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Mech 2 Math week 4 tutorial

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This week, it's about solving nonlinear 1st order DE's. See lectures 7 & 8 online.

A) Pick some separable equations with initial conditions to solve:

a) two or three straight forward ones where you can go all the way to solve $y(x)$.

b) one where $y(x)$ is only determined implicitly. Remind them of Newton's method to get approximate solutions y for given x .

c) one where you can solve for $y = G(x)$

but $G(x)$ involves an integral you can't do explicitly. Approximate y for a given x using numerical integration.

B) Pick 2-3 autonomous 1st order equations. Find critical points & classify as stable or unstable.

C) Consider Example 5 of Lecture 7

$y' = \frac{y \cos x}{1+2y^2}$ \rightarrow see how far they can get.

a) separable $\ln|y| + y^2 = \sin x + C.$

b) show that for any C, solutions come in symmetric pairs $\pm y.$

c) Consider $y > 0$ solutions, find an implicit expression for the amplitude of oscillations as a function of C.

d) Determine numerically the maximum oscillation amplitude.