MATLAB equivalent representation of expression

Expression	Matlab representation
$x = \delta(t)$	$syms\ t;\ \ x = dirac(t)$
$x = u(t)$	$syms\ t;\ \ \ x = heaviside(t)$
$x = u(t - t_0)$	$syms\ t\ t_0;\ \ x = heaviside(t - t_0)$
$x=\delta(t - t_0)$	$syms\ t\ t_0;\ x = dirac(t - t_0)$
$x = e^{j\omega t}$	$syms\ t;\ \ x = exp(1i * t * \omega)$
$x = e^{-\lvert t\rvert}\cos(\omega t)$	$syms\ t\ \ \omega;\ x = \exp(-abs(t).* \cos(\omega * t)$
$x = \frac{1}{j\omega} + \pi\delta(\omega)$	$syms\ \omega;\ x = \left(\frac{1}{j * \omega}\right) + pi * dirac(\omega)$
$x = 2\pi\delta(\omega - \omega_0)$	$syms\ \omega\ \omega_0;\ x = 2 * pi * dirac(\omega - \omega_0)$

Example: Evaluation of "*definite integral*" *in* MATLAB

- **int(expr,var,a,b)**

  - inbuilt function in MATLAB computes the definite integral of **"expr"** with respect to the symbolic scalar variable **var** from a to b.

- $F = \int_0^1 x \log(1+x)\, dx$

```
syms x
expr = x*log(1+x);
F = int(expr,[0 1]);

Output:  F = 1/4
```

```
syms x
F = int(x*log(1+x),[0 1]);


Output:  F = 1/4
```

- $F = \int_0^{10} \frac{\cos(t)}{\sqrt{1+t^2}}\, dt$

```
syms t
f = cos(t)/sqrt(1 + t^2);
Fint = int(f,t,0,10)
Fvpa = vpa(Fint)
```

Fvpa =

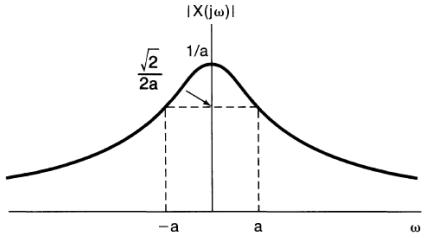
0.37570628299079723478493405557162

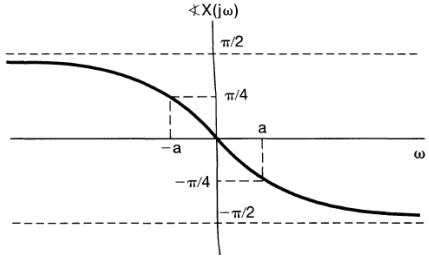
Example of evaluate Fourier-Transform using MATLAB

$$x(t) = e^{-at}\,u(t), a > 0$$

Analytical method

$$X(\omega) = \frac{1}{a + j\omega}$$

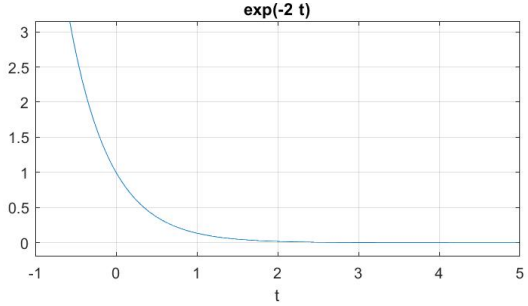




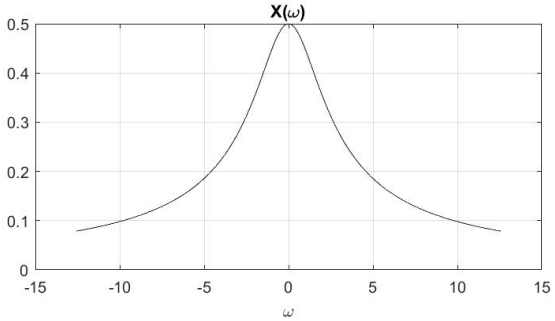
With MATLAB

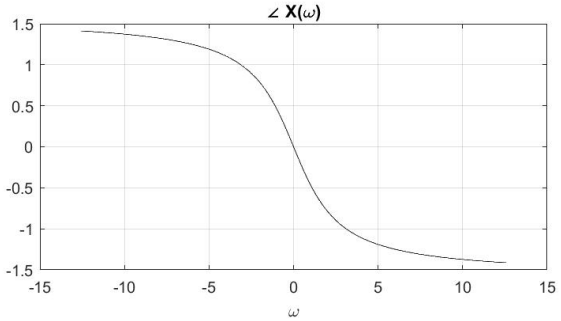
```
clc; clear all; close all;
syms t a

a=2; % consider a value of "a"
x= exp(-a*t).*heaviside(t); %expression

figure; subplot(2,2,1);
y= exp(-a*t);
ezplot(y, [-1, 5]); grid on; % original time-domain signal


k=1; mag=[]; phase=[]; omega=[];

for f= -2:0.01:2
    xw = int(x.*exp(-j*2*pi*f*t), t, -inf, inf); % Fourier
trans.
    mag(k)=sqrt( (real(xw))^2 +  (imag(xw))^2 ); % magnitude
    phase(k) = atan(imag(xw)/real(xw)); % phase
    omega(k)= 2*pi*f;
    k=k+1;
end
```

Cont..




```
subplot(2,2,3);
plot(omega, mag, 'k'); % magnitude plot
title('X(\omega)'); xlabel('\omega'); grid on;

subplot(2,2,4);

plot(omega, phase, 'k'); % magnitude plot
title('\angle X(\omega)'); xlabel('\omega');
grid on;
```





Task: Fourier transform

1. Write a MATLAB script to evaluate the Fourier-transform of the following signals:

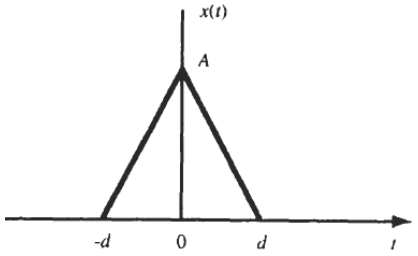
$(a)\ x(t) = e^{-|t|}\sin(10t)$

$(b)\ y(t) = 0.5\,[r(t+2) - 2r(t) + r(t-2)]$

$$(c)\ x(t) = \begin{cases} 0, t < -1 \\ t+1, -1 \le t < 1 \\ 2, t \ge 1 \end{cases}$$

$(d)\ x(t) = u(-t)$

(e)



(i) Plot the *magnitude and phase* of the Fourier-transform (assume f from -2 *to* 2)
(ii) Verify the obtained result *in (i) with analytical*

2. Write a MATLAB script to evaluate the impulse response $h(t)$ of a LTI system whose magnitude response is given as

$$|H(\omega)| = \begin{cases} 1, -\pi \le \omega \le \pi \\ 0, else \end{cases}$$

Note: can't use MATLAB inbuilt function

Cont..

3. Write a MATLAB script to evaluate the signal in time domain $x(t)$ from the Fourier-transform.

$$(a)\ X(\omega) = \frac{1}{(a + j\omega)^2}$$

$$(b)\ X(\omega) = \frac{1}{2 - \omega^2 + j3\omega}$$

Note: can't use MATLAB inbuilt function

Structure of lab report

a) Title of the experiment → "Creation a document using MS office"

b) Your name → XYZ, Roll-no: 1234

c) About the experiments →

d) Content of the experiment (diagram/programme source code/flowchart) →

e) Your observation/what you learned →

After complementation of the LAB, document has to be uploaded in Google classroom
filename: StudentName_rollNo

Thank you!