

IBM-PC BASIC Program for Harmonic Oscillator

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10 CLS                Clear Screen
20 SCREEN 2           Select Graphics mode
30 INPUT "Stepsize"; H
40 INPUT "Number of steps"; N
50 INPUT "Guess for E"; E
60 LINE (0,100)-(600,100) Draw X-axis
70 XSCALE=30          Scale factors for plotting
80 YSCALE=10
90 X=0                Initial values
100 Y1=1
110 Y2=0
120 FOR I=1 TO N
130 X=X+H
140 Y1=Y1+H*Y2
150 Y2=Y2+H*(X*X-E)*Y1
160 PSET (FIX(X*XSCALE+.5), 100-FIX(Y1*YSCALE+.5)) Plot (x, y1)
170 NEXT I
```

Phys 315

Homework #4

Due Feb. 28, 1985

Determine the eigenvalues of the simple harmonic oscillator by the numerical method discussed in class. Find E_n to 3 significant figures for

- (a) $n=0, 2, 10$ using $h=.1$ (1.057889137,
- (b) $n=0$ using $h=.05, .02$
- (c) $n=1$ using $h=.1, .3$

- Optional Many extensions of this problem are possible. Here are some suggestions, any of which can be done independently of the others.
- (1) Implement a higher-order numerical method and compare the accuracy of E_n .
 - (2) Figure out an automatic scheme for the computer to improve your guess for E .
 - (3) Figure out how you might integrate out from $x=0$ and in from $x=\infty$ and try to match your solutions at some intermediate value of x . Use the discrepancy to suggest how to change E .
 - (4) Make nice plots of the eigenfunctions.
 - (5) Try some other potentials, e.g. particle in a box.

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