Basics

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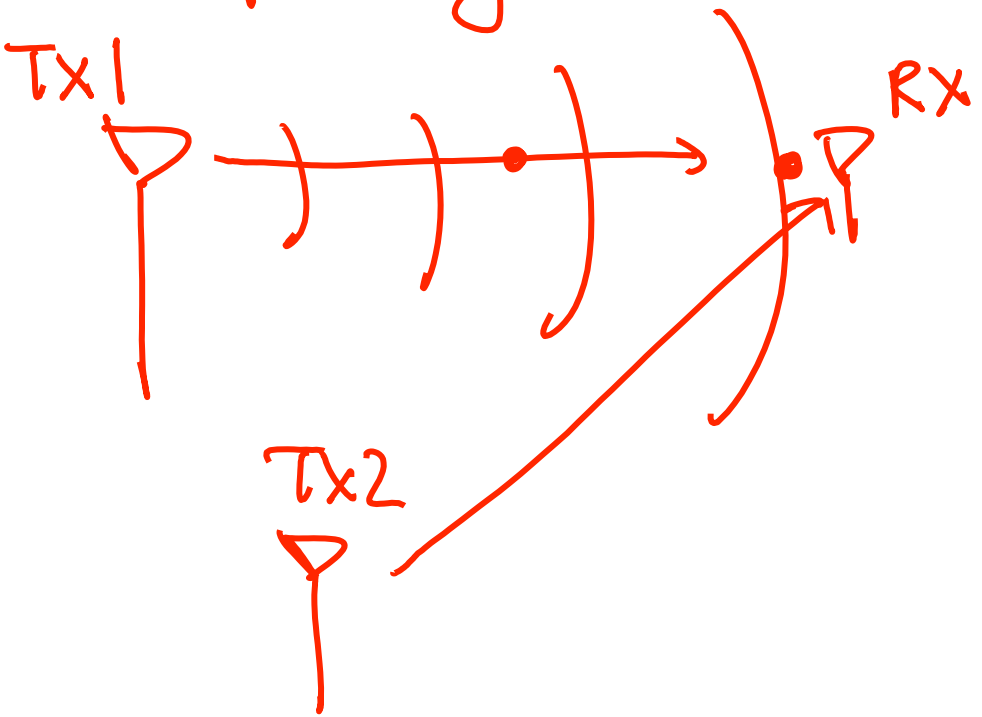
Multiplexing

$\cos(\omega t + \phi)$



$S_1(t)$ → Tx1

$S_2(t)$ → Tx2

"+"

Rx1 ↘ $r(t) = S_1(t) + S_2(t)$

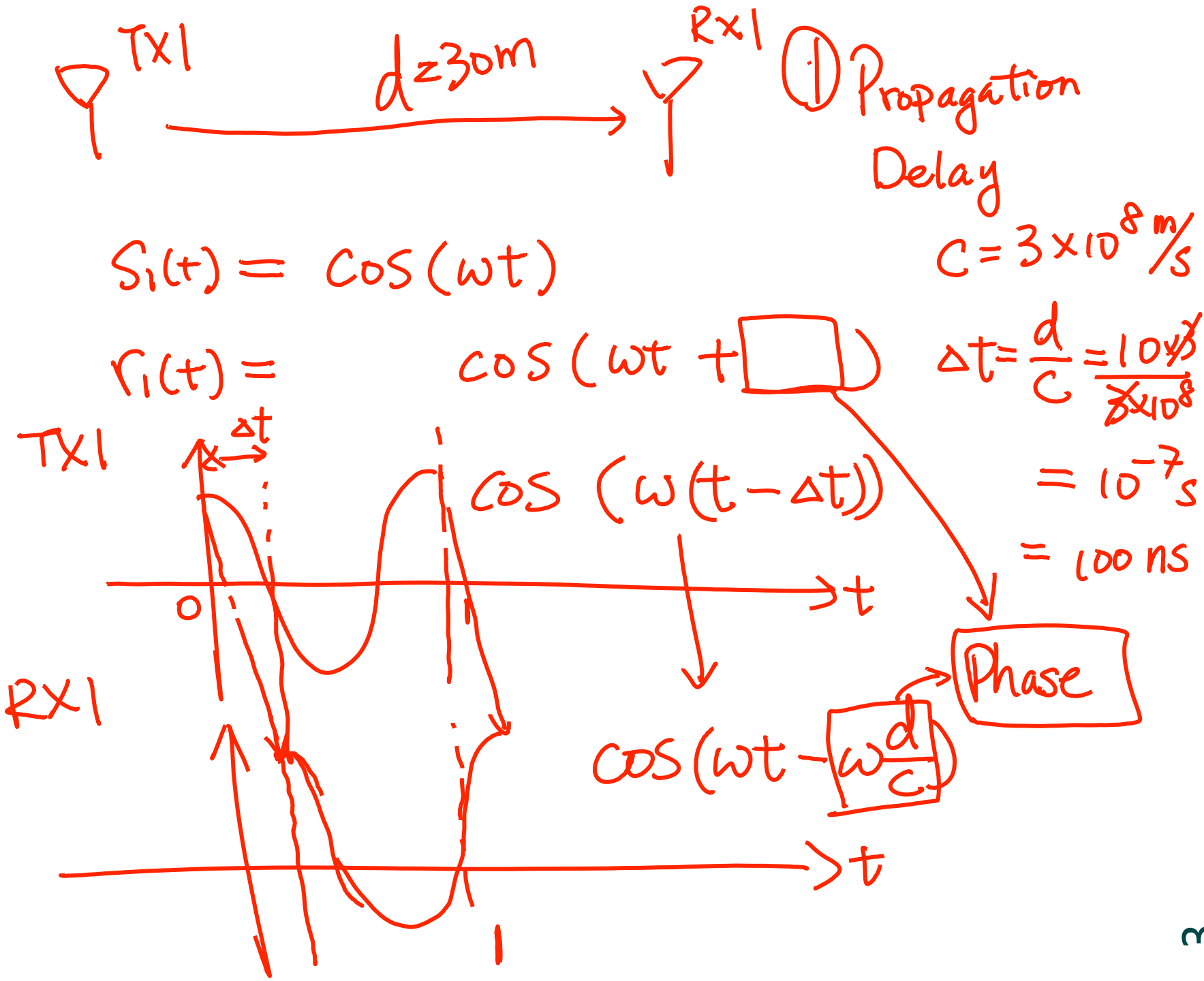
Tx1

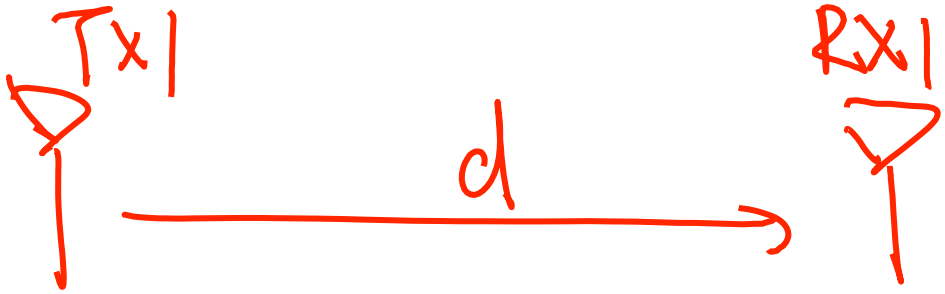
(1)

Wireless Comm.

⇓

Broadcast "+"


TX1
d=30m
RX1
① Propagation Delay
$s_1(t) = \cos(\omega t)$
$r_1(t) =$
$\cos(\omega t +$ [ ] $)$
$c = 3 \times 10^8$ m/s
$\Delta t = \frac{d}{c} = \frac{10}{3 \times 10^8}$
$= 10^{-7}$ s
$= 100$ ns
TX1
Δt
$\cos(\omega(t - \Delta t))$
0
t
RX1
Phase
$\cos(\omega t - \omega \frac{d}{c})$
t



$$s_1(t) = \rho_1 \cos(\omega t)$$

$$r_1(t) = \frac{\rho_1}{a} \cos(\omega t)$$

② a: channel loss

$$a \propto \frac{1}{d}$$

X

這邊上課講錯，應該是

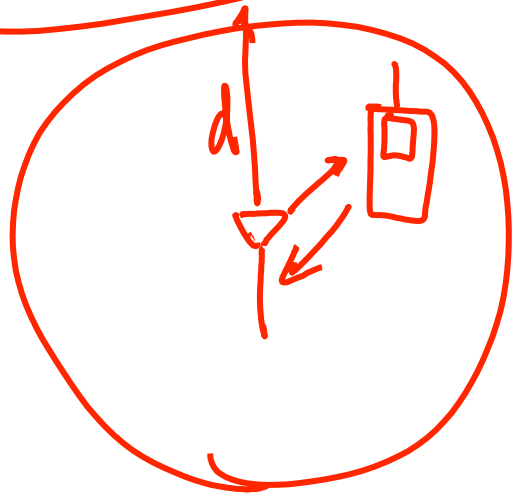
$$a \propto d$$

1. Spatial Multiplexing

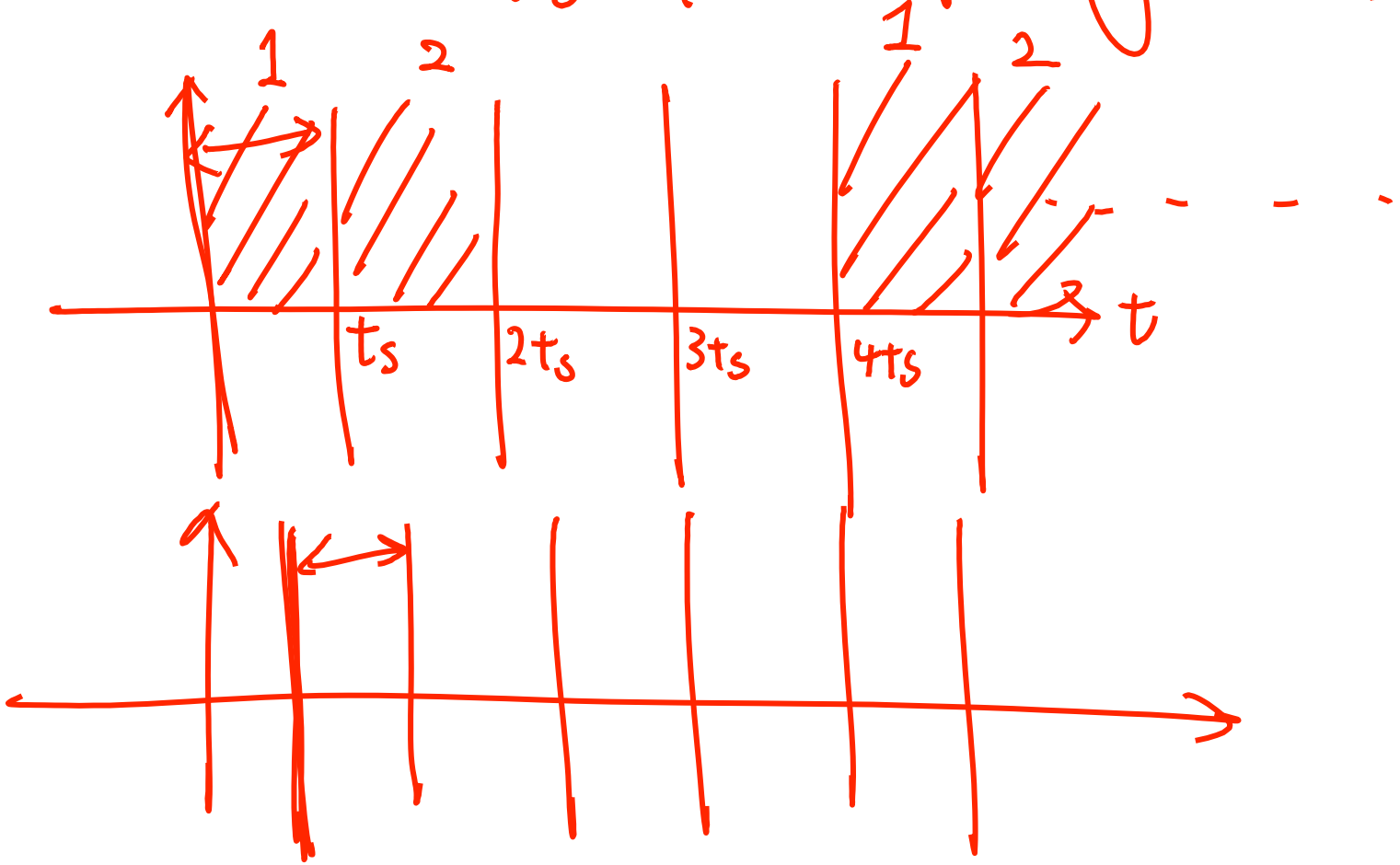
↓

space

Directional Multiplexing



2. Time-Division Multiplexing



3. Code-Division Multiplexing

4. Freq. Multiplexing

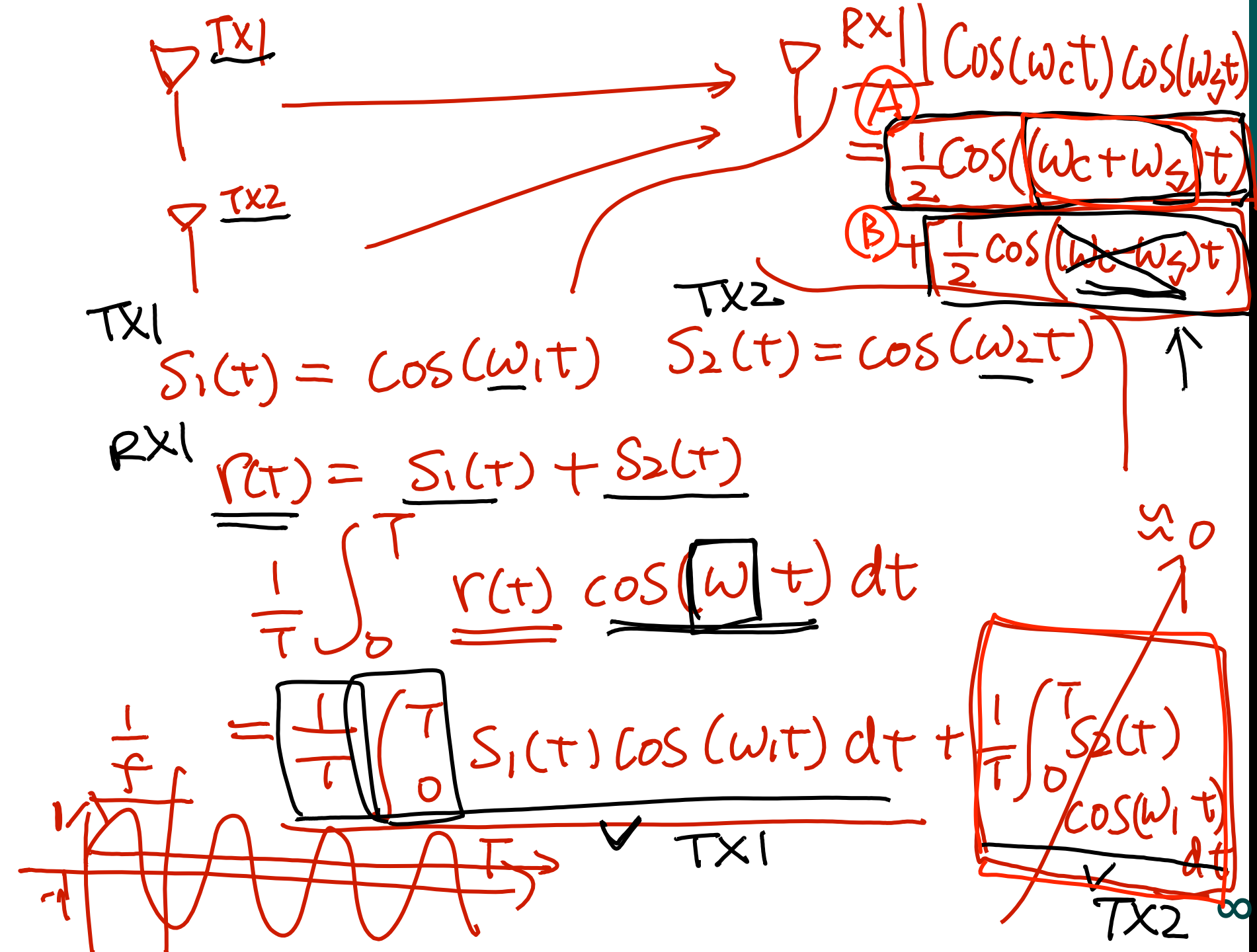
$$s_1(t) = \cos(\omega_c t)$$

$$\frac{1}{T}\int_0^T s_1(t)\cos(\omega_c t)$$

$\cos(\omega_c t)\cos(\omega_c t)$

$\cos(\omega_c t)\cos(\omega_y t)$

$\omega_c \neq \omega_y$

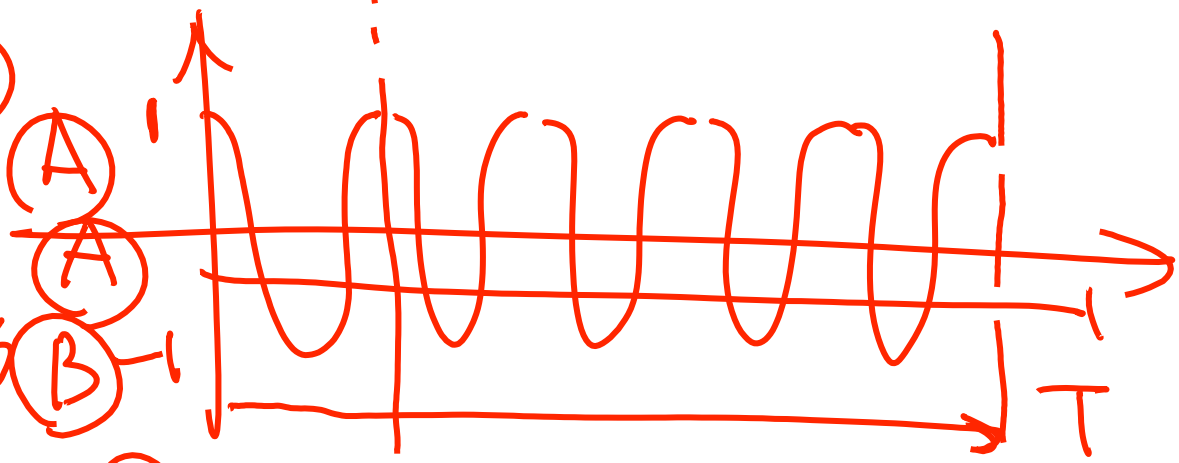

TX1
TX2
RX1
$\cos(\omega_c t)\cos(\omega_s t)$
A
$\frac{1}{2}\cos((\omega_c+\omega_s)t)$
B
$\frac{1}{2}\cos((\omega_c-\omega_s)t)$
TX1
$s_1(t)=\cos(\omega_1 t)$
TX2
$s_2(t)=\cos(\omega_2 t)$
RX1
$r(t)=s_1(t)+s_2(t)$
$\frac{1}{T}\int_0^T r(t)\cos(\omega t)\,dt$
≈ 0
$=\frac{1}{T}\int_0^T s_1(t)\cos(\omega_1 t)\,dt+\frac{1}{T}\int_0^T s_2(t)\cos(\omega_1 t)\,dt$
$\frac{1}{f}$
1
-1
T
TX1
TX2

如果

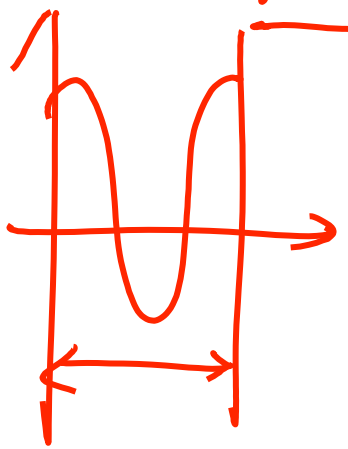
$\cos((\omega_c+\omega_s)t) = \cos(2\omega_c t)$

$\omega_c = \omega_s$

(TX1)

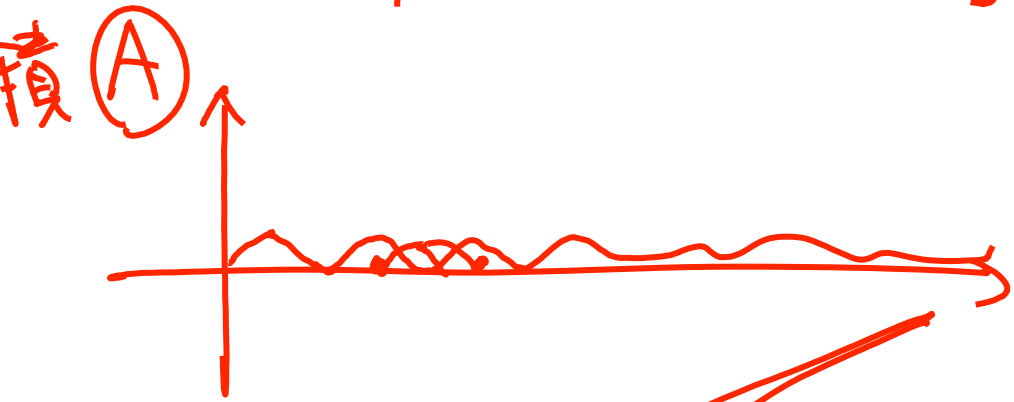


$T \rightarrow \frac{1}{\frac{\omega}{2\pi}}$



$\omega_c \neq \omega_s$

(TX2)



$\cos(0) = 1$

$\frac{1}{T}\int_0^T \cos(0) = 1$