1. With $\Delta x = 0.01$ solve numerically the boundary value problem

$$y'' + 2y = x, \quad 0 < x < 2,$$

$$y(0) = 0, \quad y(2) = 0,$$

by using the finite difference method. Compare graphically your result with the exact analytical solution.

2. With $\Delta x = \Delta y = 0.01$, estimate the value of the following integral by using the trapezoidal rule,

$$\int_{0}^{1} \int_{0}^{1} x e^y \, dx \, dy,$$

and compare the result obtained with the exact solution.

3. Solve problem 2 again by using the Monte-Carlo method with 10,000 random points.

4. Approximate the integral

$$I(x) = \int_{0}^{1.5} e^{-x^2} \, dx,$$

by using the eight point Gaussian Quadratures.

Maple gives the following results:

- $z := \text{int}(\exp(-x^2), x=0..3/2);$  
  $$z := \frac{1}{2} \text{erf}\left(\frac{3}{2}\right) \sqrt{\pi}$$

- evalf(z);
  $$0.8561883935$$