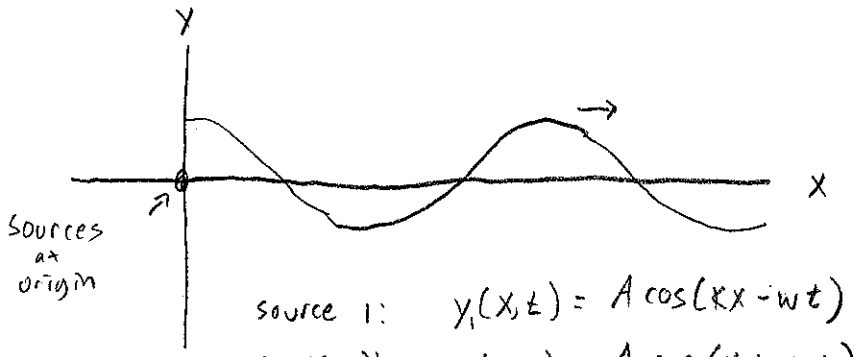
267 Problem # 1 Solution

a.)



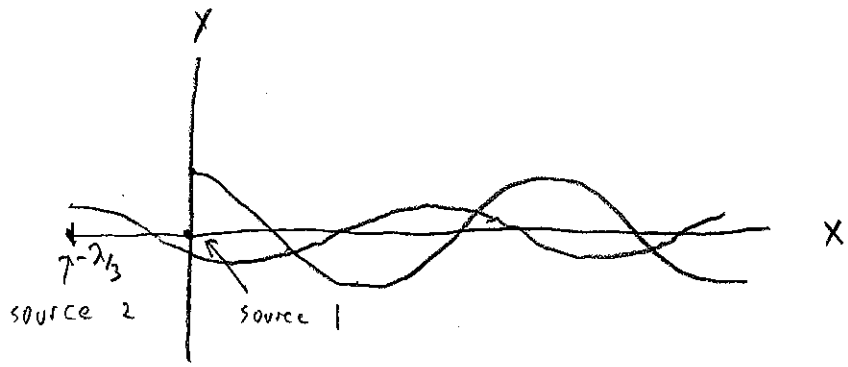
source 1: $y_1(x,t) = A\cos(Kx - wt)$

source 2: $y_2(x,t) = A\cos(Kx - wt)$

waves add linearly

$$y_1(x,t) + y_2(x,t) = 2A\cos(Kx - wt)$$

b.)



$$y_1(x,t) = A\cos(Kx - wt)$$

$$y_2(x,t) = \frac{A}{2}\cos\left(K(x + \lambda/3) - wt\right)$$

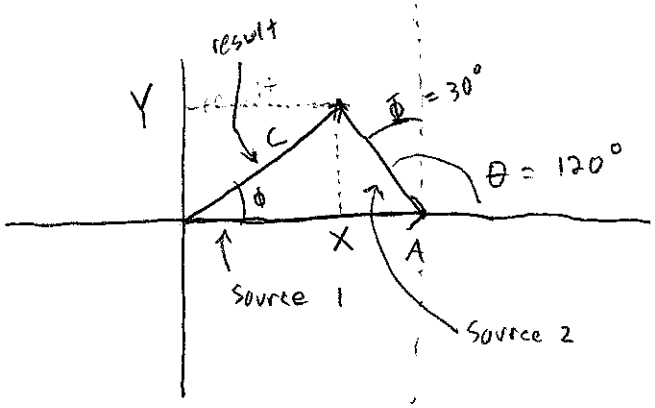
$$= \frac{A}{2}\cos\left(Kx - wt + 2\pi/3\right)$$

$K = \frac{2\pi}{\lambda}$

$\lambda = \frac{2\pi}{K}$

use phasors to add waves

$2\pi/3$ radians = 120°



$$X = A - \frac{A}{2}\sin(30°)$$

$$Y = \frac{A}{2}\cos(30°)$$

b.) cont.

$\sin(30°) = \frac{1}{2}$

$\cos(30°) = \frac{\sqrt{3}}{2}$

$X = A - \frac{A}{2}\left(\frac{1}{2}\right) = \frac{3}{4}A$

$Y = \frac{\sqrt{3}}{4}A$

Amplitude of wave is

$$C = \left[X^2 + Y^2\right]^{1/2}$$

$$= A\left[\left(\frac{3}{4}\right)^2 + \left(\frac{\sqrt{3}}{4}\right)^2\right]^{1/2} = \frac{\sqrt{3}}{2}A$$

phase of wave is

$$\phi = \tan^{-1}\left[\frac{Y}{X}\right] = \tan^{-1}\left[\frac{\sqrt{3}/4}{3/4}\right] = \pi/6 \text{ rad}$$

$$= 30°$$

$$y_1(x,t) + y_2(x,t) = \frac{\sqrt{3}}{2}A\cos(kx - \omega t + \pi/6)$$