We thus say this method of modulation

$y(t) = x(t)\cos(\omega_0 t)$ is $\boxed{}$

In an AM radio, ω_0 ranges from
500 kHz to 1.6 MHz.

$\boxed{\text{AM}}$

We will talk more about AM in
Chapter 8.

* 2nd Application of the multiplication property

Computing FT using the product form

Example $x(t) = \dfrac{\sin t \sin t/2}{\pi t^2}$

Find $X(j\omega)$

Ans:

* Differential Equations & F.T.

Q: consider a differential equation

$$\sum_{k=0}^{N} a_k \frac{d^k}{dt^k} y(t) = \sum_{k=0}^{M} b_k \frac{d^k}{dt^k} x(t)$$

Knowing $x(t)$, how to find $y(t)$

☆ How to use an LTI sys to solve this ordinary differential equation?

Sol'n:

* Once we find $H(j\omega)$, we can compute output $y(t)$ for any given input $x(t)$ by

$$\begin{tikzcd} x(t) \arrow[rr, leftrightarrow] \arrow[d, leftrightarrow] & & y(t) \arrow[d, leftrightarrow] \\ X(j\omega) \arrow[rr, leftrightarrow, "\cdot H(j\omega)"'] & & Y(j\omega) \end{tikzcd}$$

Example $\frac{dy(t)}{dt} + a\,y(t) = x(t)$ where $a > 0$

find $h(t)$, $H(j\omega)$?

Ans:

How to find $h(t)$?

Ans: ① Too hard for direct computation in this example.

② Can be solved by table look-up (Table 4.2)

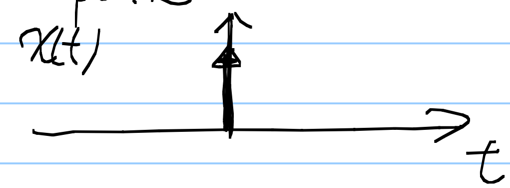
Review

* CT FT:

A signal can now be represented in either time or freq domain.

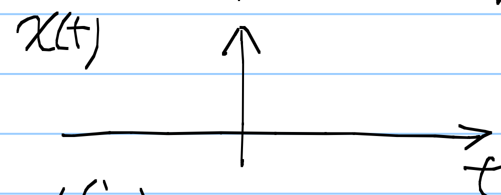
* 6 important F.T pairs.

① $x(t) = \delta(t)$

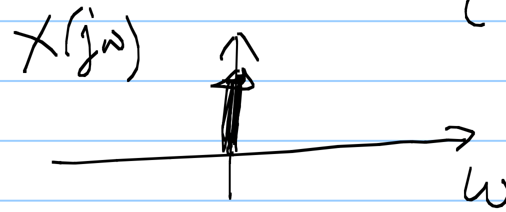


$X(j\omega) =$

② $x(t) =$



$X(j\omega) = \delta(\omega)$



③ Example 4.4

$x(t) = u(t+T_1) - u(t-t_1)$

$X(j\omega) =$

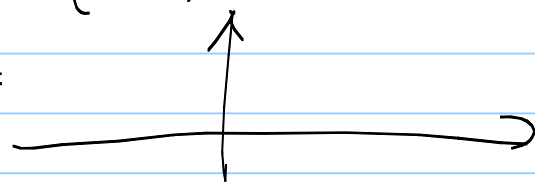
④ Example 4.5

$x(t) =$

$X(j\omega) = u(\omega+W) - u(\omega-W)$

(5) $x(t) = \cos(\omega_0 t)$

$X(j\omega) =$



$x(t) = \sin(\omega_0 t)$

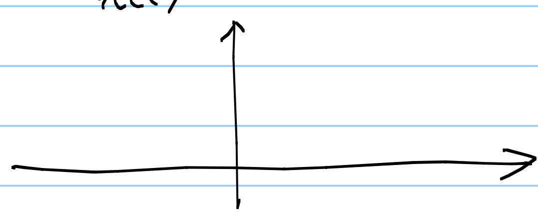
$X(j\omega) =$

(6) Example 4.8

$$x(t) = \sum_{k=-\infty}^{\infty} \delta(t - kT)$$

$X(j\omega) =$

$x(t)$



$X(j\omega)$

(6.1) $x(t) =$

$$X(j\omega) = \sum_{k=-\infty}^{\infty} \delta(\omega - kW)$$

Exercise: Plot $x(t)$ $X(j\omega)$ by yourselves