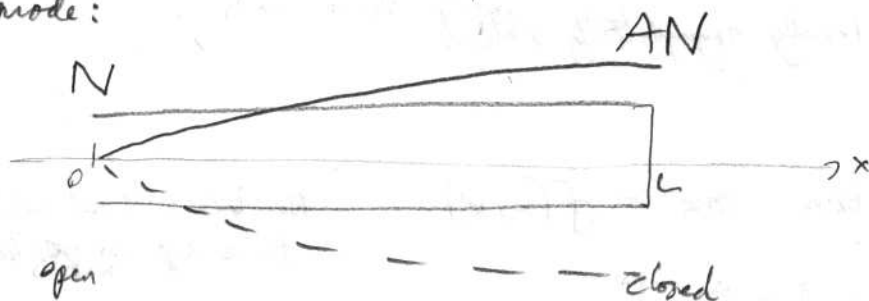


# MATH 5 WORKSHEET : Pipe mode frequencies

Barnett  
5/4/07

If one end open, other closed ('open-closed' pipe), get  
(pressure)  $\left\{ \begin{array}{l} \text{Node at open end} \\ \text{Anti Node at closed end.} \end{array} \right.$

1<sup>st</sup> mode:

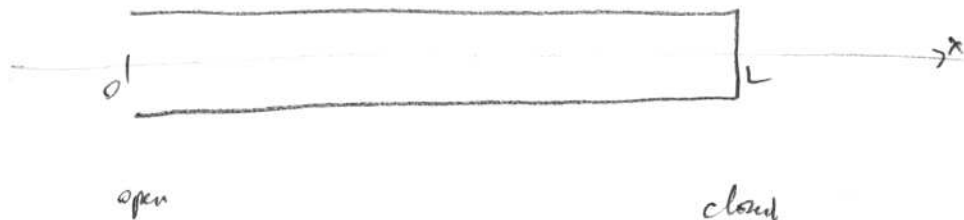


I've drawn mode shape.  
What fraction of a  
wavelength  $\lambda$  is  $L$ ?

So what is frequency  $f_1$ ?  
(in terms of  $L, c$ )

2<sup>nd</sup> mode:

draw the next mode that matches the boundary conditions,  
labelling N, AN locations.



What fraction of  $\lambda$  is  $L$ ?

So what is the freq.?

What is general rule for frequencies (mode  $n$ )?

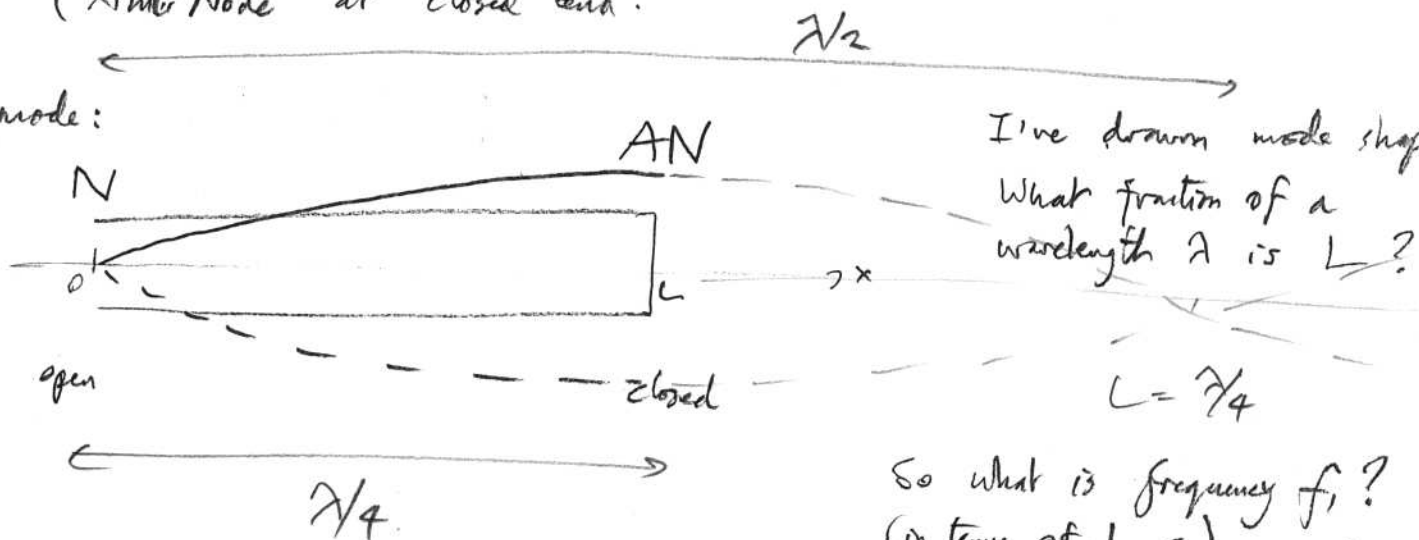
Which harmonics of fundamental are present?

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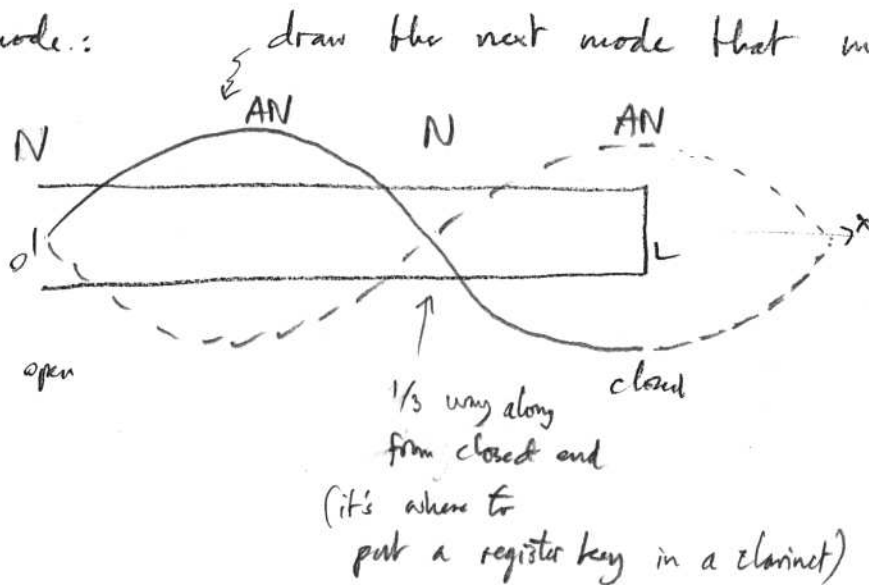
(pressure)  $\left\{ \begin{array}{l} \text{Node at open end} \\ \text{Anti Node at closed end.} \end{array} \right.$

1<sup>st</sup> mode:



So what is frequency  $f_1$ ?  
 (in terms of  $L, c$ )  $f_1 = \frac{c}{\lambda} = \frac{c}{4L}$

2<sup>nd</sup> mode:



What fraction of  $\lambda$  is  $L$ ?

$3/4$ , i.e.  $\lambda = \frac{4}{3}L$

So what is the freq.?  $f_2 = \frac{c}{4/3 L} = 3 \frac{c}{4L}$

What is general rule for frequencies (mode  $n$ )?

$$f_n = (2n-1) \frac{c}{4L}$$

Which harmonics of fundamental are present? 1, 3, 5, ... just odd.