In the name of God

# Department of Physics
# Shahid Beheshti University

## COMPUTATIONAL PHYSICS

### Exercise Set 7

### (Date Due: 1397/02/16)

**1.** Compute Temperature profile for position and time for a rod.

**2.** Solve Laplace's equation ($\nabla^2\Phi(x,y)=0$) numerically for a 2D area with $300\times 300$ pixels. Suppose that $\Phi(0,y)=y^2$, $\Phi(x,0)=x$, $\Phi(L,y)=0$ and $\Phi(x,L)=1$ (relaxation method or finite difference method)

**3.** Solve the following integration numerically:

$$\langle v_z^2\rangle = \int_{-\infty}^{+\infty} dv_x \int_{-\infty}^{+\infty} dv_y \int_{-\infty}^{+\infty} dv_z v_z^2 p_v(\vec{v})$$

here $p_v(\vec{v}) = \left(\frac{\beta m}{2\pi}\right)^{3/2} \exp\left(-\frac{\beta m \vec{v}^2}{2}\right)$. You can imagine any values for free parameters.

**4.** Using Euler and RF4 methods, solve following initial value problem:

$$y''(t) + ay'(t) + \omega^2 y(t) = \cos(\omega_1 t)$$

with $y(0)=A$, $y'(0)=0$ and take any arbitrary values for other free parameters.

**5.** Linear Boundary value problem: Suppose numerically $y''(t)+2y'(t)+y(t)=0$ with $y(0)=1$ and $y(1)=3$ and compare it with exact solution.
(For more details see (secondDE.pdf).

http://www.stewartcalculus.com/data/CALCULUS Concepts and Contexts 4th edition/upfiles/3c3-2ndOrderLinearEqnsStu.pdf (I have uploaded it in my webpage entitled secondDE.pdf)

Good luck, Movahed