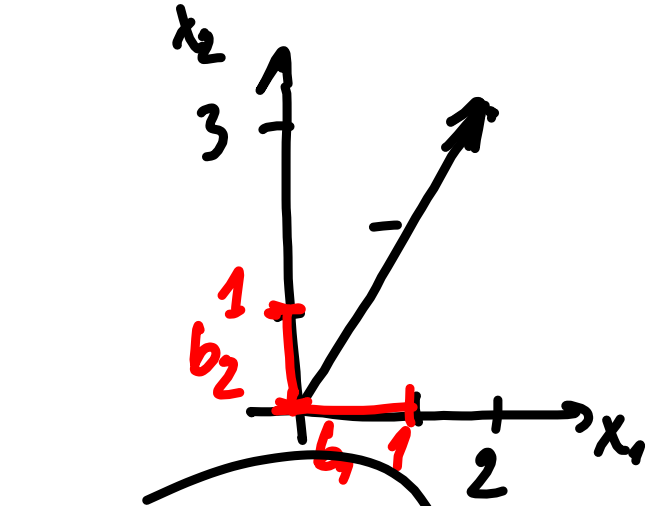


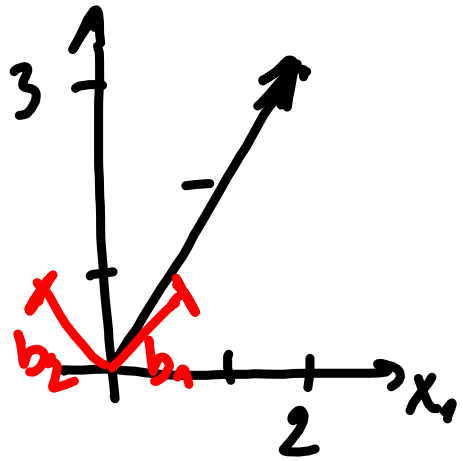
$$c = \sum_{n=1}^{N} x[n]\,b[n]$$

$$x = \begin{bmatrix} 2 \\ 3 \end{bmatrix} \quad b_1 = \begin{bmatrix} 1 \\ 0 \end{bmatrix} \quad b_2 = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

$$c_1 = x^T b_1 = x[1]\,b[1] + x[2]\,b[2] =$$

$$\begin{bmatrix} 2 & 3 \end{bmatrix} \begin{bmatrix} 1 \\ 0 \end{bmatrix} = 2$$

$$c_1 = x^T b_2 = \begin{bmatrix} 2 & 3 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} = 3$$



$$b_1 = \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} \quad b_2 = \begin{bmatrix} -\frac{1}{\sqrt{2}} \\ +\frac{1}{\sqrt{2}} \end{bmatrix}$$

$$c_1 = x^T b_1 = \begin{bmatrix} 2 & 3 \end{bmatrix} \begin{bmatrix} \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} = 3{,}5$$

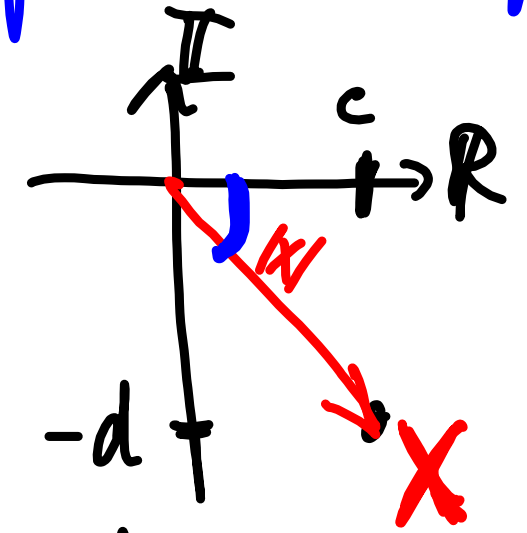
$$c_2 = x^T b_2 = \begin{bmatrix} 2 & 3 \end{bmatrix} \begin{bmatrix} -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} \end{bmatrix} = 0{,}7$$

$\sqrt{c^2 + d^2}$

sqrt(c.^2 + d.^2)

np.sqrt(np.pow(c,2) + np.pow(d,2))

$X = c - jd$



$|X| = \sqrt{c^2 + d^2}$ ✓

≈ how much!

X = c + 1j*d;

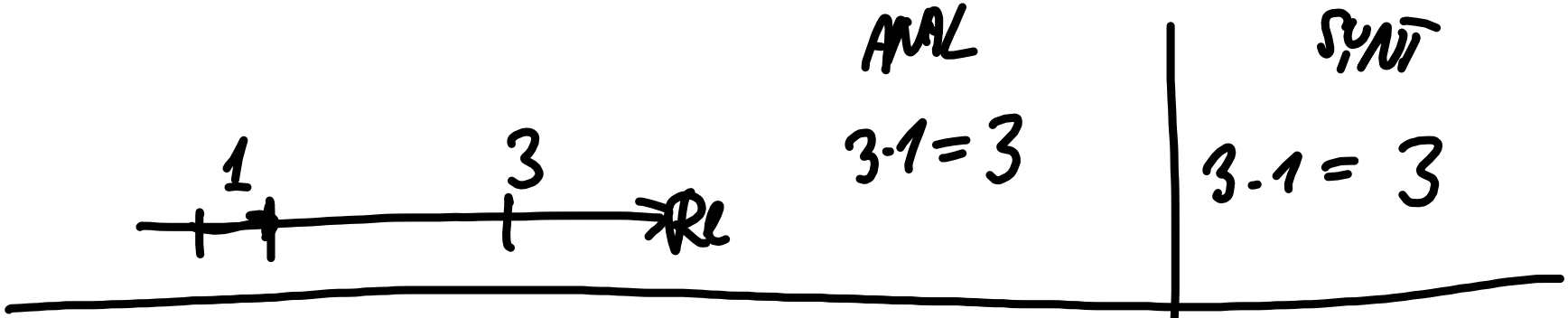
which frequency ✓ k

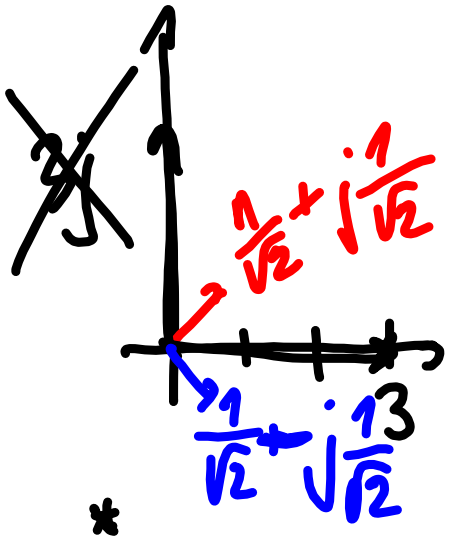
$\cos\left(2\pi \frac{k}{N} n\right)$

norm. freq.

$F_s \rightarrow Hz$

how shifted arg(X) ✓

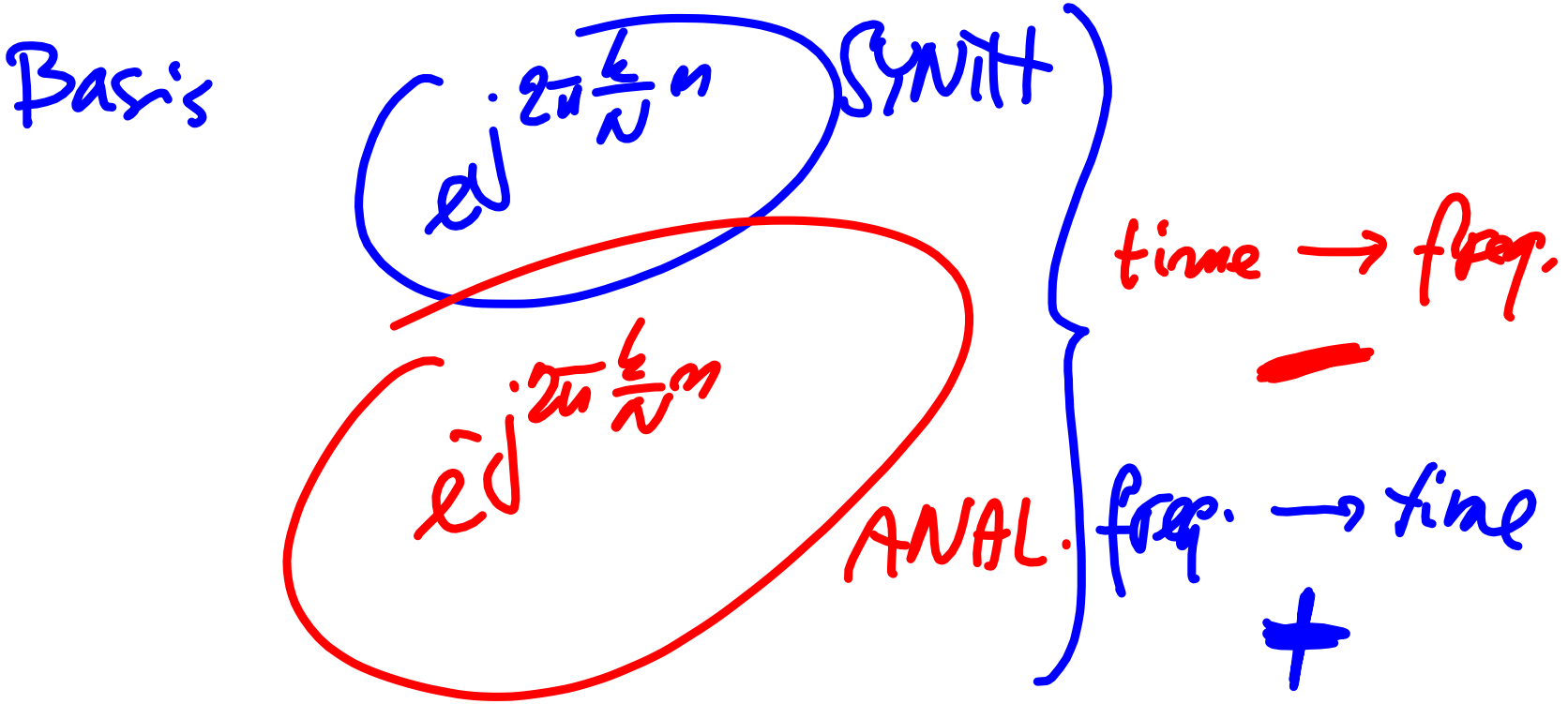




a^*

$2.12 + j\,2.12$

$2.12 - j\,2.12$


Basis
SYNTH
ANAL.
time → freq.
freq. → time
−
+