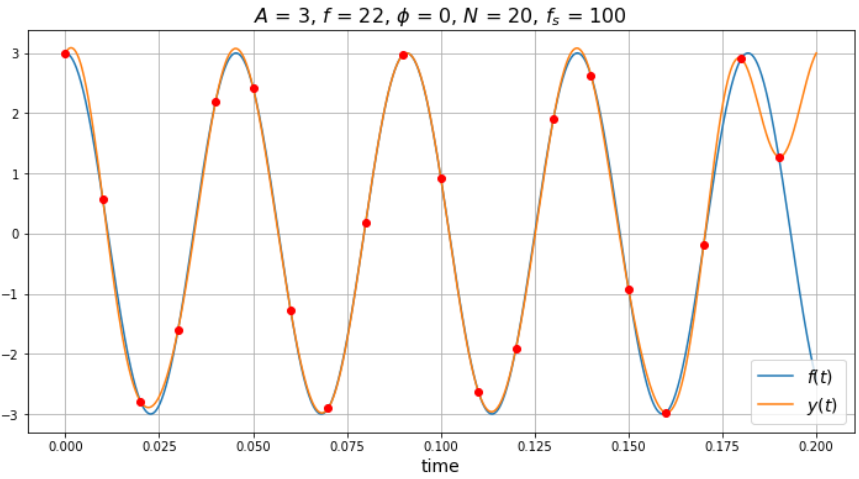
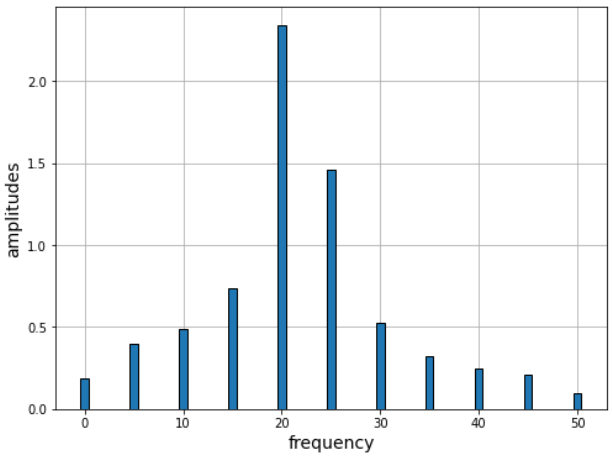
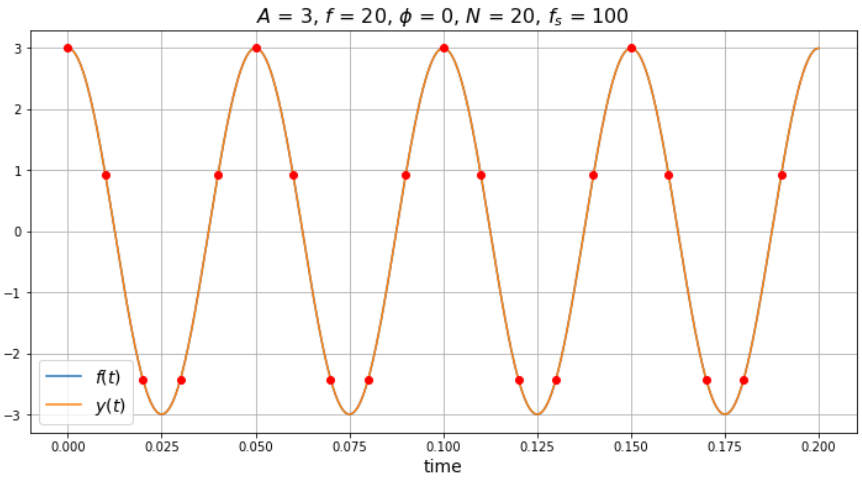
1. Given A, f, ϕ, N and f_s, take N samples with frequency f_s from a signal

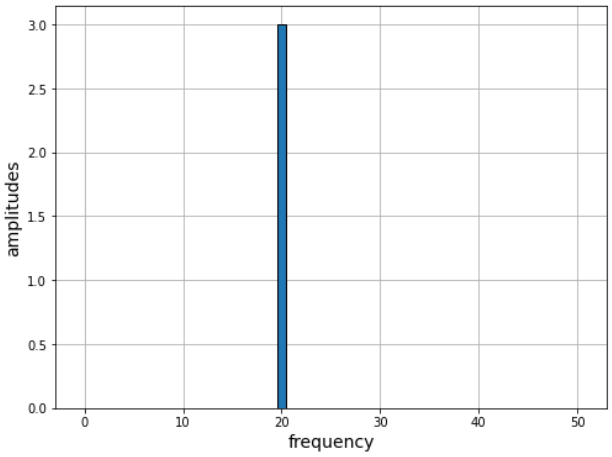
$$f(t) = A\cos(2\pi ft + \phi)$$

and draw the graphs of $f(t)$ and the curve $y(t)$ from DFT for $t = 0 \ldots T = N/f_s$ together with the samples to the same picture, and the amplitudes found by DFT.









The point: the curves are identical i.e DFT "finds the frequency f", if f is in the frequency list used by DFT,

$$f_0 = \frac{f_s}{N}, 2f_0, 3f_0, \ldots, Mf_0 = \frac{f_s}{2}$$

(if $f = f_s/2$, then the curves may or may not be the same, it depends on the phase-angle ϕ)

2. Given U, T and N, take N samples from the signal below with sampling frequency f_s such that the sampling period $N/f_s = T$ and draw the graph of the curve $y(t)$ from DFT and the samples, and the amplitude spectrum of the signal.