Mathematica

We will use Mathematica in this course for solving some of the homework and reading assignments. As you already know from PHYS 221, Mathematica is a great tool for quick analysis. We will use it mainly to plot graphs and to solve differential equations which are only numerically accessible.

get started: logon ⟶ Windows Icon ⟶ Search for "mathematica" ⟶ Mathematica 9 ⟶ Notebook

help: • help button on right side of menue bar on top ⟶ HelpBrowser ⟶ type in keyword or if you know command then type that in
• ?Command or ??Command

set up command: Shift + Enter

functions: Function[·] (all functions start with capital letter)

lists: {·, ·, ·, etc. } e.g. l={3, 5, 6}

element of list: l[[2]] (gives 5)

arithmetic: + - * / ^ e.g. $3^2 + 6 * 2$ (the * can be replaced with space)

comments: (*...*)

save session: File ⟶ SaveAs ⟶

load session: File ⟶ Open ⟶

reevaluate notebook: Evaluation ⟶ Evaluate Notebook

clear all variables: Evaluation ⟶ Quit Kernel ⟶ Local

print session: File ⟶ Print ⟶

Mathematica Class Aug. 29, 2014

1. Type in the commands on the backside of this page and write next to them which task they do.

2a. Confirm that Eq.(2.21) is a solution to Eq.(2.19) by solving the DE $\frac{\mathrm{d}}{\mathrm{dt}} v(t) = -kv(t)$ with the initial condition $v(0) = v_0$.

2b. Set $v_0 = 2.2$ and $k = 5.6$ and plot the resulting $v(t)$ for $0 \leq t \leq 1.2$.

3a. Numerically solve $y'(x) = 3.4 \cos(y(x))$ for $y(x)$ with initial condition $y(0) = 0.5$.

3b. Plot the solution for $0 \leq x \leq 4.0$.

4a. Given the DE $y'' = -ky(x)$ what is $y(x)$?

4b. Solve the DE of (4a) with $k = 5.6$ and $y(0) = 3.2$ and $y'(0) = 0$ and plot the solution for $0 \leq x \leq 3\pi$.

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(* Mathematica Class Aug. 29, 2014 *)
(* problem 1.*)

N[Pi]

N[Pi, 12]

Solve[4 x^2 - 39 x + 54 == 0, x]

NSolve[x^5 - x^2 + 5 == 0, x]

Factor[x^3 + 4 x^2 - 39 x + 54]

a = {3, 5, 6}

b = {1, 9, -2}

c = {a, b}

MatrixForm[c]

Transpose[{a, b}]

f[t_] := 0.05 Exp[t]
graph1 = Plot[f[t], {t, 0, 6.0}];
graph2 = ListPlot[Transpose[{a, b}], PlotStyle → PointSize[.017]] ;
Show[graph1, graph2]

Clear[f, t, a]

D[7 t^3 - 5 t + Log[t], t]

Integrate[t^4, t]

DSolve[{y'[x] == 2.6 y[x], y[0] == 3.0}, y[x], x] (* Solve DE *)

solution = DSolve[{y'[x] == 2.6 y[x], y[0] == 3.0}, y[x], x]

f[x_] = y[x] /. solution[[1, 1]]

Plot[f[x], {x, 0.0, 4.0}]

solution = NDSolve[{y'[x] == 5.0 Sin[y[x]], y[0] == 3.0}, y[x], {x, 0, 4.0}];
f[x_] = y[x] /. solution[[1]]; Plot[f[x], {x, 0, 4.0}]
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