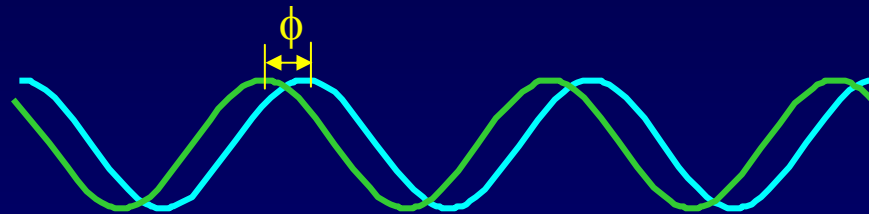


Adding Sine Waves with Different Phases

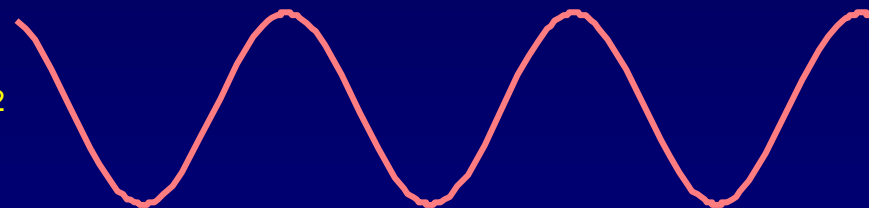
Suppose we have two sinusoidal waves with the same A_1 , ω , and k : $y_1 = A_1 \cos(kx - \omega t)$ and $y_2 = A_1 \cos(kx - \omega t + \phi)$
 One starts at phase ϕ after the other:

Spatial dependence of 2 waves at $t = 0$:



Resultant wave:

$$y = y_1 + y_2$$



Use this trig identity:

$$A_1 (\cos \alpha + \cos \beta) = 2A_1 \cos\left(\frac{\beta - \alpha}{2}\right) \cos\left(\frac{\beta + \alpha}{2}\right)$$

$$y_1 + y_2$$

$$(\phi/2)$$

$$(kx - \omega t + \phi/2)$$

$$y = 2A_1 \cos(\phi/2) \cos(kx - \omega t + \phi/2)$$

Amplitude

Oscillation