

Note this wave has a maximum in the middle.

(iii) in general, at what frequencies are there resonances?

The resonances are at frequencies mf_1 , where m is a positive integer (starting at 1)

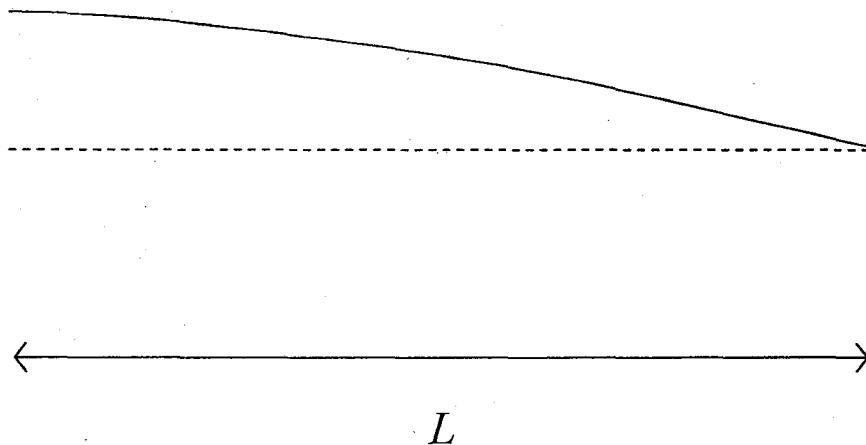
(b) For the case where the line is short-circuited at one end,

(i) what is the lowest frequency at which there is a resonance?

In this case, the voltage is zero at the short-circuited end, while still being maximum at the open end, so the standing wave for the lowest frequency is a quarter wave, and so the frequency of this lowest resonance is

$$f_{1short} = c / 4L$$

i.e., for the case where the short circuit is on the right end of the line



(ii) what is the next frequency at which there is a resonance?

The next possibility is for three quarter waves to fit on the line, so the corresponding frequency is $3f_{1short}$.