① Use D'Alembert's formula to find $u(\frac{1}{2}, 2)$ and $u(1, 3.4)$ if

$$\begin{cases} u_{tt} - 4u_{xx} = 0 & 0 < x < 2, \ t > 0 \\ u(x,0) = x, \quad u_t(x,0) = x & 0 < x < 2 \\ u(0,t) = u(2,t) = 0 & t > 0 \end{cases}$$

Notice: Solution is not smooth here and it is in fact discontinuous along some characteristic lines.

② Use the parallelogram rule to find $u(\frac{\pi}{2}, \pi)$, and $u(\frac{\pi}{4}, \frac{\pi}{2})$ if

$$\begin{cases} u_{tt} - u_{xx} = 0 & 0 < x < \pi, \ t > 0 \\ u(x,0) = \sin x, \quad u_t(x,0) = 0 & 0 < x < \pi \\ u(0,t) = t^3, \quad u(\pi,t) = t^4 & t > 0 \end{cases}$$

Answers: ① $\frac{1}{2}, -1.4$

② $u(\frac{\pi}{2}, \pi) = \frac{\pi^3}{8} + \frac{\pi^4}{16} - 1$, $u(\frac{\pi}{4}, \frac{\pi}{2}) = \frac{\pi^3}{64}$