Mech 2 Math week 5 tutorial

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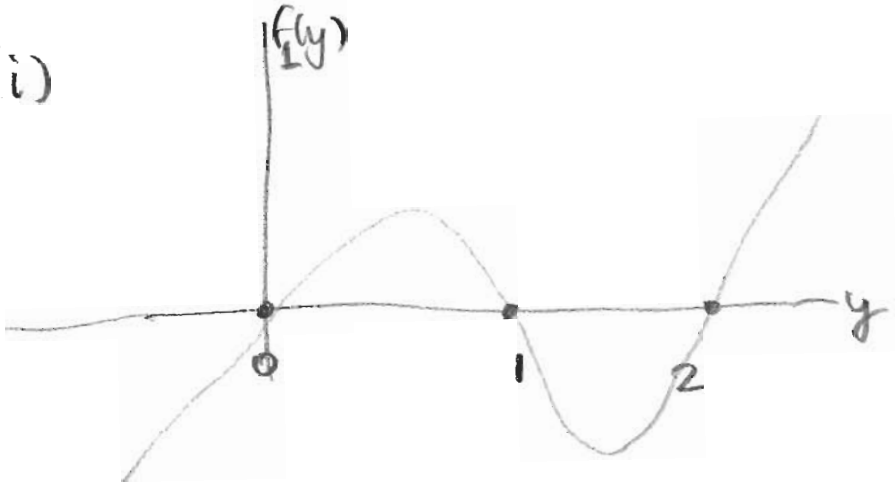
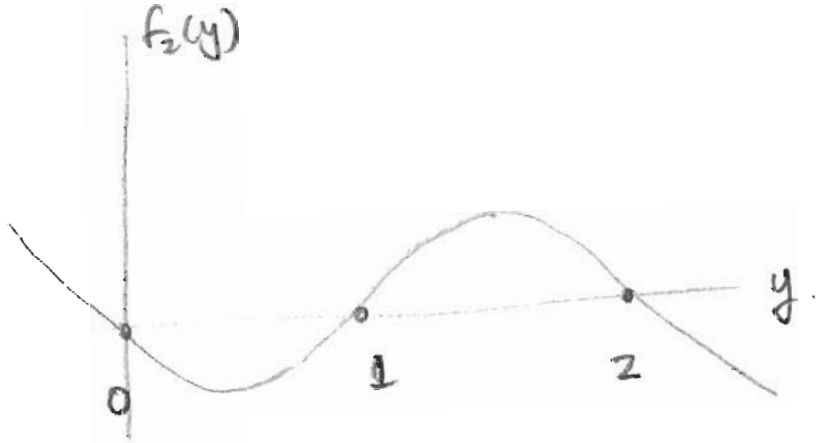
This week, it's more autonomous Equations & stability of their equilibria. Then, on to numerical solution of ODE's - FE, 2-types of 2RK, then 4RK. See lectures 9-10 online.

A) Consider autonomous ODE's $y' = F(y)$, $y(0)$ given. For three possible F's:

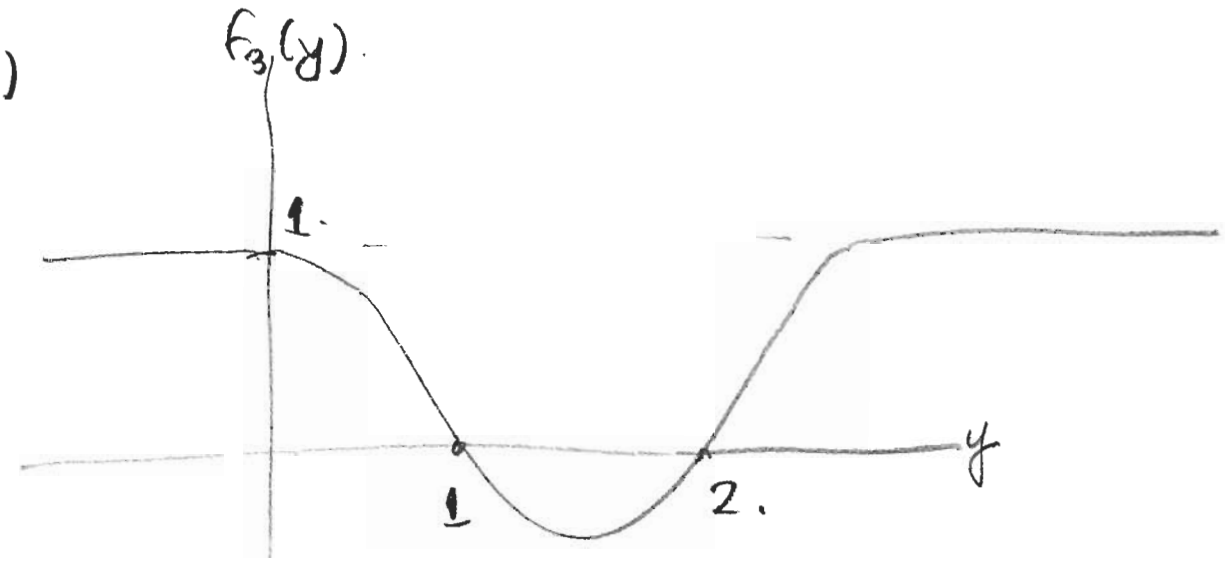
(i)



(ii)



(iii)



+ Show that in all three cases, if $y(0) > 0$, $y(t) > 0$ for all $t > 0$.

+ Find all equilibrium solutions (critical points) and remind them what this means.

+ Determine the stability of the critical points in all cases.

+ Get them to sketch some solution curves, $y(t)$. You could get them in groups f_1, f_2, f_3 and get them to sketch $y(t)$ starting from a) $y(0) = \frac{1}{2}$

b) $y(0) = \frac{3}{2}$

c) $y(0) = 5/2$.

+ Help them understand how $y(t)$ can be sketched from $f(y)$.

B) Go over the mechanics of numerical ODE solvers: FE, IE, ME, 4RK. Give some example $y' = f(y,t)$, get them to do a time step or two of the various methods.

Do an example where you change a second order problem into a first order system and use FE to solve this for a few steps.