n, y_n)h$$
$$t_{n+1} = t_n + h$$

Entry Task:

Given $\frac{dy}{dt} = 2t - y, y(2) = 4$.

Estimate $y(4)$ using Euler's method with step size $h = 0.5$.

t_n	y_n	$f(t_n, y_n)$	$f(t_n, y_n)h$
2	4	$2(2)-(4) = 0$	$(0)(0.5) = 0$
2.5	4	$2(2.5)-(4) = 1$	$(1)(0.5) = 0.5$
3	4.5	$2(3.0)-(4.5) = 1.5$	$(1.5)(0.5) = 0.75$
3.5	5.25	$2(3.5)-(5.25) = 1.75$	$(1.75)(0.5) = 0.875$
4	6.125		

Conclusion: $y(4) \approx$

For comparison (obtained by integrating factors) Actual solution:

$$y(t) = 2(t+e^{2-t} - 1), \text{ so } y(4) = 6.270671$$

Exam 1 is Wednesday in class.

Please come early and help set up the classroom (we need 46 seats set up at the long tables, if there aren't 46, then we need to squeeze in some chairs from the back).

Allowed:

1. A **basic scientific calculator (bring this!!!)**
(NO graphing calculators)
2. An 8.5 by 11 inch sheet of handwritten notes (front/back)
3. A pencil or black/blue pen

Details and rules:

1. 5 pages of questions, 50 minutes, use your time effectively. Time is a big factor!
2. Show your work!
3. Clearly indicate the work you want grade, put a box around your final answer.

4. We take cheating very seriously. There may be multiple test versions. Do not copy of a neighbor. Do not let your eyes wander. I report many cases to the academic misconduct board each year often because a student happened to see the answer or work of a neighbor and copied it down.

If we find even one part of one answer that is clearly copied from a classmate, then you will get a zero on the entire exam and you will meet in front of the academic misconduct board for further penalties.

(Penalties include academic probation or expulsion depending on severity of cheating)

Quick Review: Exam 1 is about 1st order differential equations

Ch. 1 Differential Equation Basics

2.1 Integrating factor method

2.2 Separable Equations

2.3 Applications

- Know homework,
- Know basic translation tools

2.4 Existence/Uniqueness

2.5 Equilibrium Analysis

2.6 Exact Equations

2.7 Euler's Method

Other Notes: change of variable,
constants of integration, checking work