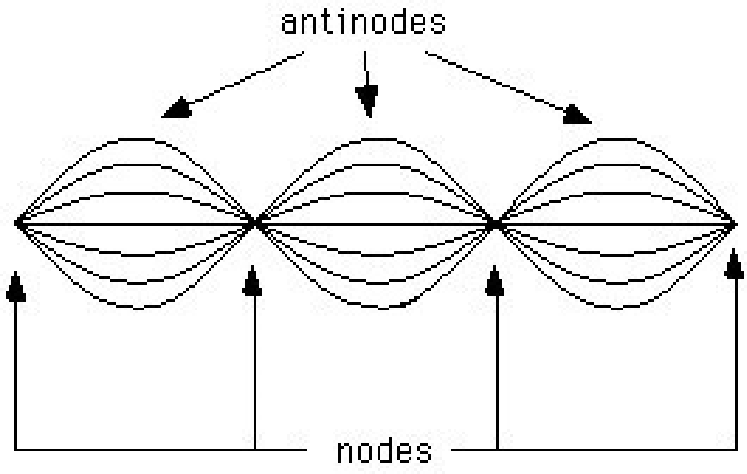
Standing Waves: Interference in One Dimension

⇨ A standing wave interference pattern occurs if interfering waves have the same amplitude, wavelength, frequency, and are traveling in opposite directions.

- Called a standing wave for short.

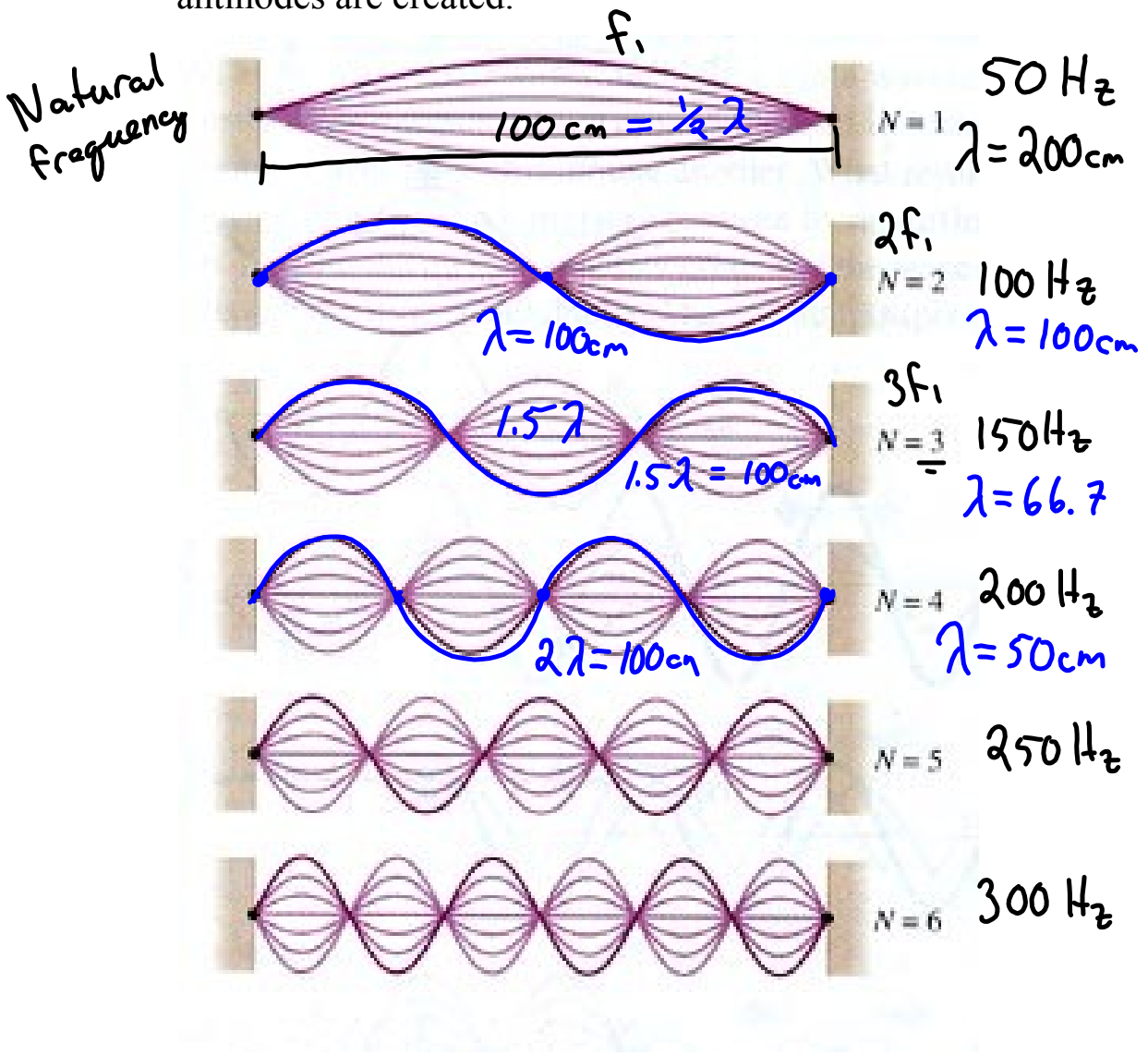


⇨ The node, or nodal point, is where crests and troughs of equal amplitude interfere destructively. For one-dimensional waves the fixed ends are nodal points.

⇨ The antinodes, or loops, are areas of constructive interference.

⇨ The number of nodal points for a given medium depends on the physical structure of that medium, thus only certain frequencies will produce a standing wave pattern. Such frequencies are resonance frequencies for that medium.

- If one antinode were created with a certain frequency, say f_1, then to create two or three antinodes (etc.) the frequency would have to be $2f_1$, or $3f_1$ respectively. Note the decrease in amplitude as more antinodes are created.



- The distance between two successive nodes in a vibrating string is ½λ
- The point of maximum displacement from a node is ¼λ

Examples

Pg 30 - 32 prob. Set

1. What is the wave speed of a standing with containing 2.5 waves in 50 cm and waves are created 62 times each second?

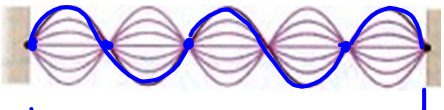
$f = 62\ Hz$ $v = f\lambda$

$\lambda = ?$

$v = ?$

$v = (62)(20)$

$= 1240\ cm/s$



$2.5\lambda = 50cm$

$\lambda = \frac{50}{2.5} = 20cm$

2. A standing wave pattern contains 8 nodes (with a node at the beginning and end) The distance between the second and 6th node 70 cm. The wave speed is 102 cm/s. What is the frequency of the traveling waves?

Review by reading MHR page 356 - 358.