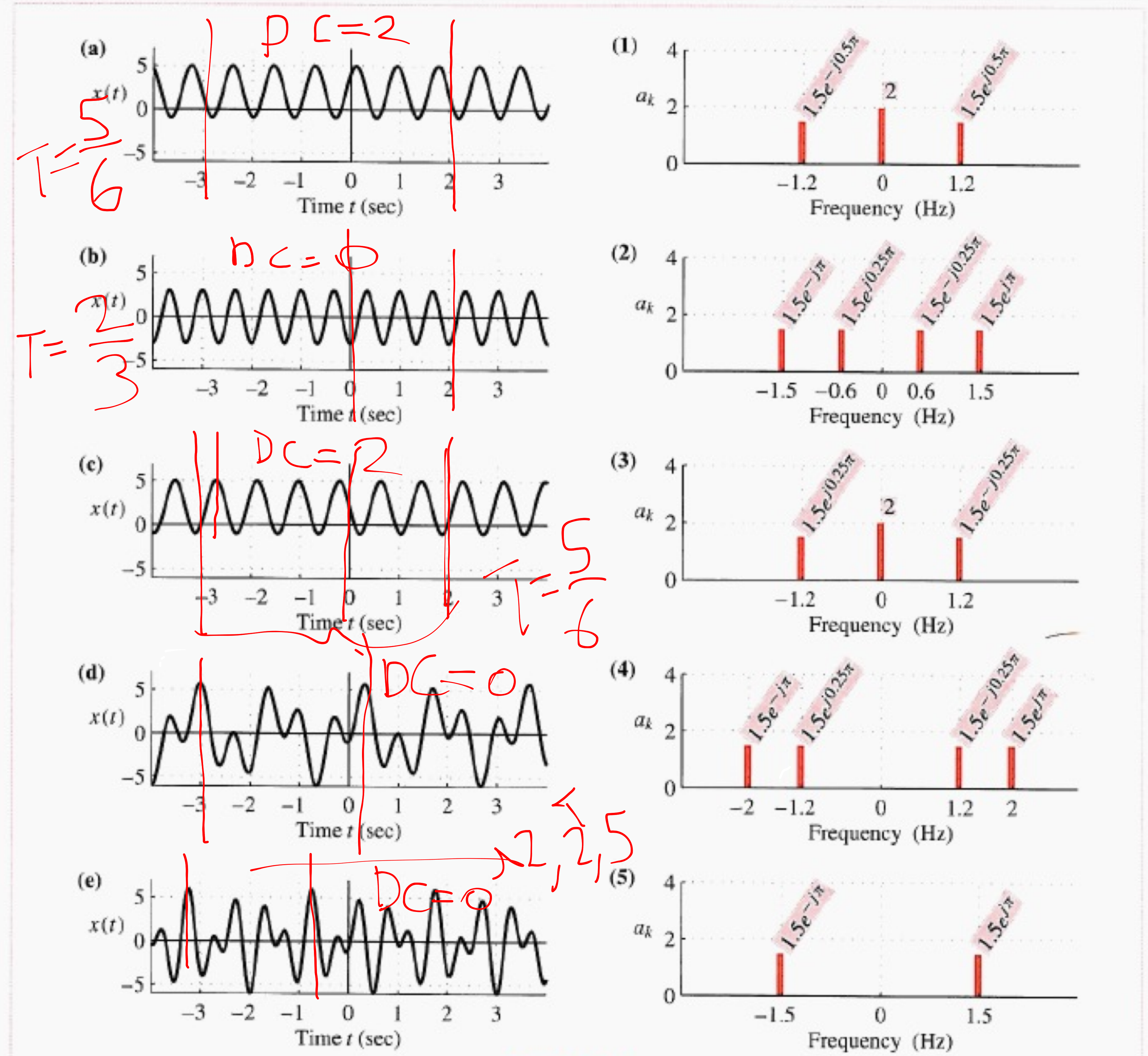


(a)
x(t)
Time t (sec)
(b)
x(t)
Time t (sec)
(c)
x(t)
Time t (sec)
(d)
x(t)
Time t (sec)
(e)
x(t)
Time t (sec)
(1)
a_k
$1.5e^{-j0.5\pi}$
2
$1.5e^{j0.5\pi}$
Frequency (Hz)
(2)
a_k
$1.5e^{-j\pi}$
$1.5e^{j0.25\pi}$
$1.5e^{-j0.25\pi}$
$1.5e^{j\pi}$
Frequency (Hz)
(3)
a_k
$1.5e^{j0.25\pi}$
2
$1.5e^{-j0.25\pi}$
Frequency (Hz)
(4)
a_k
$1.5e^{-j\pi}$
$1.5e^{j0.25\pi}$
$1.5e^{-j0.25\pi}$
$1.5e^{j\pi}$
Frequency (Hz)
(5)
a_k
$1.5e^{-j\pi}$
$1.5e^{j\pi}$
Frequency (Hz)
DC=2
T=5/6
DC=0
T=2/3
DC=2
T=5/6
DC=0
DC=0
T=2,2.5

Figure P-3.19

$$-j = 1 \cdot e^{-j\pi/2}$$

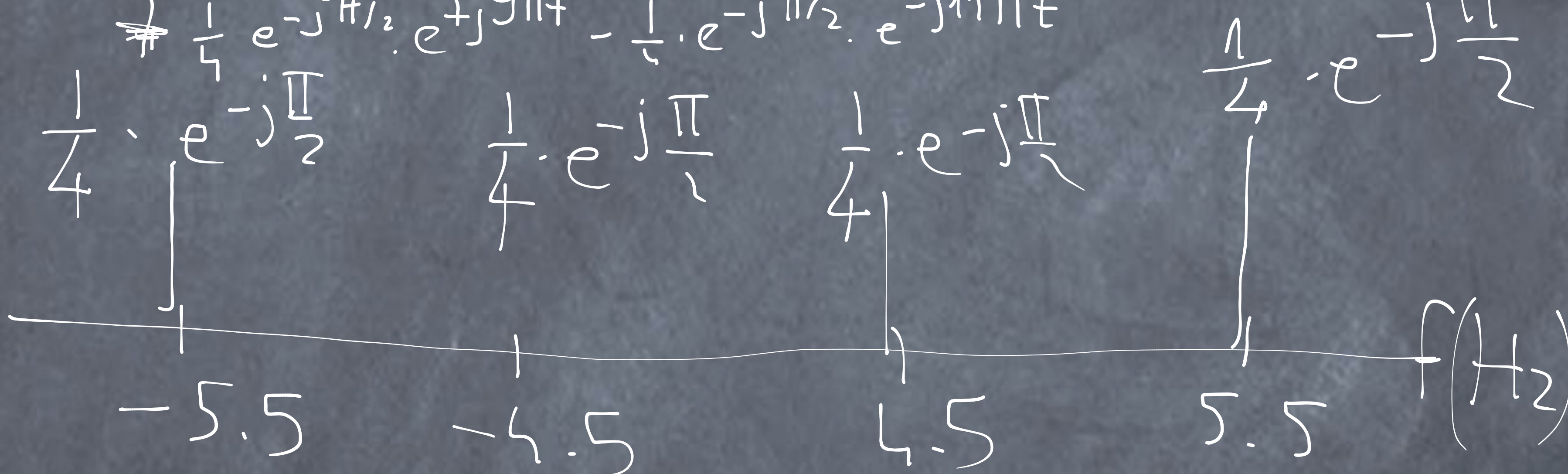
Ex: $x(t) = \cos(\pi t) \cdot \sin(10\pi t)$

Plot the spectrum vs. f(Hz)

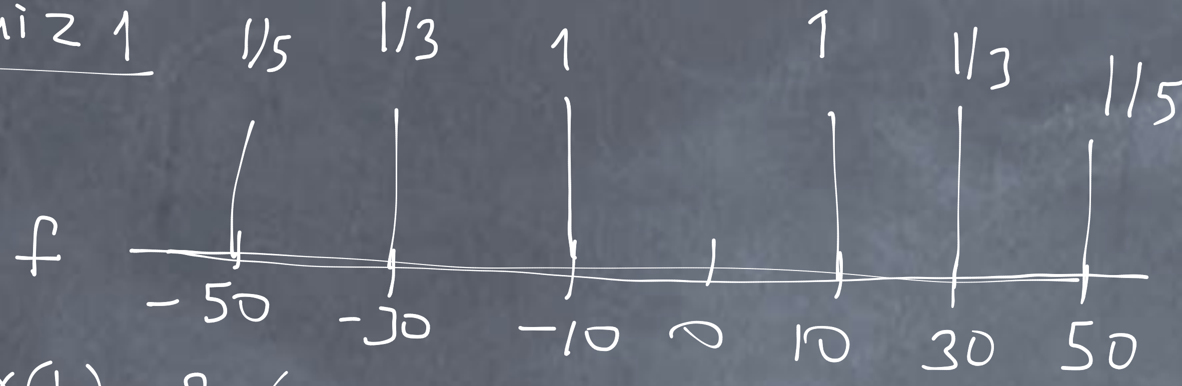
$$\left(\frac{e^{j\pi t} + e^{-j\pi t}}{2}\right)\left(\frac{e^{j10\pi t} - e^{-j10\pi t}}{2j}\right) \qquad \frac{1}{j} = -j$$

$$= \frac{1}{4}\underbrace{e^{-j\pi/2}}_{(-j)} \cdot e^{j11\pi t} - \frac{1}{4} \cdot e^{-j\pi/2} \cdot e^{-j9\pi t}$$

$$+ \frac{1}{4} e^{-j\pi/2} \cdot e^{+j9\pi t} - \frac{1}{4} \cdot e^{-j\pi/2} \cdot e^{-j11\pi t}$$



Quiz 1



$x(t) = ?\ (\cos \dots)$

$= \frac{2}{5}\cos(100\pi t) + \frac{2}{3}\cdot\cos(60\pi t) + 2\cos(20\pi t)$

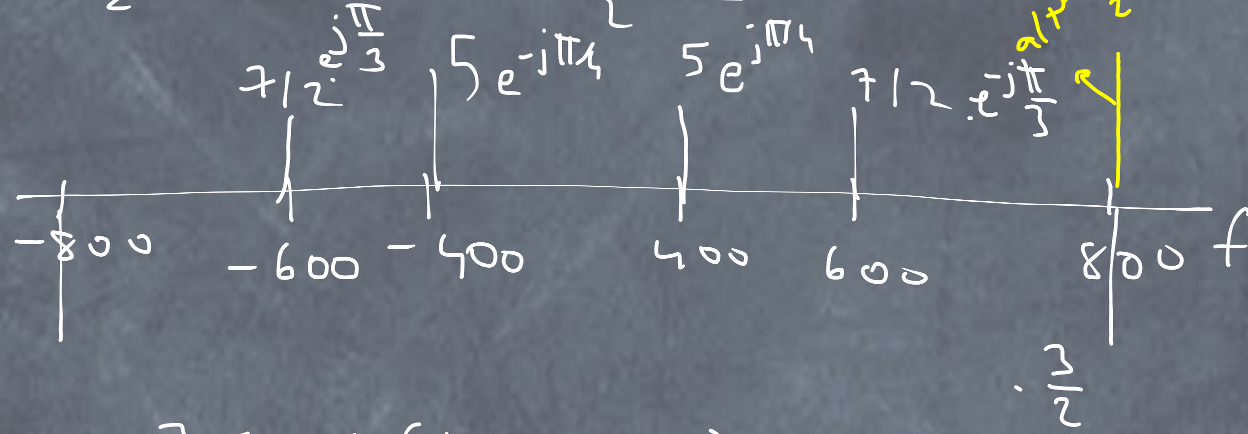
3.1 $x(t) = 10\cos(800\pi t + \pi/4) + 7\cos(1200\pi t - \pi/3)$
$- 3\cos(1600\pi t)$

* Sketch spectrum

$5 \cdot e^{j\pi/4} \cdot e^{j800\pi t} + 5 \cdot e^{-j\pi/4} \cdot e^{-j800\pi t}$

$\frac{7}{2} \cdot e^{-j\pi/3} \cdot e^{j1200\pi t} + \frac{7}{2} \cdot e^{j\pi/3} \cdot e^{-j1200\pi t}$

$-\frac{3}{2} \cdot e^{j1600\pi t} - \frac{3}{2} \cdot e^{-j1600\pi t}$ alternative: $\frac{3}{2} \cdot e^{j\pi}$



$-3\cos(1600\pi t)$
$= \underline{3}\cos(1600\pi t + \pi)$ alternation

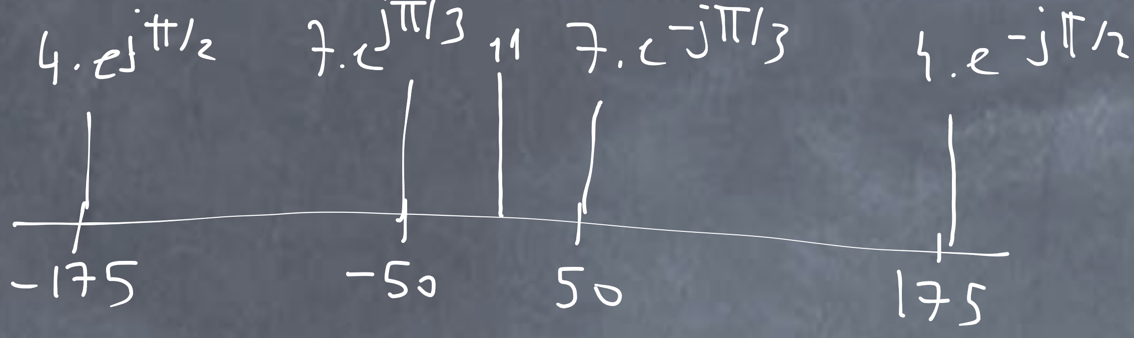
(c) $y(t) = x(t) + \underline{5\cos(1000\pi t + \pi/2)}$

$f_f = 200$

$1000\pi = 2\pi f$
$f = 500$

ebob$(400, 600, 800, 500)$
$= 100\,\text{Hz}$

3.2



$$x(t) = 8\cos\left(350\pi t - \frac{\pi}{2}\right) + 14\cos(100\pi t - \pi/3)$$

$$+ 11$$

$$f_f = 25\,Hz.$$

3.3 $x(t) = \sin^3(27\pi t)$

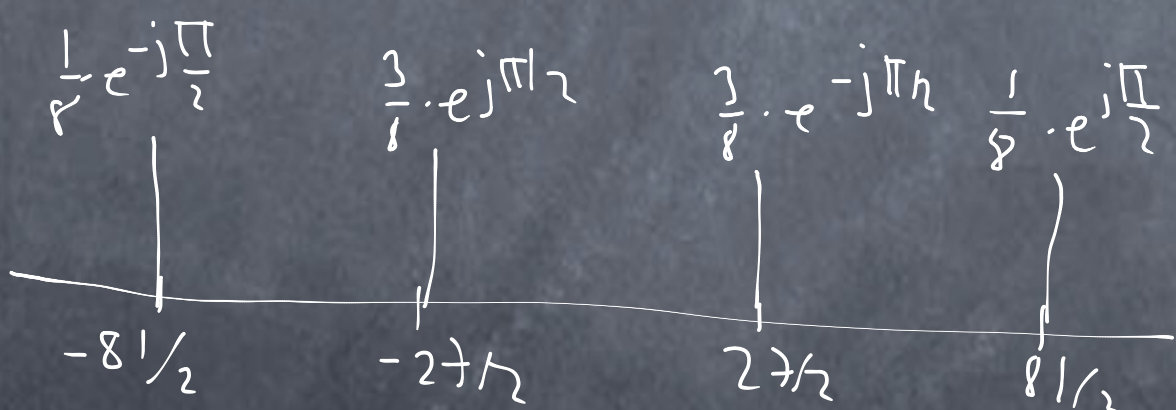
$$= \left(\frac{1}{2j}e^{j27\pi t} - \frac{1}{2j}\cdot e^{-j27\pi t}\right)^3$$

$$(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3$$

$x(t) =$

$$j^2 = -1$$
$$j^3 = -j \qquad \left(\frac{1}{2j}\right)^3 = \frac{1}{8}(-j)^3$$
$$= \bar{j}/8$$

$$x(t) = \frac{1}{8}\cdot e^{j\pi/2}\cdot e^{j81\pi t} + \frac{3}{8}\cdot e^{-j\pi/2}\cdot e^{27\pi t} +$$
$$\frac{3}{8}\cdot e^{j\pi/2}\cdot e^{-j27\pi t} + \frac{1}{8}\cdot e^{-j\pi/2}\cdot e^{-81\pi t}$$



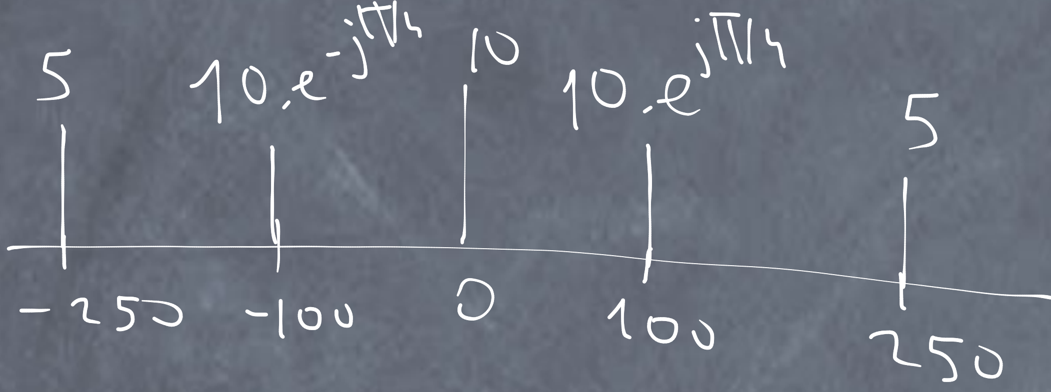
3.5 $10 + 20\cos\left(2\pi(100)t + \frac{\pi}{4}\right) + 10\cos\left(2\pi(250)t\right)$

$A\cos(\omega t + \phi) \Rightarrow \underbrace{A \cdot e^{j\phi}}$ → complex amplitude

$f_f = 50$

$X_0 = 10$ $X_1 = 0$ $X_2 = 10 \cdot e^{+j\frac{\pi}{4}}$ $X_3 = 0$

$X_4 = 0$ $X_5 = 5$



3.6 $x(t) = [12 + 7\sin(\pi t - \pi/3)]\cos(13\pi t)$

$$\left[12 + \frac{7}{2j} e^{-j(\pi t - \pi/3)} - \frac{7}{2j} e^{-j(\pi t - \pi/3)}\right]$$

$$\times \left(\frac{1}{2} \cdot e^{j13\pi t} + \frac{1}{2} \cdot e^{-j13\pi t} \right)$$

$\vdots$