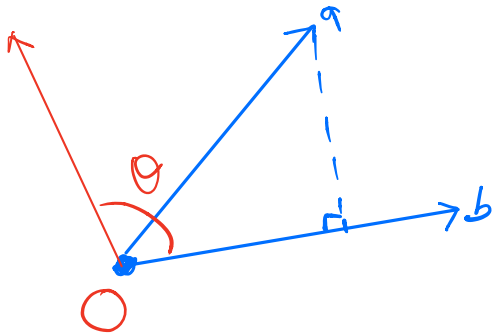


$$a \cdot b = c$$

$$1 \times n \quad n \times 1 \quad 1 \times 1$$



각도가 0에 가까워수록 커짐.

$$|b| |a| \cos \theta$$

[90° 처음
0° 처소

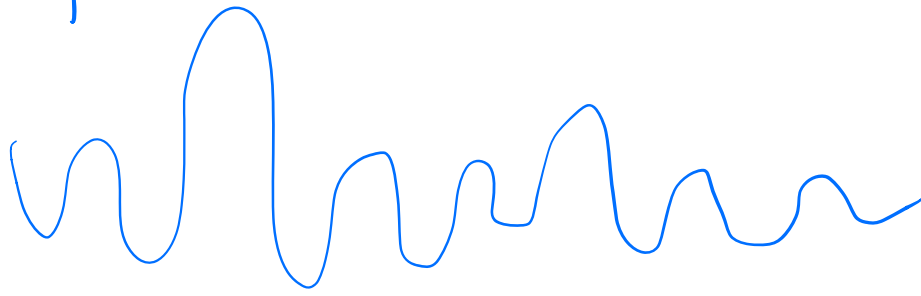


30개라 하면

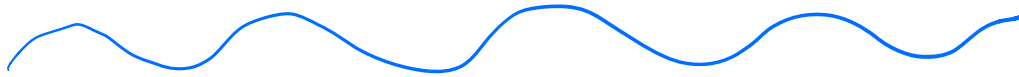
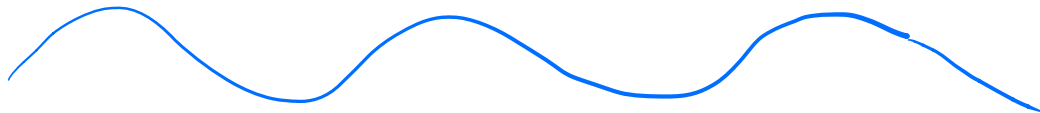
wave도 시간 장의 'vector'

어떤 wave 속에 어떤 성분이 많은가를 알아내는 것이 중요.

complex wave



target
wave

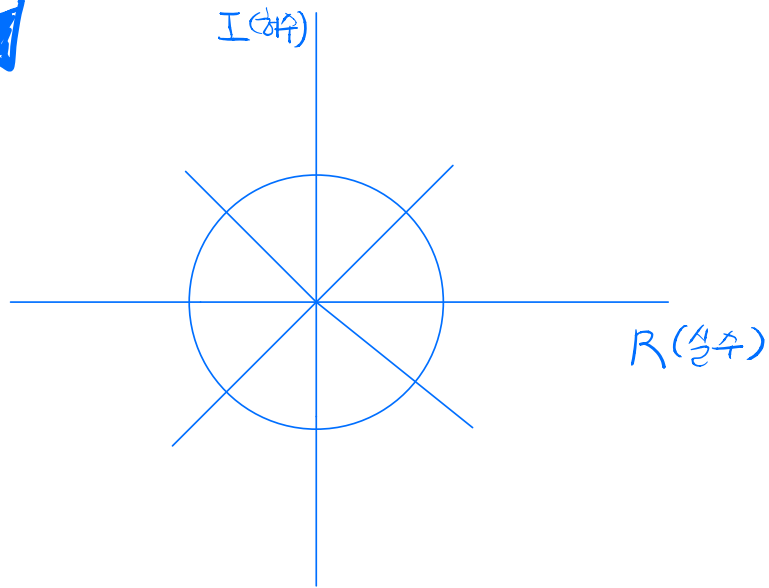


probe

★ Inner product

phasor의 가치

[simple phasor : \sin, \cos
complex phasor : $e^{j\theta}$

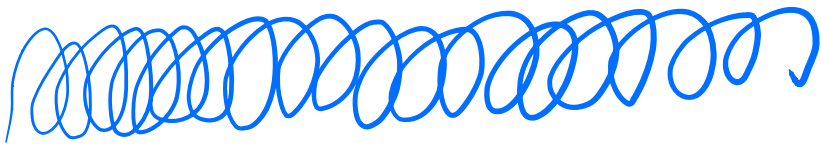
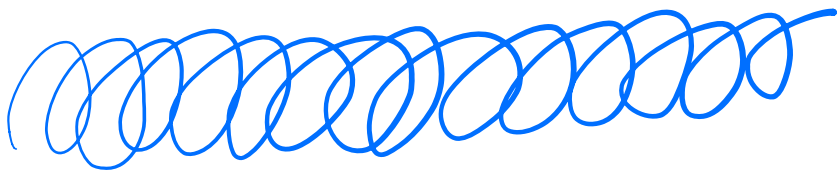
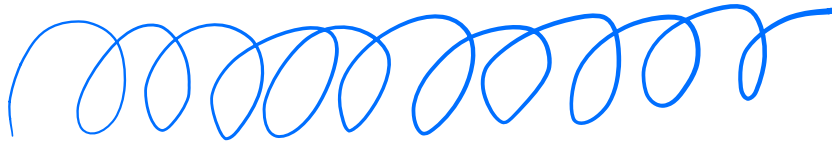
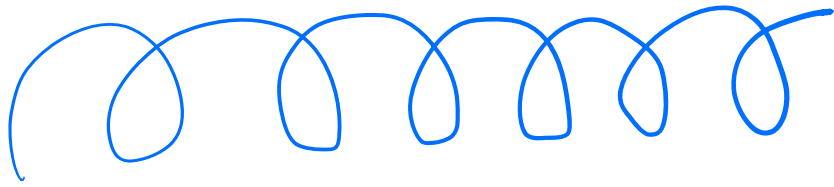


target wave 에 방향에 따라 probe 되는 값들이
너무 민감하게 변함

phase sensitivity가 너무 커서 쓰기 어려움.



⇒ ∴ complex phasor 사용!!



$$|b| \quad |a| \cos \theta = c$$

$$|x_h| \quad |x|$$

$$|x|$$

complex phaser \Rightarrow 사용하면 complex number가
(c)

결과값으로 나올 것.

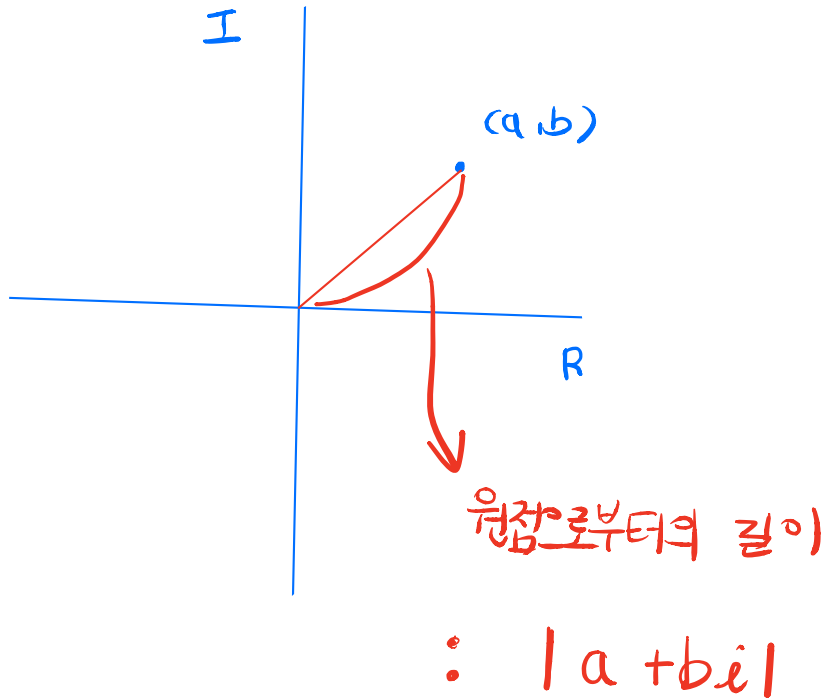
complex number가 inner product의 결과로 만들어짐.

곱했더니 complex number가 나와서 plotting이 불가능

⇒ $|a+bi|$ ★ 절댓값을 씌움

기존 wavw의 실수 벡터와 inner product를 하면 하나의 값들이 결과로 만들어짐.
그러나 그 값들이 complex number.

방법



nFFT = nSamp

amp = [];

for n in range(0, nFFT): ^{2π}

★ $\omega = 2 \cdot \pi \cdot n / \text{nFFT}$ # angular velocity
 $z = \text{np.exp}(\omega \cdot 1j) \cdot (\text{np.arange}(0, \text{nSamp}))$ # complex wave 만드는 줄
 amp.append(np.abs(np.dot(s, z)))
 절댓값

$e^{j\omega t} \times [0 \dots 100]$

for 루프 $W = 2\pi \times 0 / 100 = 0$

$= 2\pi \times 1 / 100$

⋮

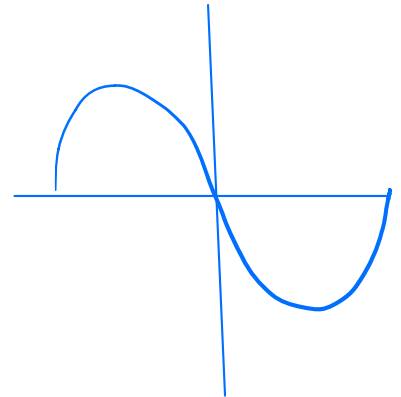
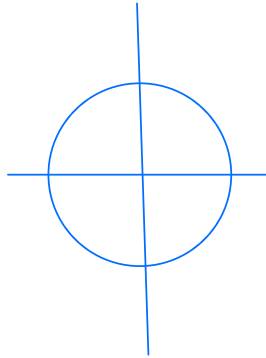
$$[2\pi \times \square \quad [0 \dots 100]] i$$

$$[0 \dots \dots \dots 2\pi] i$$

$\xrightarrow{100\% H}$

θ

$$\Rightarrow e^{\theta i} \text{ (한바퀴)}$$



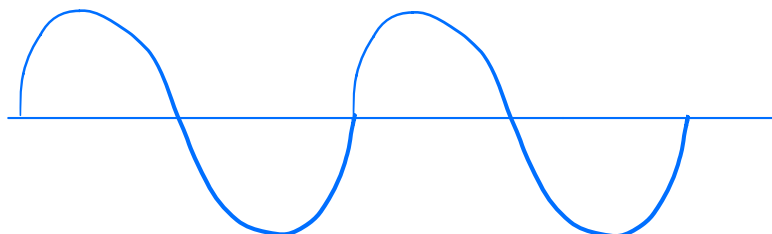
n 이 2가 들어가면

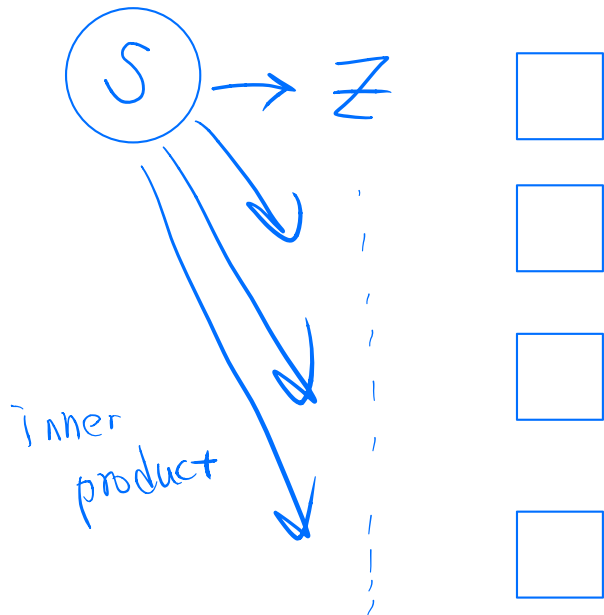
$$2\pi \times 2 \quad [0 \dots 1] i$$

$$[0 \dots \dots \dots 4\pi] i$$

$\xrightarrow{\theta}$

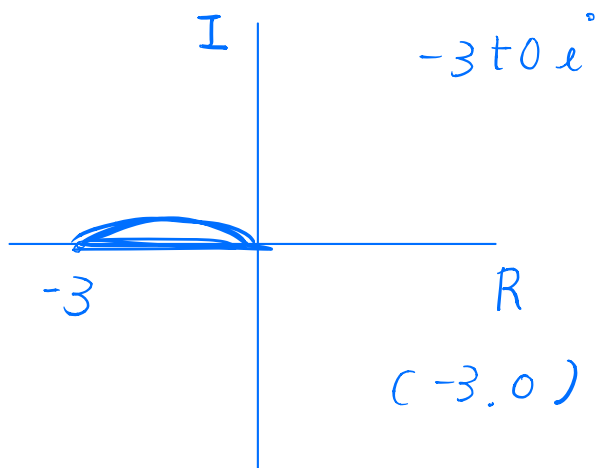
$$\Rightarrow e^{\theta i} \text{ (2바퀴)}$$





$Z_{n_{\text{samp}}-1}$

*abs의 의미



```
amp.append(np.abs(np.dot(s,z)))
```

다들 4고 4씩 100의 횟수만큼

amp에는 허수가 들어갈 수 x

⇒ 이제 amp를 plotting하면 됨

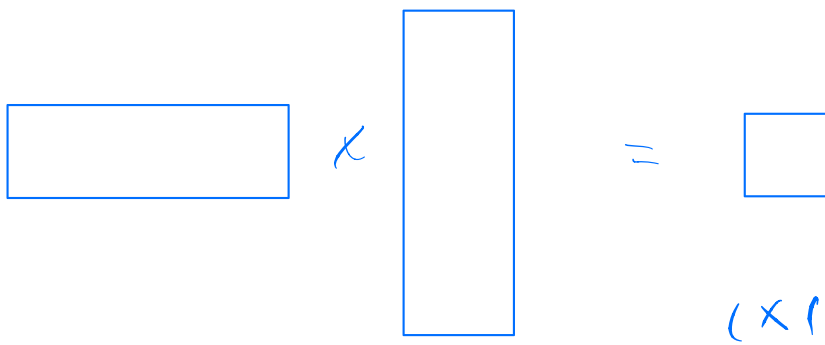
```

fig = plt.figure()
ax = fig.add_subplot(111)
freq = np.arange(1,nFFT+1)*sr/nFFT;
ax.plot(freq, amp)
ax.set_xlabel('frequency (Hz)')
ax.set_ylabel('amplitude')

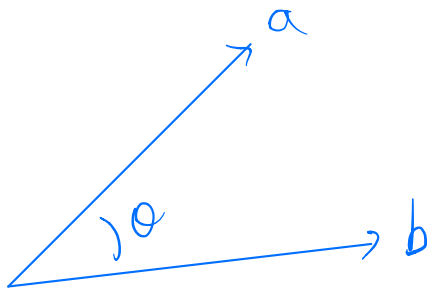
```

$$\begin{array}{l}
 \text{vector} \quad \quad \quad \text{sr} \quad \quad \quad \text{samp} \\
 [1 \dots 100] \times 10000 / 100 \\
 \hline
 \downarrow \text{ >44 same} \\
 = [100 \dots 10000] \quad \sim \quad \left(\frac{1}{\sqrt{N}} \right)
 \end{array}$$

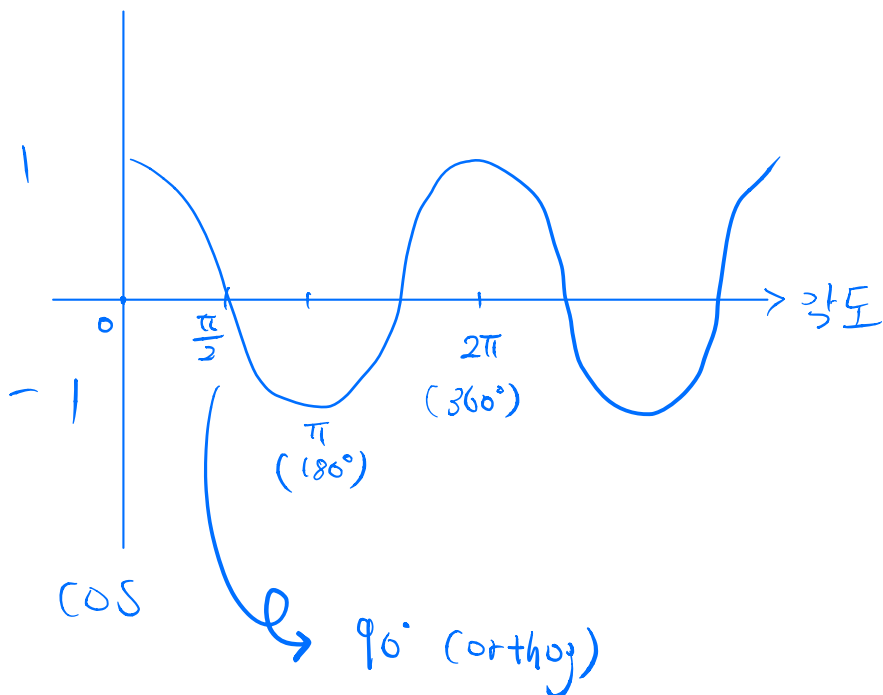
dot product



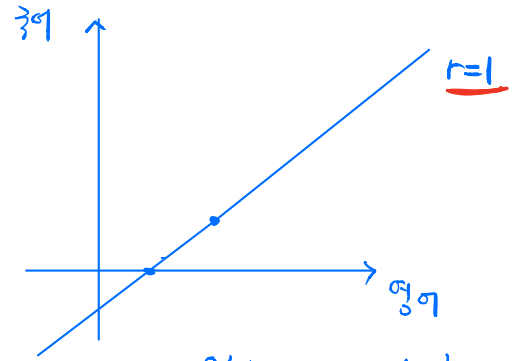
Same sized vectors



$$\cos(\theta) = r$$



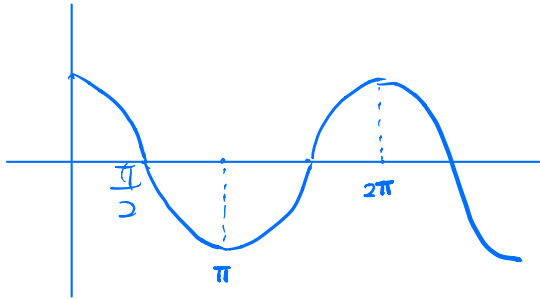
학생 수	a = 영어	b = 국어
1	10	0
2	20	10
...
10	100	90



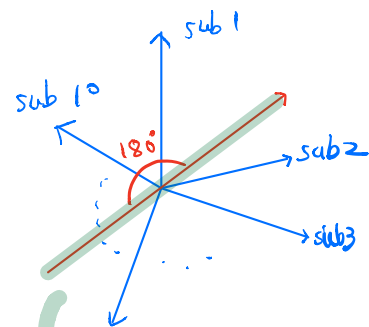
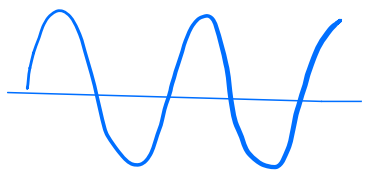
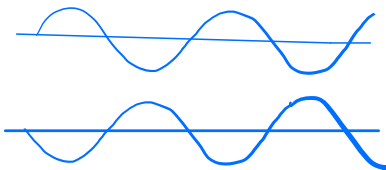
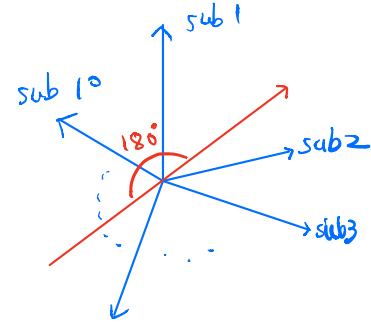
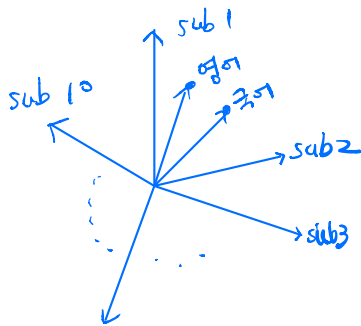
일직선상에 가자음수록
r 값이 '1'에 가깝다.

Q) 어떤 data를 줬었는지 one's 경우

⇒ 영어, 국어 test 이의 각도가 '0'이 될 것



10차원



이런게 선형과 관련성