HW2.

The governing equation is as follows:

$$\frac{\partial \phi}{\partial t} - \alpha \frac{\partial^2 \phi}{\partial x^2} = 0,\ 0.1 \le x \le 1.5.$$

Boundary conditions & initial condition are:

$$\frac{\partial \phi}{\partial x} = c = 2 - \pi \sin\left(\frac{\pi}{30}\right) e^{-\alpha\left(\frac{\pi}{3}\right)^2 t} \ @x = 0.1$$

$$\phi = 3 @ x = 1.5$$

$$\phi = 2x + 3\cos\left(\frac{\pi}{3}x\right) e^{-\alpha\left(\frac{\pi}{3}\right)^2 0.9} \ @t = 0.9$$

Exact solution of this problem is as follows:

$$\phi_{exact} = 2x + 3\cos\left(\frac{\pi}{3}x\right) e^{-\alpha\left(\frac{\pi}{3}\right)^2 t}.$$

$$s = \frac{\alpha \Delta t}{\Delta x^2} = 0.2, \alpha = 0.25$$

Compute corresponding root-mean-square (rms) errors

t=10.7	$\Delta x = 0.35$	$\Delta x = 0.175$	$\Delta x = 0.0875$	Convergence rate r
②'+③'				
②'+⑤'				

Compute error distribution with Δx=0.35 at t=10.7

t=10.7	$x = 0.1$	0.45	0.8	1.15	1.5
②'+③'					
②'+⑤'					