INSTITUTO SUPERIOR DE ENGENHARIA DE LISBOA

PROCESSAMENTO DIGITAL DE SINAL

Laboratório 1 - Geração e visualização de sinais reais e complexos

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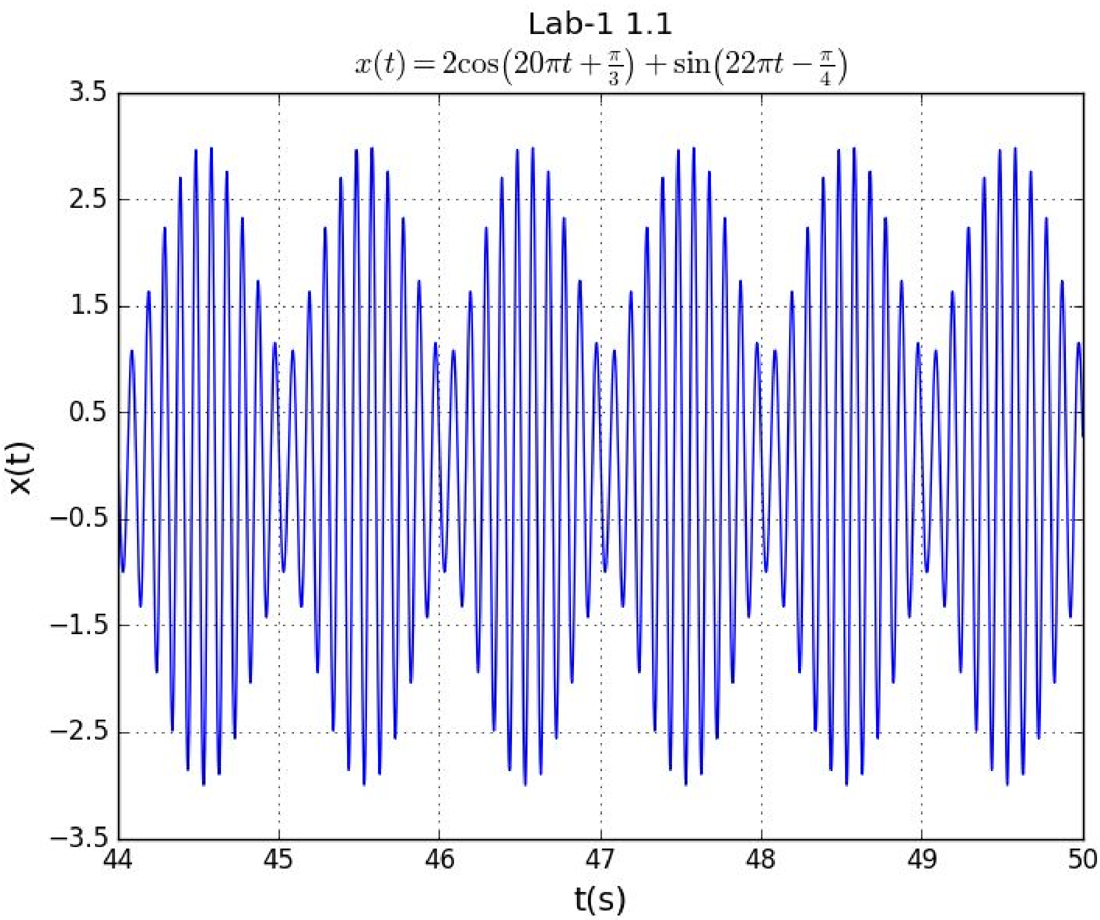
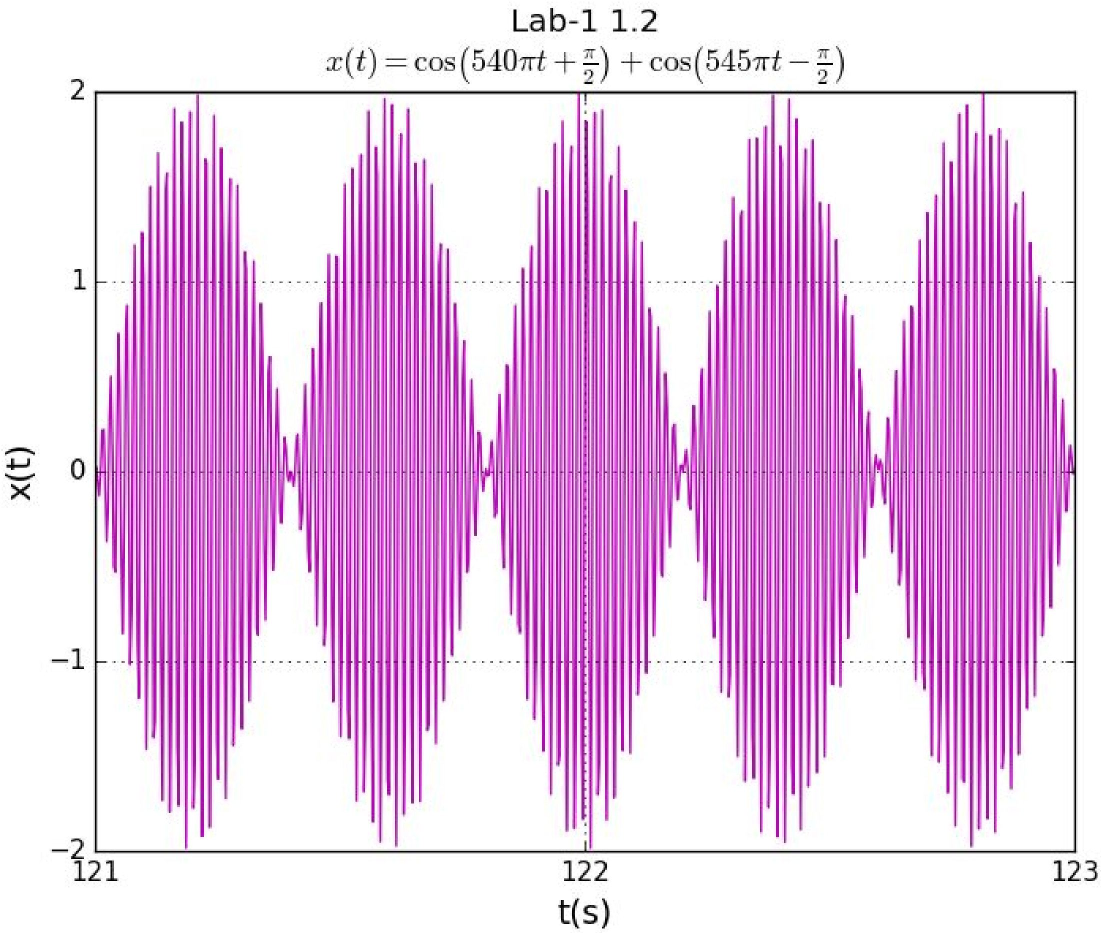
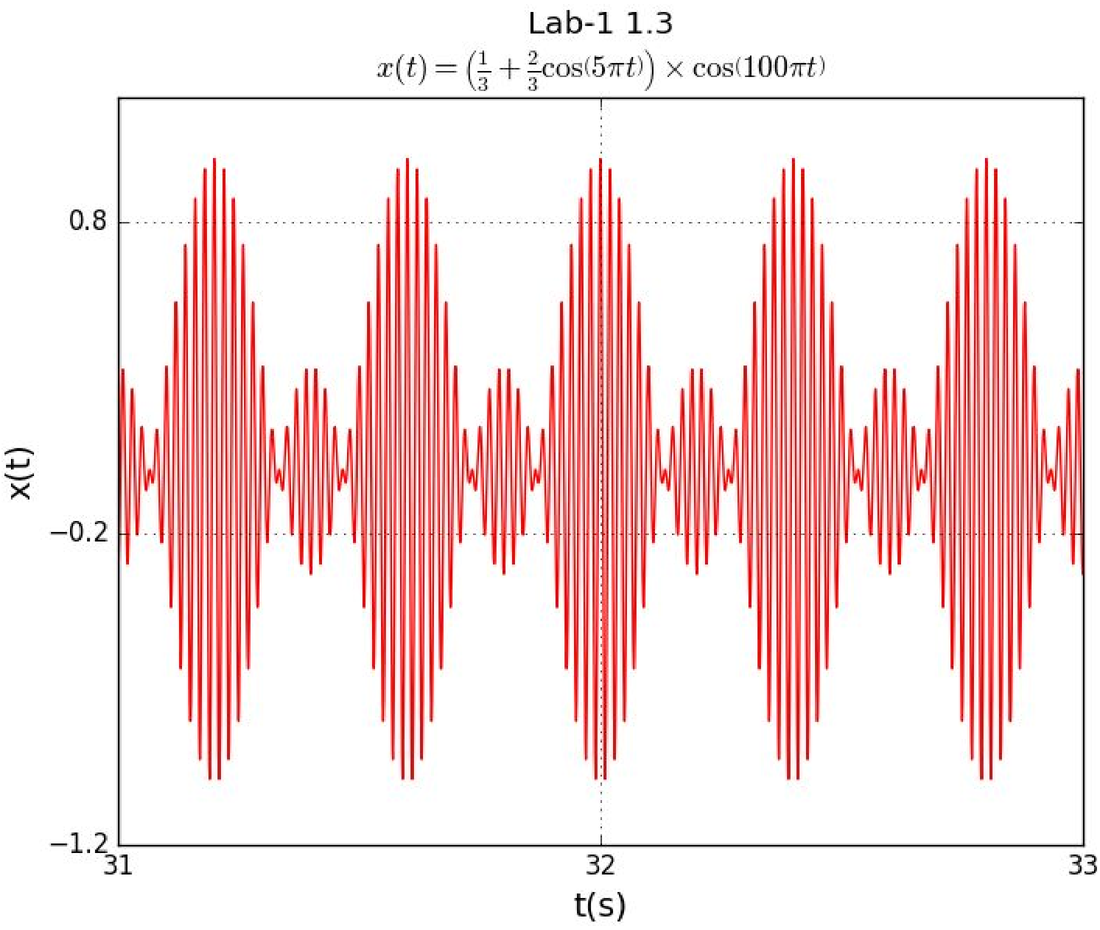
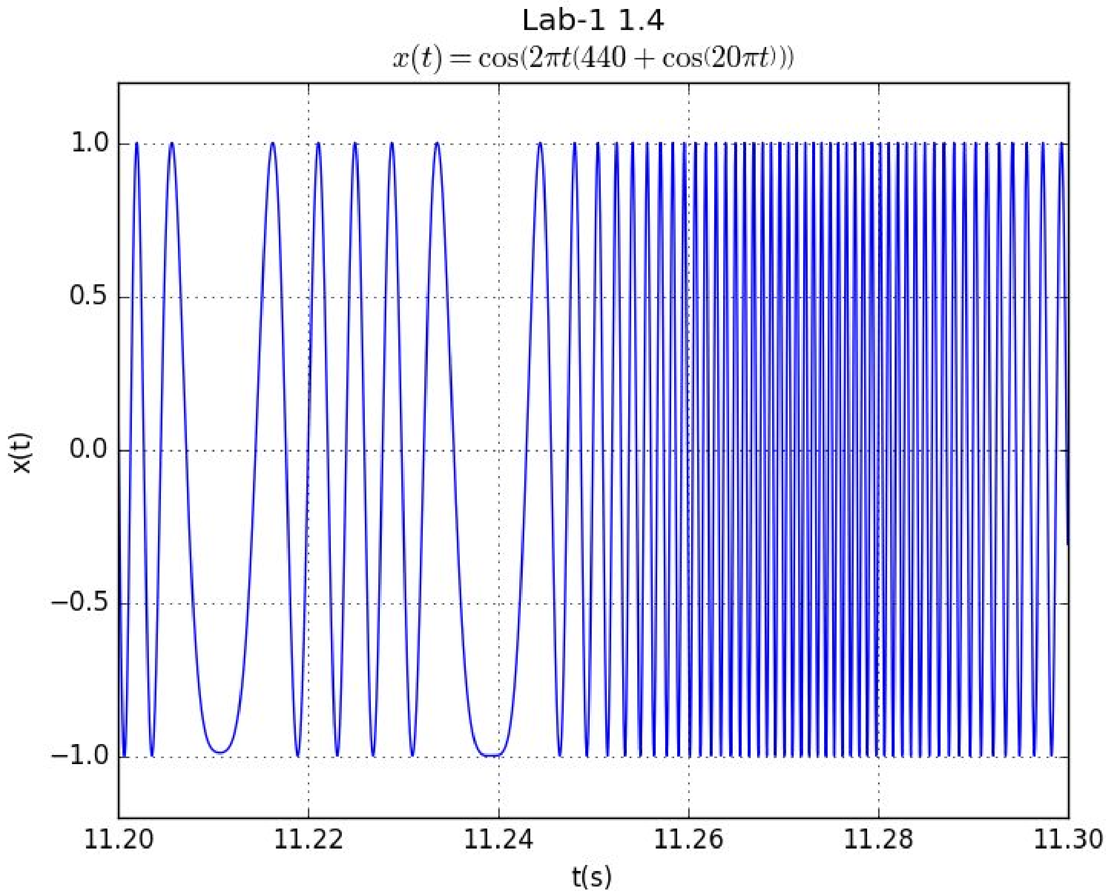
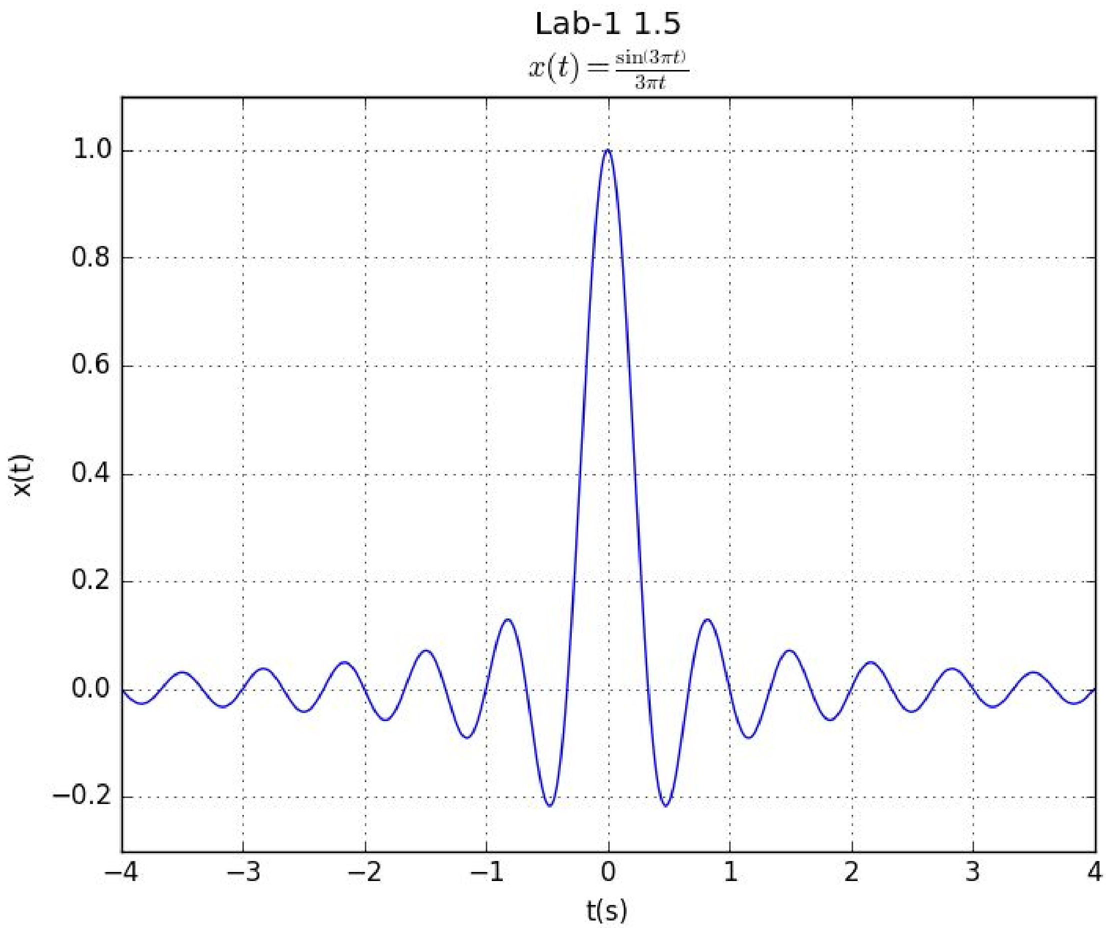
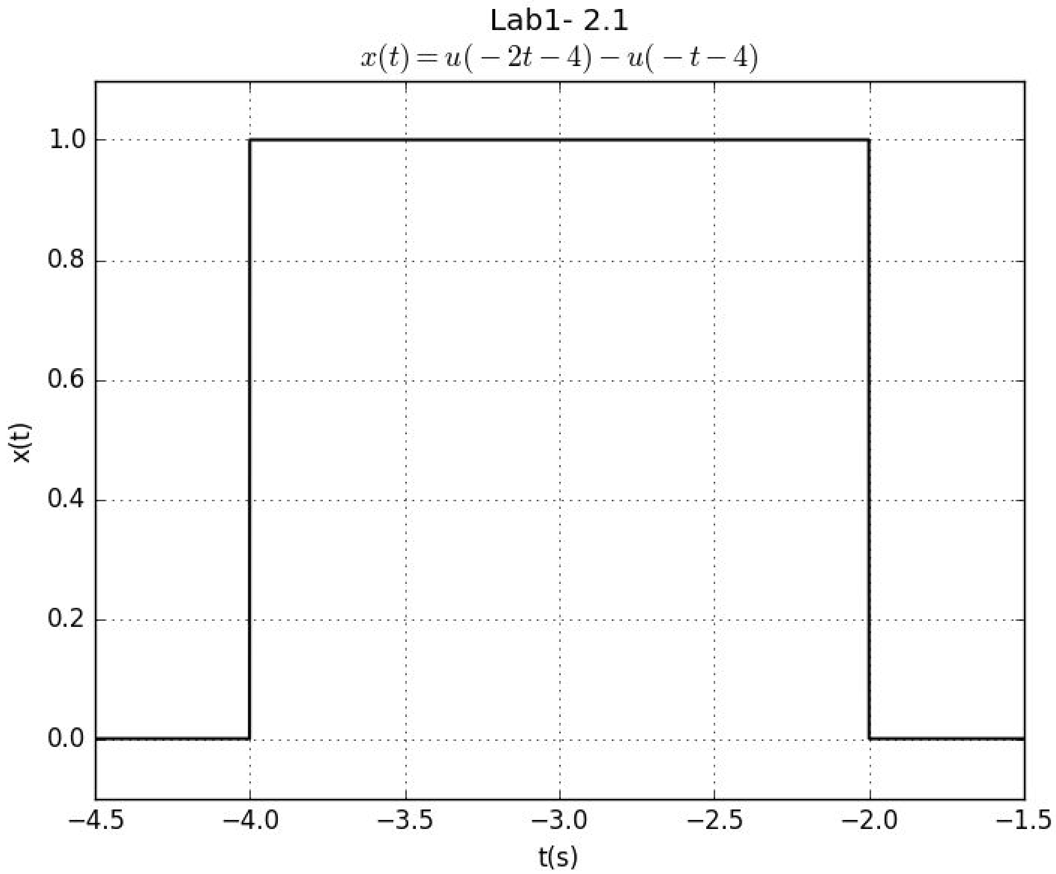


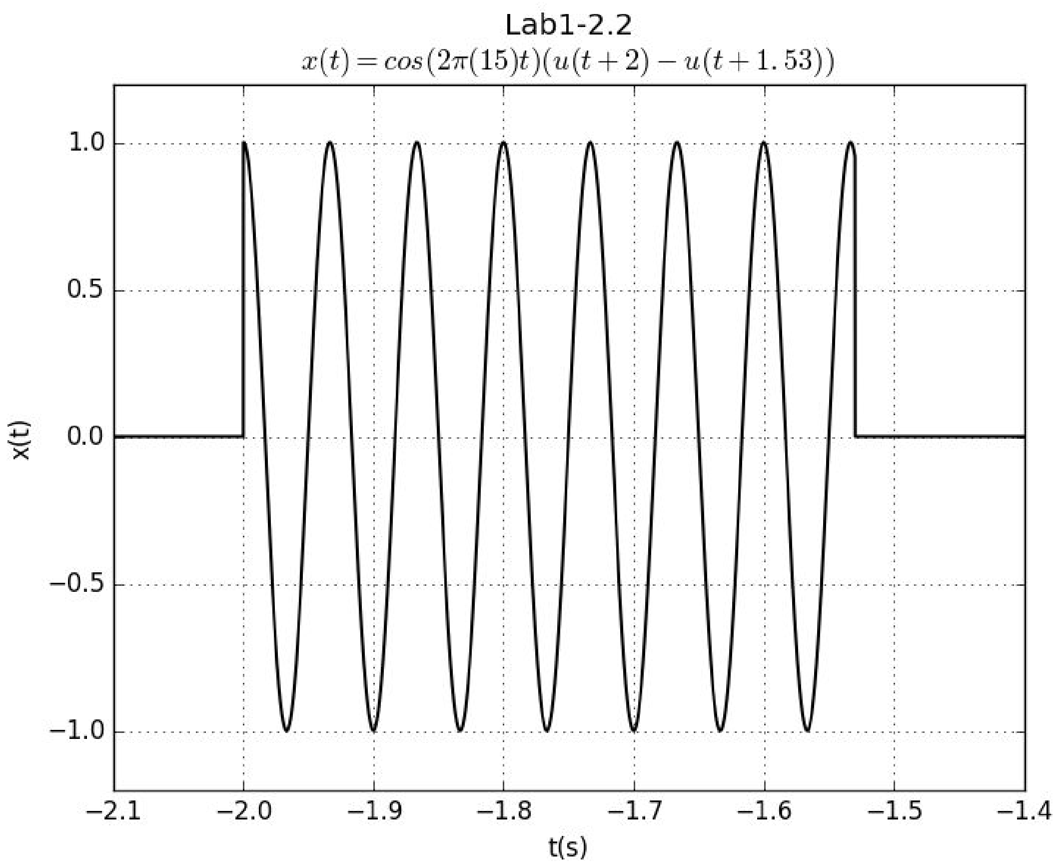

Lab-1 1.2
$x(t) = \cos\left(540\pi t + \frac{\pi}{2}\right) + \cos\left(545\pi t - \frac{\pi}{2}\right)$
2
1
0
−1
−2
x(t)
121
122
123
t(s)

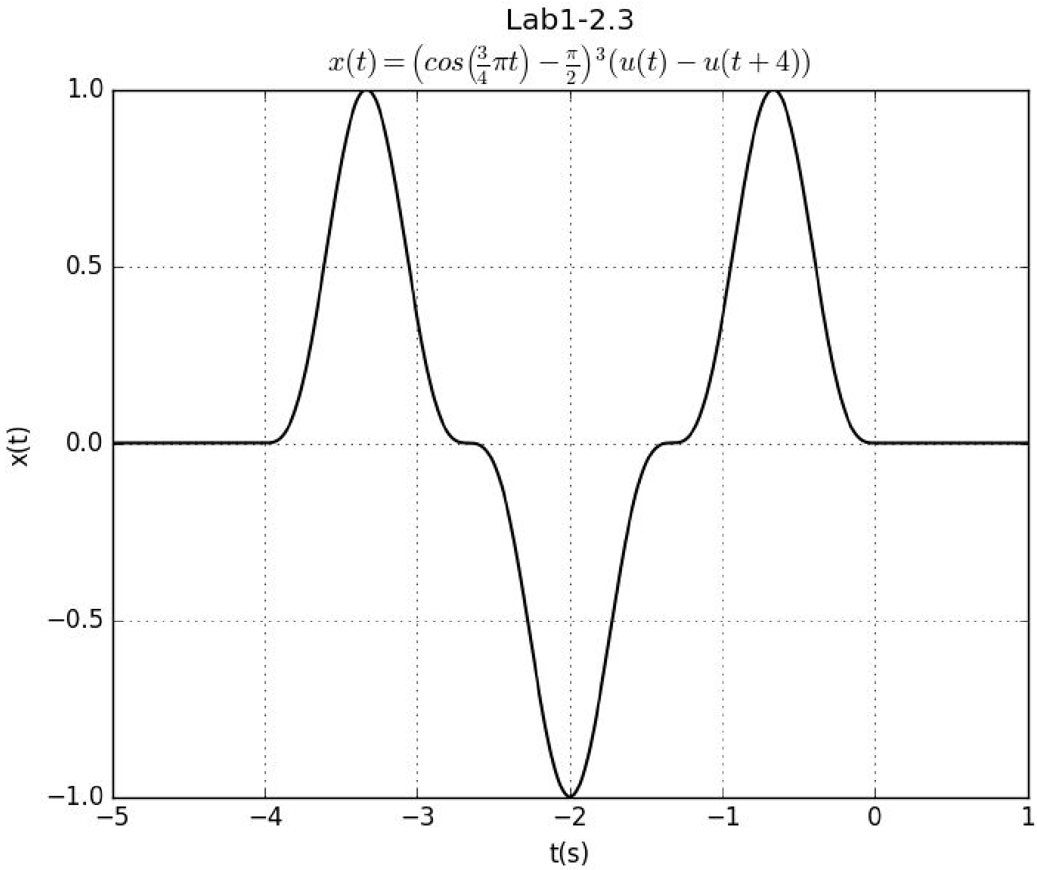

Lab-1 1.3
$x(t) = \left(\frac{1}{3} + \frac{2}{3}\cos(5\pi t)\right) \times \cos(100\pi t)$
0.8
−0.2
−1.2
x(t)
31
32
33
t(s)

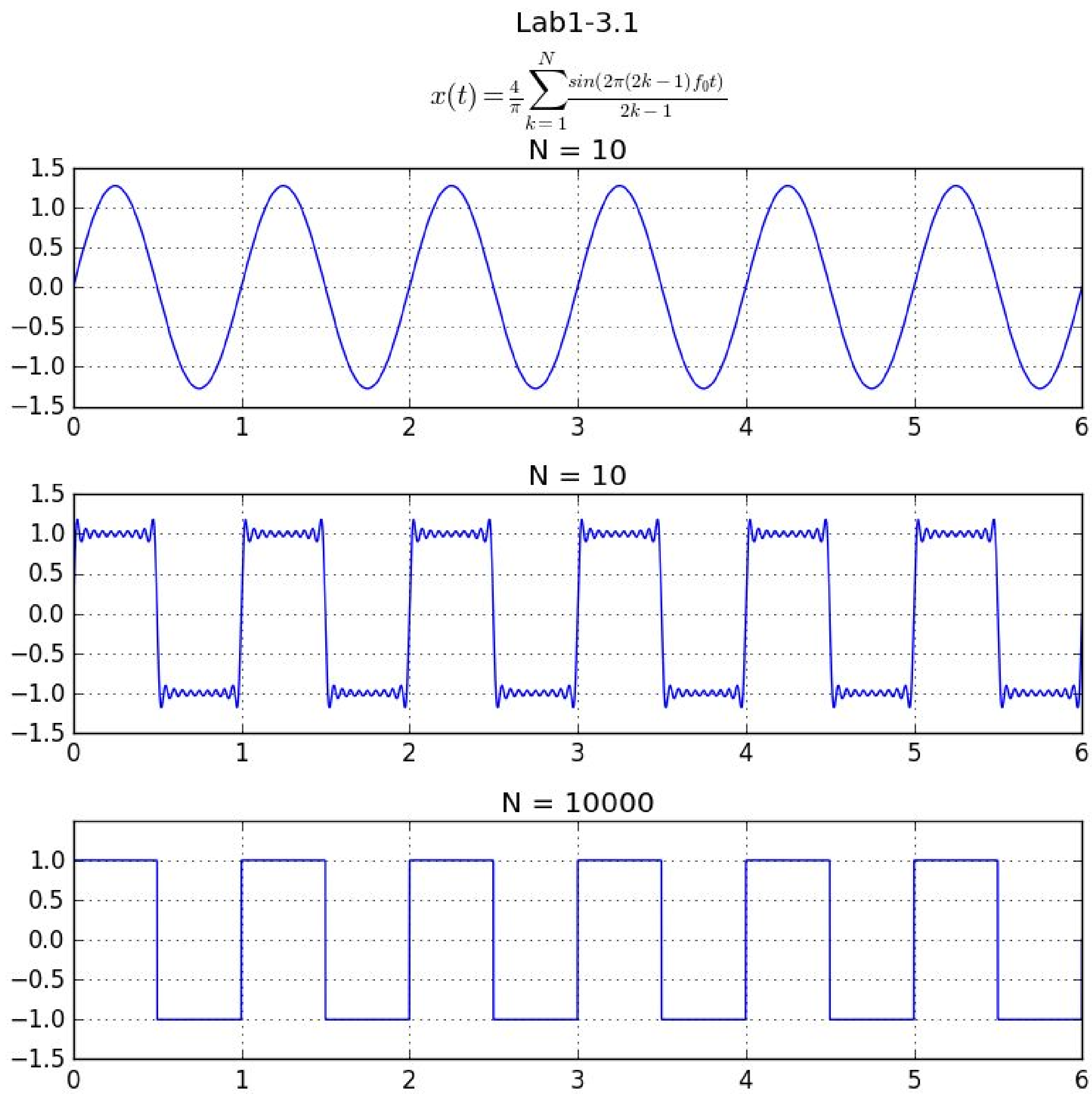

Lab-1 1.4
$x(t) = \cos(2\pi t(440 + \cos(20\pi t)))$
1.0
0.5
0.0
−0.5
−1.0
x(t)
11.20
11.22
11.24
11.26
11.28
11.30
t(s)


Lab-1 1.5
$x(t) = \frac{\sin(3\pi t)}{3\pi t}$
1.0
0.8
0.6
0.4
0.2
0.0
−0.2
x(t)
−4
−3
−2
−1
0
1
2
3
4
t(s)


Lab1- 2.1
$x(t) = u(-2t-4) - u(-t-4)$
1.0
0.8
0.6
0.4
0.2
0.0
x(t)
−4.5
−4.0
−3.5
−3.0
−2.5
−2.0
−1.5
t(s)

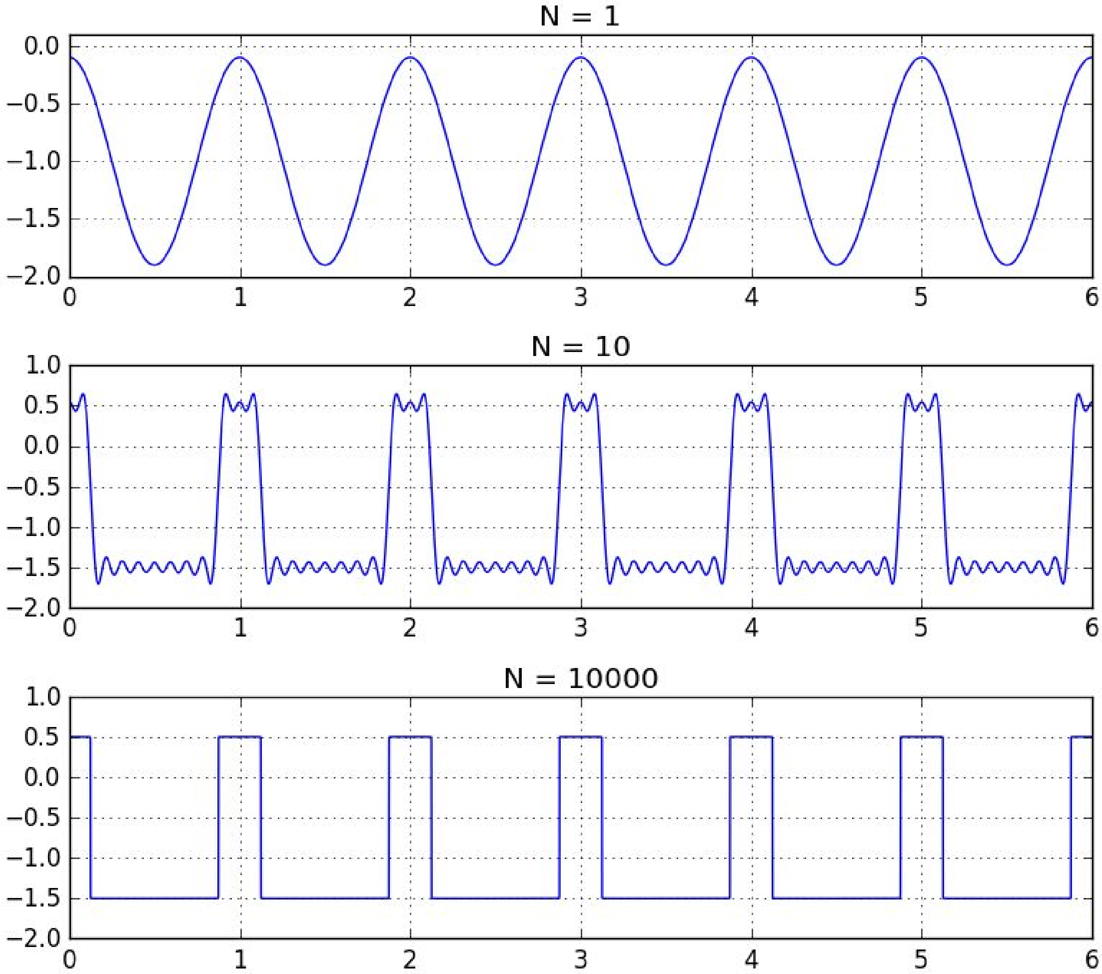

Lab1-2.2
$x(t) = cos(2\pi(15)t)(u(t+2) - u(t+1.53))$
1.0
0.5
0.0
−0.5
−1.0
x(t)
−2.1
−2.0
−1.9
−1.8
−1.7
−1.6
−1.5
−1.4
t(s)

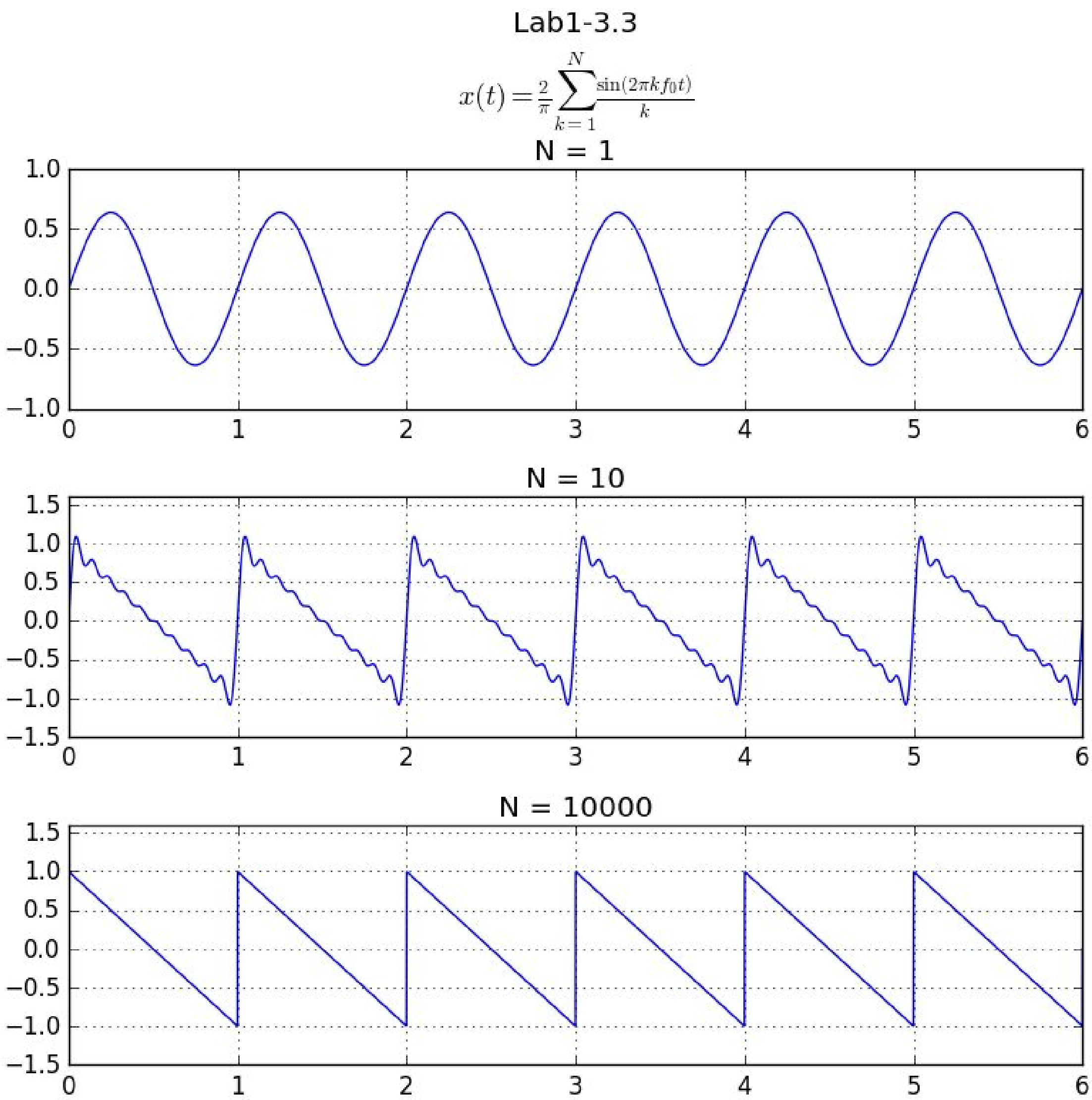

Lab1-2.3
$x(t) = \left(cos\left(\frac{3}{4}\pi t\right) - \frac{\pi}{2}\right)^3 (u(t) - u(t+4))$
1.0
0.5
0.0
−0.5
−1.0
x(t)
−5
−4
−3
−2
−1
0
1
t(s)

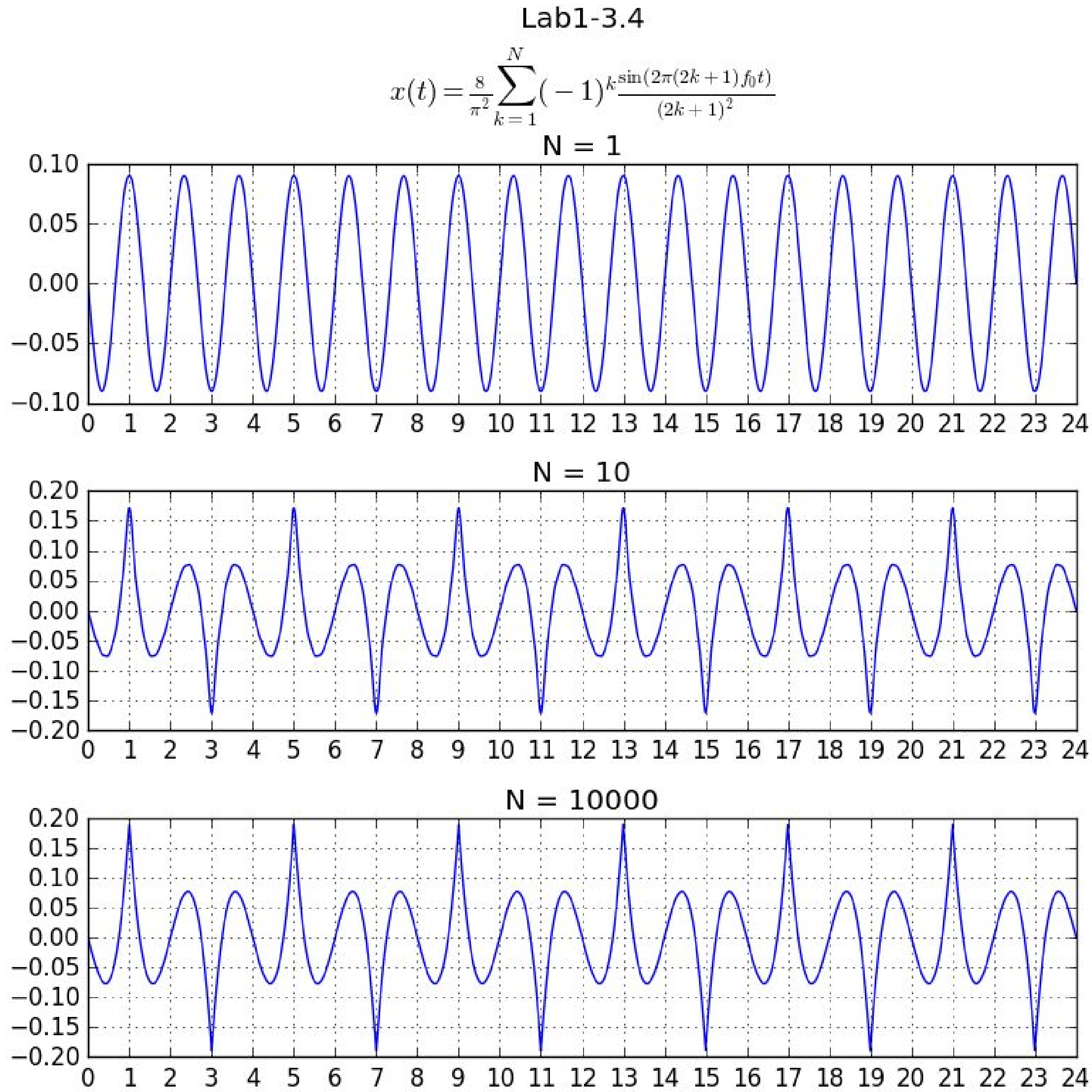

Lab1-3.1
$x(t) = \frac{4}{\pi}\sum_{k=1}^{N}\frac{sin(2\pi(2k-1)f_0t)}{2k-1}$
N = 10
N = 10
N = 10000

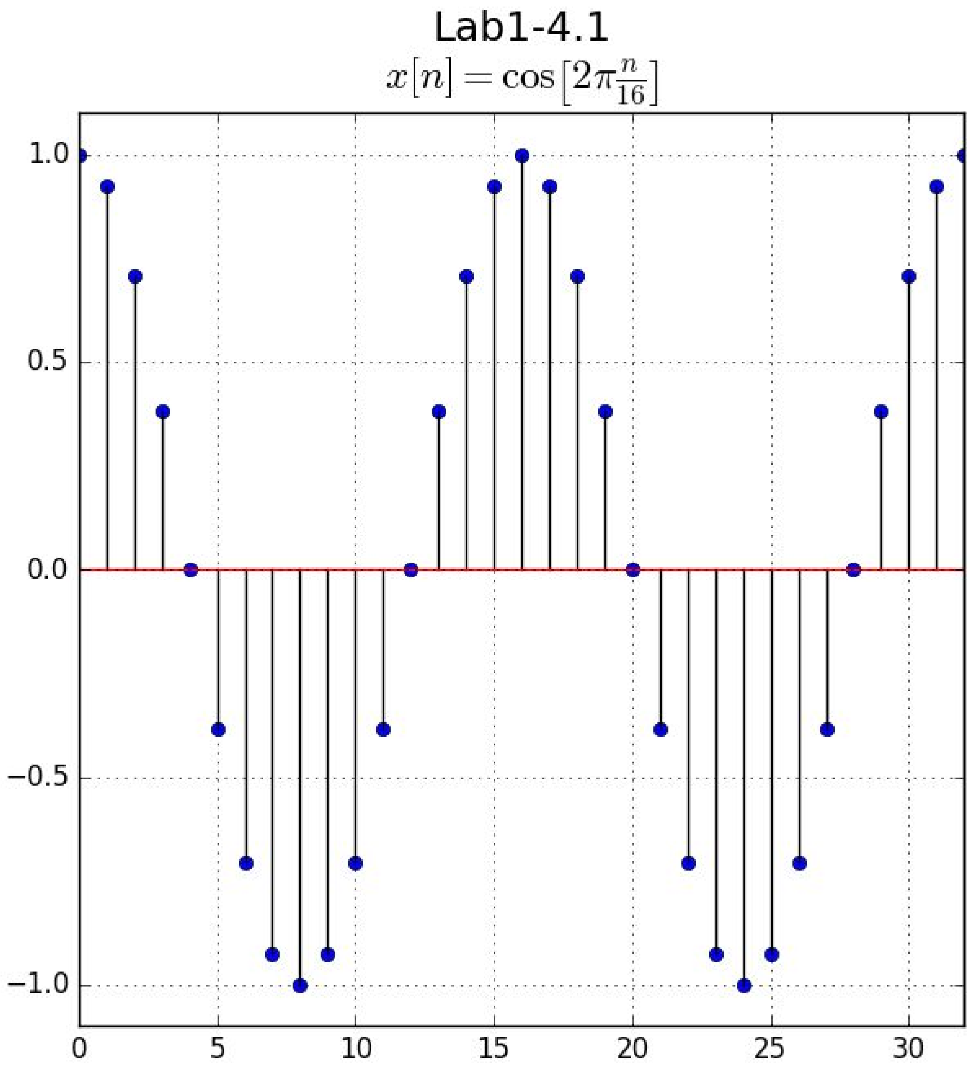
Lab1-3.2

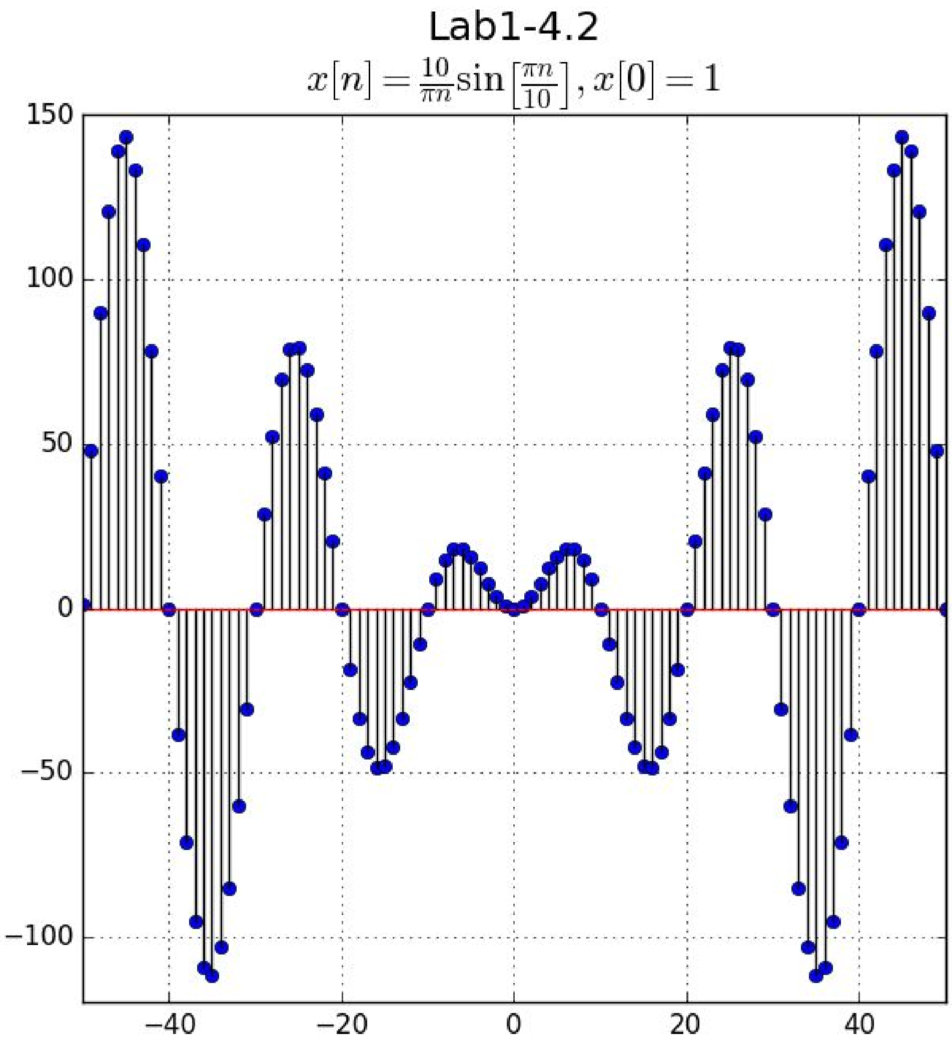
$$x(t) = -1 + \sum_{k=1}^{N} \frac{\sin(\pi/4)}{\pi k/4} \cos(2\pi k f_0 t)$$

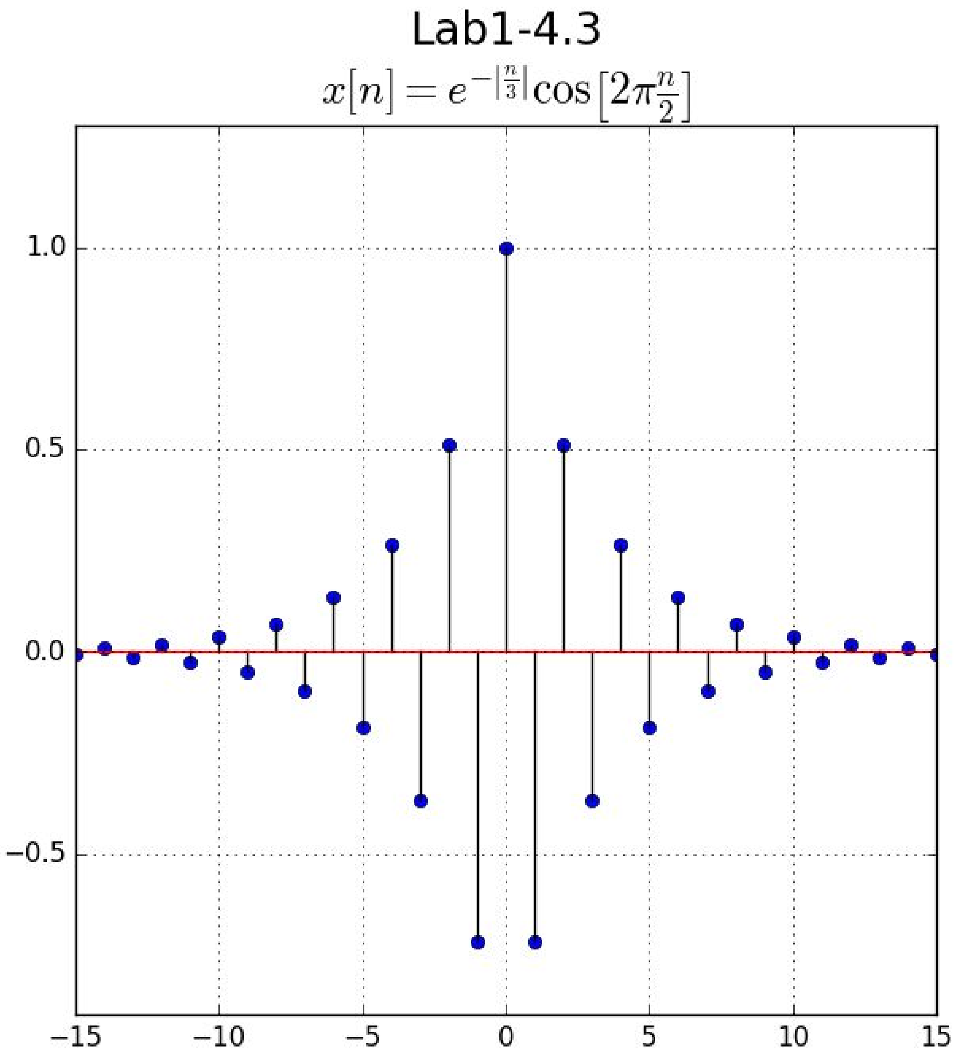


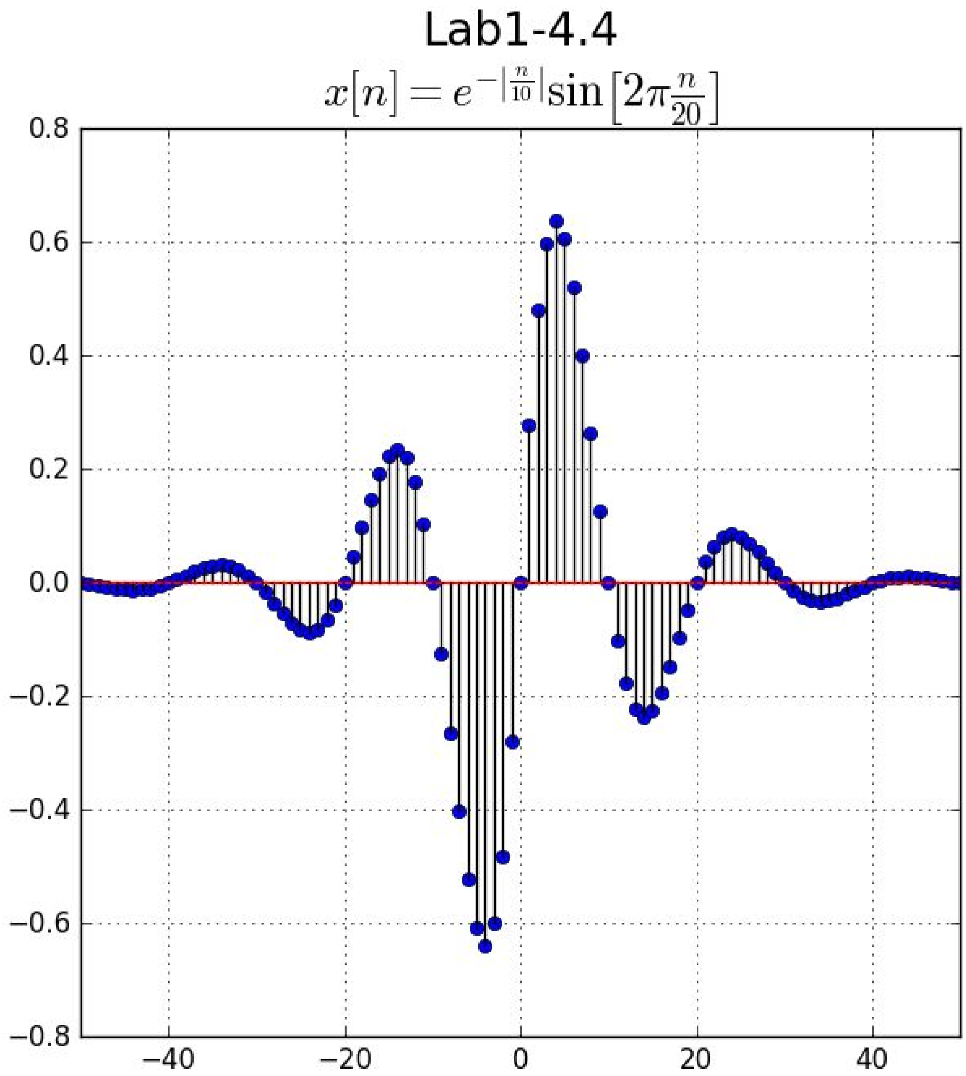

Lab1-3.3
$x(t) = \frac{2}{\pi}\sum_{k=1}^{N}\frac{\sin(2\pi k f_0 t)}{k}$
N = 1
N = 10
N = 10000

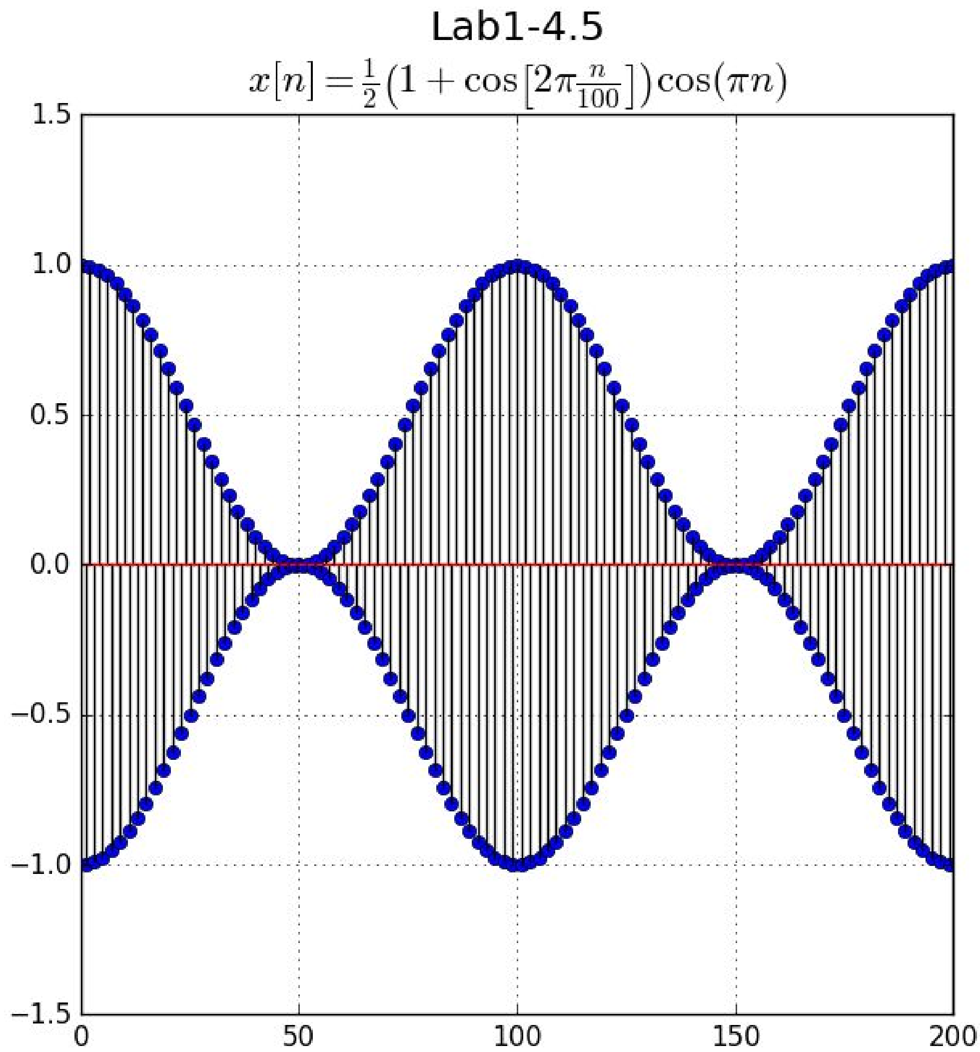

Lab1-3.4
$x(t) = \frac{8}{\pi^2}\sum_{k=1}^{N}(-1)^k\frac{\sin(2\pi(2k+1)f_0 t)}{(2k+1)^2}$
N = 1
N = 10
N = 10000


Lab1-4.1
$x[n] = \cos\left[2\pi\frac{n}{16}\right]$
1.0
0.5
0.0
−0.5
−1.0
0
5
10
15
20
25
30


Lab1-4.2
$x[n] = \frac{10}{\pi n} \sin\left[\frac{\pi n}{10}\right], x[0] = 1$
150
100
50
0
−50
−100
−40
−20
0
20
40


Lab1-4.3
$x[n] = e^{-|\frac{n}{3}|}\cos\left[2\pi\frac{n}{2}\right]$
1.0
0.5
0.0
−0.5
−15
−10
−5
0
5
10
15


Lab1-4.4
$x[n] = e^{-|\frac{n}{10}|}\sin\left[2\pi\frac{n}{20}\right]$
0.8
0.6
0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.8
−40
−20
0
20
40


Lab1-4.5
$x[n] = \frac{1}{2}\left(1 + \cos\left[2\pi\frac{n}{100}\right]\right)\cos(\pi n)$
1.5
1.0
0.5
0.0
−0.5
−1.0
−1.5
0
50
100
150
200