# Lecture 3

Suppose the oscillator at $x=0$ is fixed at $\theta=0$ for all times:

$$\theta(0,t) = 0 \qquad \underline{\text{all } t}$$

$$f(0-vt) + g(0+vt) = 0 \qquad (*)$$

$vt = y$ (a position)

$$(*) \Rightarrow \quad g(y) = -f(-y) \quad \underline{\text{all } y}$$

$$\Rightarrow \theta(x,t) = f(x-vt) + \underbrace{g(x+vt)}_{-f(-x-vt)}$$

general solution with zero <u>boundary condition</u> at $x=0$:

$$\theta(x,t) = f(x-vt) - f(-x-vt)$$

Next, suppose the oscillator at x=L is <u>also</u> fixed at $\theta = 0$: (3.2)

$$\theta(L,t) = 0 = f(L - vt) - f(-L - vt)$$

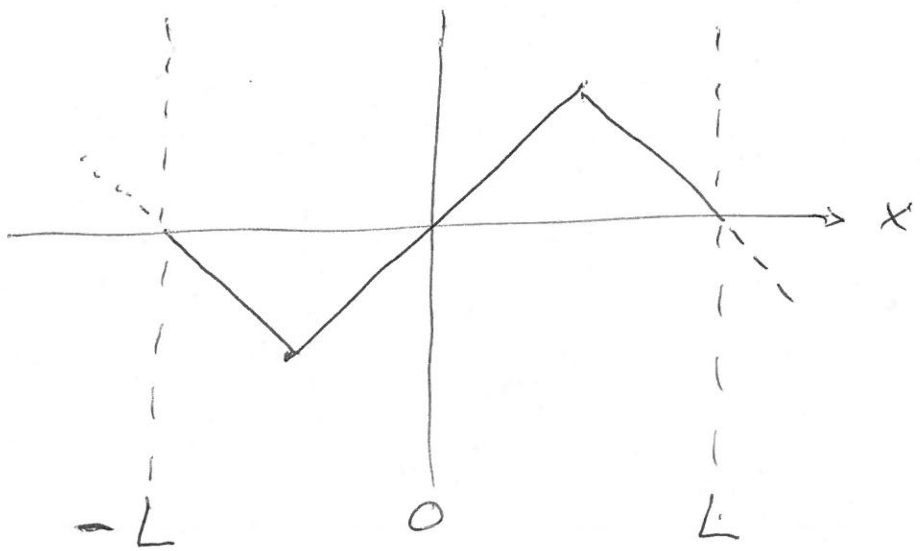
<u>for all t</u>

introduce $y = L - vt$:

$$f(y) = f(y - 2L) \quad \underline{\text{all } y}$$

f is <u>periodic</u> with period 2L

Example: $f = Z$ "periodic zig-zag"

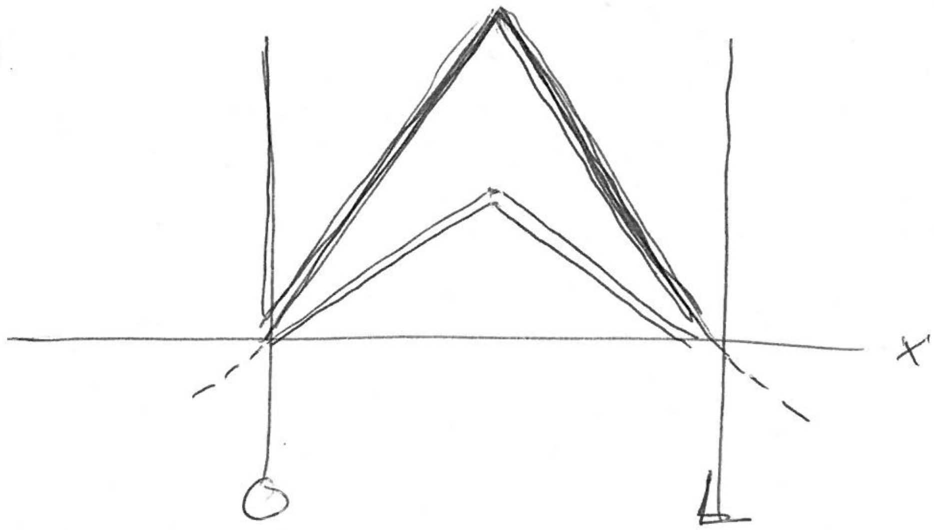


3.3

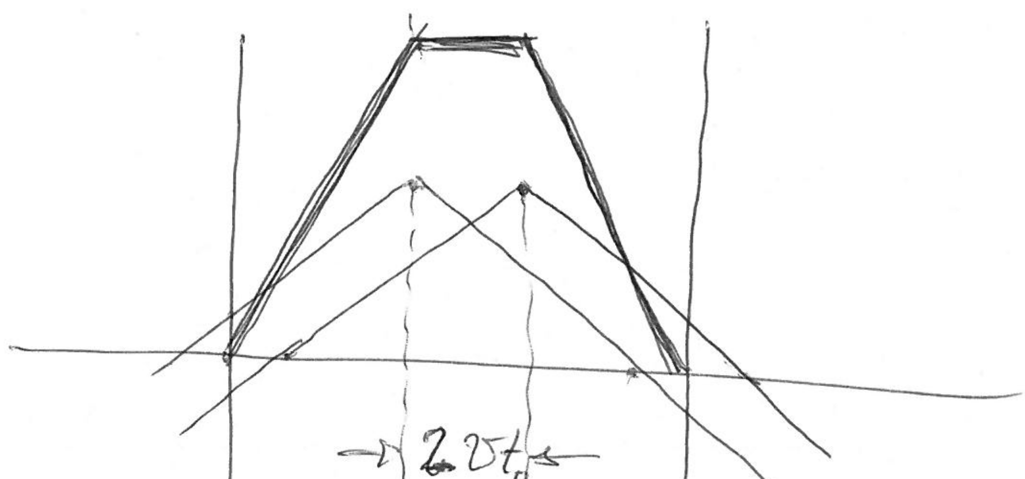
Since $Z(-x) = -Z(x)$, $g(x) = f(x)$

$$\theta(x,t) = Z(x - vt) + Z(x + vt)$$

$\theta(x, 0)$




$\theta(x, t_0)$




$\theta(x, t_1)$

$vt_1 = \frac{L}{2}$