* Users online: TAMattH

* Bry joined

Bry: Good morning

TAMattH: Hi! Feel free to ask questions; this is really just a Q&A session.

TAMattH: Good morning!

Bry: Okay I was waiting for anyone else

TAMattH: Yeah, don't worry about that. Attendance isn't mandatory and I'm not going to lecture -- just answer questions.

Bry: I just would like more of an explanation of Existence and Uniqueness Thm

TAMattH: Can you be a bit more specific? Do you want an example? An explanation of the necessary hypotheses? etc.

Bry: I guess an example would be the best

TAMattH: Do you have Matlab installed?

TAMattH: Or Apple's proprietary grapher?

Bry: No but for next recitation I can have Matlab

TAMattH: Okay. It would be best, just in case I give an example that requires visuals.

TAMattH: https://bluffton.edu/homepages/facstaff/nesterd/java/slopefields.html << this will do for now

Bry: Could you review 5-8 in section 1.5 if you have the textbook next to you ?4

TAMattH: OK, do you want the example first?

Bry: yes

TAMattH: Ok

TAMattH: Consider the DE

$$\frac{dy}{dt} = \sqrt{|y|}$$

TAMattH: with initial condition $y(0) = 0$

TAMattH: If we call $f(t, y) = \sqrt{|y|}$ (cf. page 64) ...

TAMattH: Then f is a continuous function of t and y in a rectangle (in fact, ANY rectangle) containing (0,0) ...

TAMattH: And so the Existence Thm applies and we have $\epsilon > 0$ such that there is a function y from $(-\epsilon, \epsilon) \to \mathbb{R}$ ...

TAMattH: that satisfies the differential equation. We did *NOT* say that this solution was unique; there may be more than one ...

TAMattH: And in fact there are multiple solutions with these initial conditions ...

TAMattH: QUIZ: How can you tell?

Bry: By looking at the slope field

Bry	?
TAMattH	Yes, and by noticing that y = 0 is an equilibrium solution.
TAMattH	If you graph this DE in Matlab or Grapher ...
TAMattH	you can probably notice that this eqn has two solutions with ics (0,0) ...
TAMattH	One is the equilibrium solution ...
TAMattH	And the other is $y = x * \lvert x \rvert$.
TAMattH	(should technically be ts but you get the idea).
TAMattH	QUIZ: Why is the solution not unique? I.e., what part of the Uniqueness Thm fails, and why?
Bry	Because the DE interests the t axis two times and the partial derv is not continuous
Bry	Nvm
Bry	it doesnt intersect twice
Bry	so its because the partial derv is not continuous
TAMattH	That's correct; the PD has a denominator which vanishes at y = 0 and thus isn't continuous there. ...

TAMattH	Okay, now for those questions.
Bry	I understand
TAMattH	But first: any questions over what we've gone over?
Bry	no none so far
TAMattH	I agree that the wording of this question is confusing ...
TAMattH	All of the solutions will exist & be unique because $f(t, y)$ is a polynomial, thus continuous w/ continuous PD ...
TAMattH	The book wants you to think end behaviour -- what does each solution look like as $x \to \infty$ or $x \to -\infty$?
TAMattH	... How could you make conclusions about the functions at $\pm\infty$ based on the theorems?
Bry	I do not know
Bry	Does it have to do with the equilibrium solutions
TAMattH	Yes
TAMattH	Also think about the sign of the derivative.
TAMattH	Let's do #5 together ...

Bry okay

TAMattH Okay, so first of all our equilibrium solutions are

$$y = 0, 1, 3$$

TAMattH Also, dy/dt is trivially continuous everywhere w/ trivially continuous PD in y.

TAMattH (b/c it's a polynomial)

TAMattH Thus, for any set of initial conditions, the sol'n will both exist and be unique by the Existence and Uniqueness theorems.

TAMattH In particular -- and this is the key to the problem -- solutions cannot cross the asymptotes

$$y = 0, 1, 3$$

If they could then we would not have uniqueness ...

TAMattH at the crossing points. Okay, so for #5, since $y = 4$ at $t = 0$ our derivative is going to be positive ...

TAMattH In fact, it'll be positive at all points of our function since, as we just said, the function cannot cross the $y = 4$ horiz. asymptote.

Bry Isn't the asymptote at y=3

TAMattH Yes; sorry, that was a typo.

TAMattH We have, at $(0, 4)$, that $dy/dt = 4 * 3 * 1 = 12$ ...

Bry Np...If the the initial condition is y(0)=-2 or and negative the function will only be negative for all points because the asymptote at 0

TAMattH And so the function is increasing there. Since the derivative is not only positive but also increasing at points with positive values of t, we have that this function will increase without bound

TAMattH (To answer your question) Yes

TAMattH IF the hypotheses apply as they do in this case.

Bry OK, I see time is up.I must get ready for lecture... Thank you very much

TAMattH Ok. Is it OK if I post this conversation to Sakai, incl. your name?

Bry Yeah it is okay

TAMattH Great. See you soon!

* Bry left