Opg 4.1

$x(t) = 10\cos(880\pi t + \phi)$

$x[n] = x(nT_s) = 10\cos(880\pi nT_s + \phi)$ $\quad -\infty < n < \infty$

$T_s = 0.0001[s] \quad \Rightarrow \quad f_s = \frac{t}{T_s} = 10^4$

a) $880\pi t = 2\pi f t \;\Rightarrow\; f = 440[Hz] \;\sim\; T = \frac{1}{f} = 2.27 \cdot 10^{-3}$

Antal samples pr. periode:

$$N = \frac{T}{T_s} = \frac{1/f}{1/f_s} = \frac{f_s}{f} = \frac{10000}{440} = \underline{22.73}$$

b) $y(t) = 10\cos(\omega_0 t + \phi)$ $\quad \omega_0 > \omega = 880\pi$

Bestem ω_0, så $y[n] = y(nT_s) = x(nT_s) = x[n]$ for alle værdier af n.

$y(nT_s) = 10\cos(\omega_0 nT_s + \phi) = x(nT_s) = 10\cos(\omega nT_s + \phi)$

$\Leftrightarrow \quad \omega_0 nT_s = \omega nT_s + np2\pi \quad p \in N$

$\Leftrightarrow \quad \omega_0 = \omega + \frac{p2\pi}{T_s} = \omega + p2\pi f_s$

$\Leftrightarrow \quad f_0 = f + pf_s \quad p \in N$

F.eks. $p = 1 \;\sim\; f_0 = f + 1 \cdot f_s = 440 + 10000 = \underline{10440[Hz]}$

eller $\omega_0 = 2\pi f_0 = 2\pi 10440 = \underline{65597[rad/s]}$

c) $N_0 = \frac{f_s}{f_0} = \frac{10000}{10440} = \underline{0.9579}$