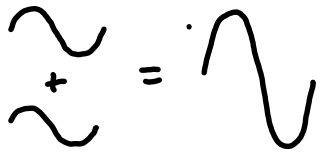
Unit 8: Waves

6 – Interference

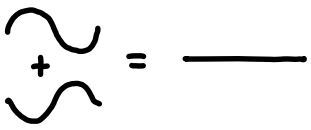
When two waves travel in the same medium they affect the medium independently. To determine their **overall** effect we use the principle of superposition.

Principle of Superposition:
The total amplitude of the waves is equal to…
The sum of the amplitudes of the individual waves.

Two waves with the same frequency and phase.
Constructive Interference:
Amplitudes add up

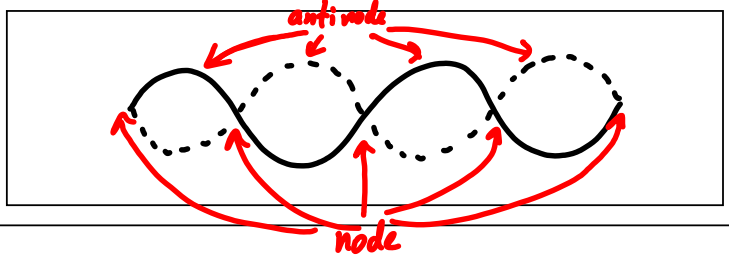


Two waves with the same frequency and opposite phase.
Destructive Interference:
Amplitudes cancel

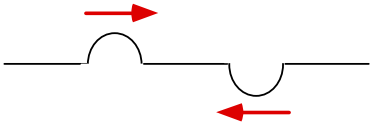


Standing Waves

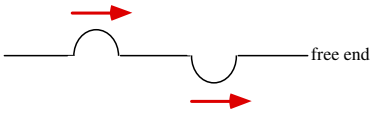
- Standing waves are caused by Constructive and destructive interference.
- Areas of complete destructive interference have no amplitude and are called nodes
- Areas of complete constructive interference have large amplitudes and are called anti-nodes



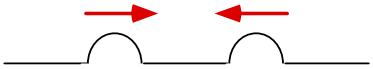
- When a wave hits a fixed boundary it will reflect and invert its amplitude.
- If a series of waves are sent along a string the reflected pulse will…
  interfere with itself.
- If the waves are sent at just the right frequency we will create a standing wave.



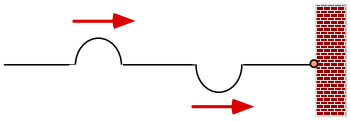
Type: destructive
Pattern:



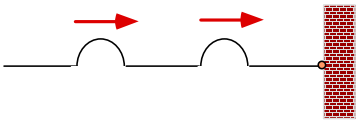
Type: destructive
Pattern:



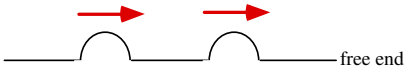
Type: constructive
Pattern:



Type: Constructive
Pattern:



Type: destructive
Pattern:

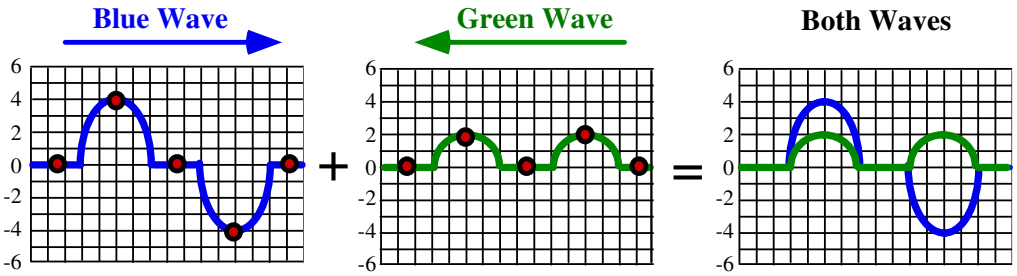


Type: constructive
Pattern:

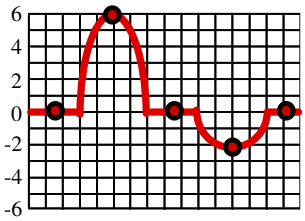
Sample Problems: Interference of Waves

Draw the interference pattern for the combinations of waves shown below. Show your calculations for the amplitude at each marked (●) location .

1.



Interference Pattern



1st dot: Amplitude = 0 + 0 = 0

2nd dot: Amplitude = 4 + ____ = 6

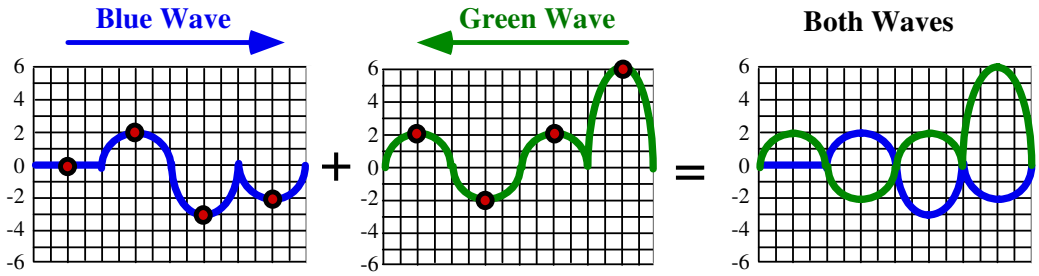
3rd dot: Amplitude = ____ + ____ = 0

4th dot: Amplitude = -4 + ____ = _____

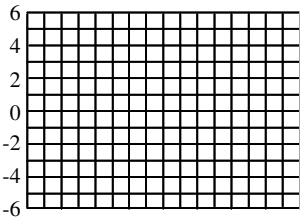
5th dot: Amplitude = ____ + ____ = _____

Check that the amplitudes drawn in the interference pattern match the values that you calculated for each 'dot'.

2.



Interference Pattern



1st dot: Amplitude = 0 + 2 = ____

2nd dot: Amplitude = ____ + -2 = _____

3rd dot: Amplitude = ____ + ____ = _____

4th dot: Amplitude = ____ + ____ = _____

Draw the interference pattern...