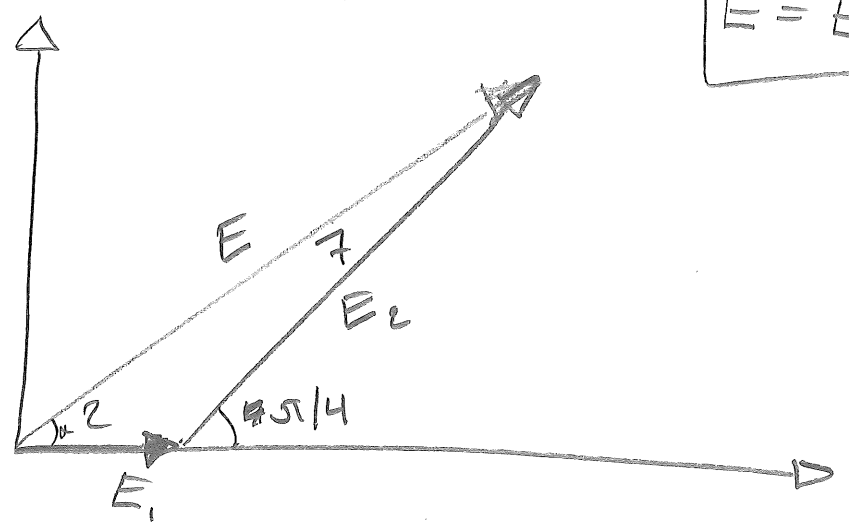
6.2

a) $E_1 = 2\cos(\omega t)$, $E_2 = 7\cos\left(\frac{\pi}{4} - \omega t\right)$

$E_1 = 2\cos(-\omega t)$

$E = E_0 \cos(\alpha - \omega t)$



$E_0 = \sqrt{2^2 + 7^2 + 2 \cdot 2 \cdot 7 \cdot \cos\left(0 - \frac{\pi}{4}\right)} =$

$= \sqrt{4 + 49 + 28\cos\pi/4}$

$= \boxed{8,53}$

$\alpha = \arctan \frac{7\sin\pi/4}{2 + 7\cos\pi/4} = 0,62 \approx 0,2\pi$

$\boxed{E = 8,53\cos(0,2\pi - \omega t)}$

6.4

$$Y_1 = 5\sin(\omega t + \pi/2)$$

$$Y_2 = 7\sin(\omega t + \pi/3)$$

Vi måste skriva om Y_1 och Y_2 på formen:

$$Y = A\cos(\alpha - \omega t)$$

$$\Rightarrow Y_1 = 5\cos(\omega t) = 5\cos(0 - \omega t)$$

$$Y_2 = 7\sin(\omega t + \pi/3 + \pi/2 - \pi/2) =$$

$$= 7\cos(\omega t - \pi/6) = 7\cos(-\omega t - (-\pi/6)) =$$

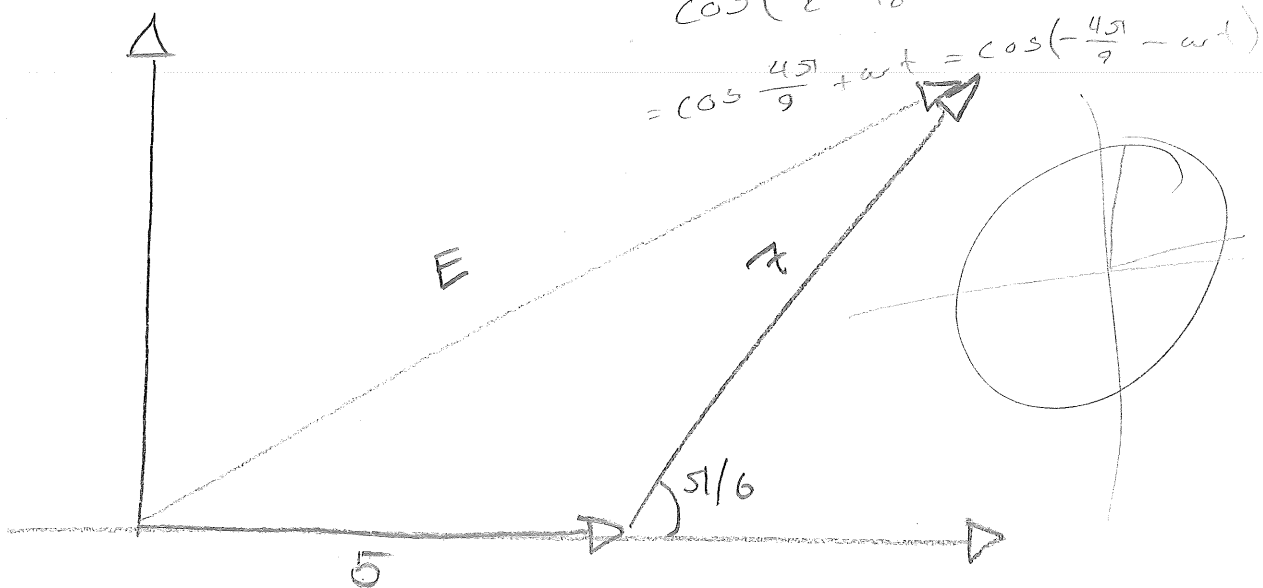
$$= 7\cos(\pi/6 - \omega t)$$

$\sin(x)$

$\cos(\frac{\pi}{2} - x)$

$\cos(\frac{\pi}{2} - \frac{\pi}{18} + \omega t) =$

$= \cos\frac{4\pi}{9} + \omega t = \cos(-\frac{4\pi}{9} - \omega t)$



$$E = E_0 \cos(\alpha - \omega t)$$

$E_0 = 11,6$

$\alpha = \arctan \frac{2}{6} = 0,31 = 0,098\pi$

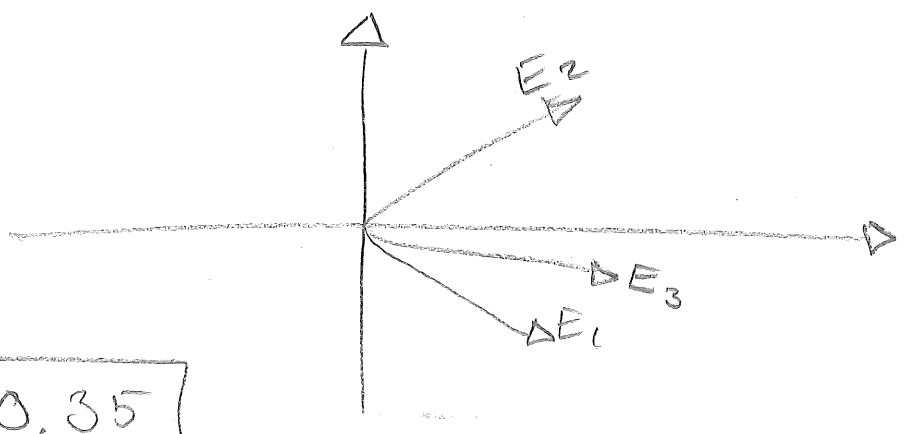
$$E = 11,6 \cos(0,098\pi - \omega t) = 11,6 \sin(\omega t + 0,4\pi)$$

6.5 $E_1 = \sin\left(\frac{\pi}{18} - \omega t\right)$, $E_2 = 3\cos\left(\frac{5\pi}{9} - \omega t\right)$

$E_3 = 2\sin\left(\frac{\pi}{6} - \omega t\right)$ period: 2 s

$E_1 = \cos\left(-\frac{4\pi}{9} - \omega t\right)$, $E_2 = 3\cos\left(\frac{5\pi}{9} - \omega t\right)$

$E_3 = 2\cos\left(-\frac{\pi}{3} - \omega t\right)$



$E_0 = 0,695$ $\alpha = 0,35$

$$\omega = \frac{2\pi}{T} = \frac{2\pi}{2s} = \frac{\pi}{s}$$

$$\Rightarrow \boxed{E = 0{,}695 \cos\left(0{,}349 - \frac{\pi}{5} t\right)}$$

6.12

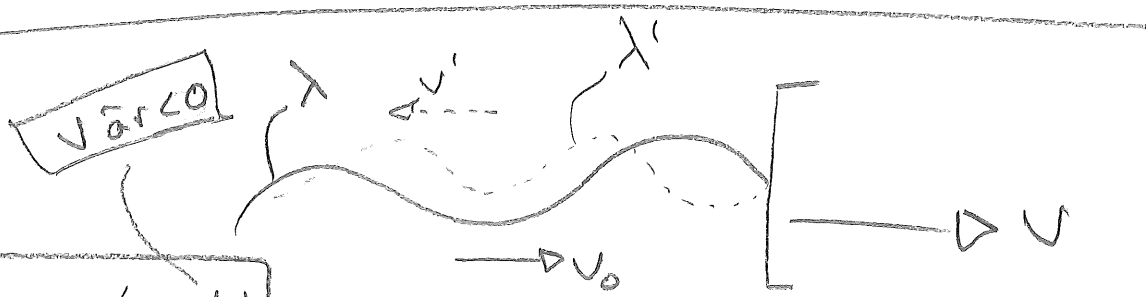
a) $$v_g = v_p - \lambda\left(\frac{dv_p}{d\lambda}\right) \quad \left| \quad k = \frac{2\pi}{\lambda} \right.$$

$$\left. \Leftrightarrow \lambda = \frac{2\pi}{k} \right.$$

(38) ger: $v_g = v_p + k \frac{dv_p}{dk} \cdot \frac{d\lambda}{dk} = \frac{d\lambda}{dk} = -\frac{2\pi}{k^2}$

$$= v_p + k \cdot \frac{-2\pi}{k^2} \cdot \frac{dv_p}{d\lambda} = \boxed{v_p - \lambda \frac{dv_p}{d\lambda}}$$

6.14



$$\boxed{\lambda' = \lambda\left(1 + \frac{v}{c}\right)} \text{ — Dopplereffekt.}$$

$$\begin{cases} f_0 \lambda = v_0 \\ f' \lambda' = v' \end{cases} \Leftrightarrow \frac{\lambda'}{\lambda} = \frac{v'}{f'} \cdot \frac{f_0}{v_0}$$

$$v' = \frac{v_0}{1 + \frac{v}{c}}$$

$$v'' = \frac{v'}{1 + \frac{v}{c}} = \frac{\frac{v_0}{1 + \frac{v}{c}}}{1 + \frac{v}{c}} = v_0 \left(1 + \frac{v}{c}\right)^{-2}$$