Fundamentals of mathematical modeling:
Tasks for E. A. Mikheeva

Task 1

Using explicit finite difference method and iterative methods, solve the problem:

$$\frac{\partial u}{\partial t} - \frac{e^u}{1+e^{2u}}\frac{\partial u}{\partial x} = 0, -1 \leq x < 0,$$

$$u(x,0) = -sin\pi x,$$

$$u(0,t) = e^{-t} - 1.$$

Task 2

Using alternating-direction implicit method, solve the boundary value problem:

$$\frac{\partial u}{\partial t} = \Delta u + yx \cdot e^{-t}, 0 < x < \pi, 0 < y < 3, t > 0$$

$$u\Big|_{x=0} = u\Big|_{x=\pi} = 0,$$

$$\frac{\partial u}{\partial y}\Big|_{y=0} = \frac{\partial u}{\partial y}\Big|_{y=3} = 0,$$

$$u\Big|_{t=0} = 0$$