

**Please show all the steps leading to the final answer**

**Question 3**

A finite string of length  $L$  that is fixed at both ends and is released from rest with an initial displacement will have the following mathematical description by the wave equation:

$$U_{tt} = a^2 U_{xx}$$

Given  $a = 30 \text{ m/s}$  and the initial velocity of  $300\sin(4\pi x)$  from its equilibrium position and  $L = 4\text{m}$ , find the solution for the displacement. What is the maximum displacement? Clearly indicate each step of your working. If the length is reduced to  $2\text{m}$ , what will the effect on the maximum displacement?

**Please show all the steps leading to the final answer**