Physics 9 Spring 1996

Homework Assignment 4.

I. Look up the MatrixForm[] and Eigenvalues[] command.

a) Find the eigenvalues of the three Pauli matrices

$$\sigma_x = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \sigma_y = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \sigma_z = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$

b) Compute the matrix products $\sigma_x \sigma_y / i$, $\sigma_y \sigma_z / i$, $\sigma_z \sigma_x / i$.

II. Look up the Table[], Evaluate[], Show[] and NDSolve[] commands.

a) Plot $\sin(nx)/(1+x)$ for $n = 1 \ldots 5$ in $(0, 2\pi)$.

b) Solve and plot $y''(t) + \eta y'(t) + y(t) = 0$ with $y(0) = 1$, $y'(0) = 0$, $\eta = 0.2$.

Determine y(t=20).

III. Look up the ContourPlot[] and Plot3D[] commands. Then plot

$$f(x, y) = \frac{1}{\sqrt{(x-1)^2 + y^2}} - \frac{1}{\sqrt{(x+1)^2 + y^2}}$$

both as a contour plot and as a surface plot.