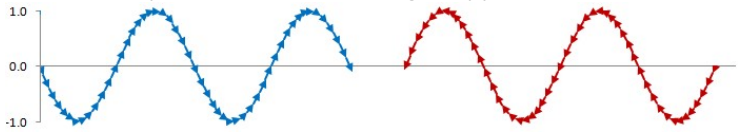
Superposition and interference

Path Difference **Path Difference is measured in wavelengths, λ**

If two waves from the same source arrive at a point having taken a different path (Eg one of them reflected), they may have travelled different distances from the source. This difference in journey is called the path difference.

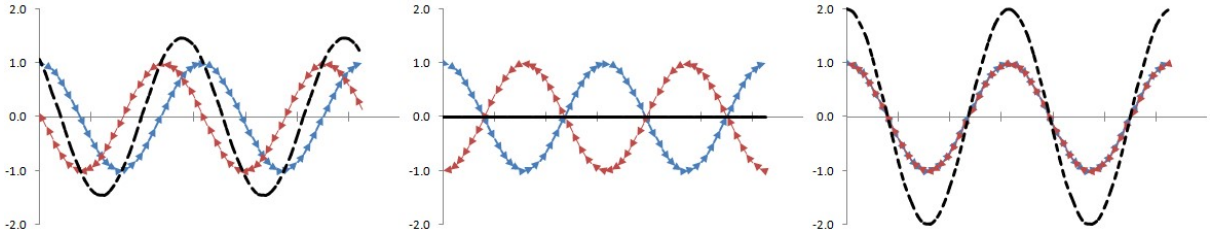
Superposition

Here are two waves that have amplitudes of 1.0 travelling in opposite directions:



Superposition is the process by which two waves combine into a single wave form when they overlap.

If we add these waves together the resultant depends on where the peaks of the waves are compared to each other. Here are three examples of what the resultant could be: a wave with an amplitude of 1.5, no resultant wave at all and a wave with an amplitude of 2.0



When waves interfere, amplitudes combine to produce a resultant amplitude

2 waves in anti-phase→ destructive interference

2 waves in phase→ constructive interference

Superposition and path difference

If two waves from the same source arrive at a point having taken a different path, the path difference will determine how these waves combine at that point. If the path difference is equal to a whole number of wavelengths (PD=λ, 2λ, 3λ, 4λ….), the two waves will be in phase at this point and constructive interference will be observed (addition of amplitudes). If the path difference is a multiple of half a wavelength (PD=0.5λ, 1.5λ, 2.5λ,3.5λ….), the two waves will be in anti-phase at that point ('out of phase') and destructive interference will be observed (reduction of amplitude/cancellation).