There is an incoming wave

$$y_i(x,t) = A\sin(kx-\omega t)$$

When it hits a wall, it can create reflections, which <u>could</u> be

$$y_2(x,t) = C\sin(kx+\omega t)$$
$$y_4(x,t) = E\cos(kx+\omega t)$$

or any mixture of these ↑. What are the proper values of coeffs C and E? Use the boundary at $x=0$, where the rope is tied to the wall $\Rightarrow$ $y(x=0)=0$

Sum is $y_i(x,t) + y_2(x,t) + y_4(x,t) = 0$

$$A\sin(kx-\omega t) + C\sin(kx+\omega t) + E\cos(kx+\omega t) = 0$$

Plug in $x=0$

$$A\sin(-\omega t) + C\sin(+\omega t) + E\cos(+\omega t) = 0$$

Here, note a $\sin(\omega t)$ term cannot cancel a $\cos(\omega t)$ term at all values of time t, so we must have separately

sin terms: $A\sin(-\omega t) + C\sin(\omega t) = 0$

cos terms: $E\cos(\omega t) = 0$

$$\Rightarrow \boxed{E = 0}$$

$$-A\sin(\omega t) + C\sin(\omega t) = 0$$

$$\Rightarrow \boxed{A = C}$$