Σήματα και Συστήματα 2019 – Εργαστήριο
Εφαρμογή 3

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Ερώτημα 1ο

```
%1
syms t w;
x=exp(-t^2);
fourier(x)
pretty(ans)
```

```
Command Window
>> %1
syms t w;
x=exp(-t^2);
fourier(x)
pretty(ans)

ans =

pi^(1/2)*exp(-w^2/4)

                /     2 \
                |    w  |
sqrt(pi) exp|  - --  |
                \     4 /

fx >>
```

Ερώτημα 2ο

```
%2
syms t w;
X=1/(1+j*w);
ifourier(X,t)
pretty(ans)
```

```
>> %2
syms t w;
X=1/(1+j*w);
ifourier(X,t)
pretty(ans)

ans =

(exp(-t)*(sign(t) + 1))/2

exp(-t)  (sign(t) + 1)
----------------------
           2

fx >>
```

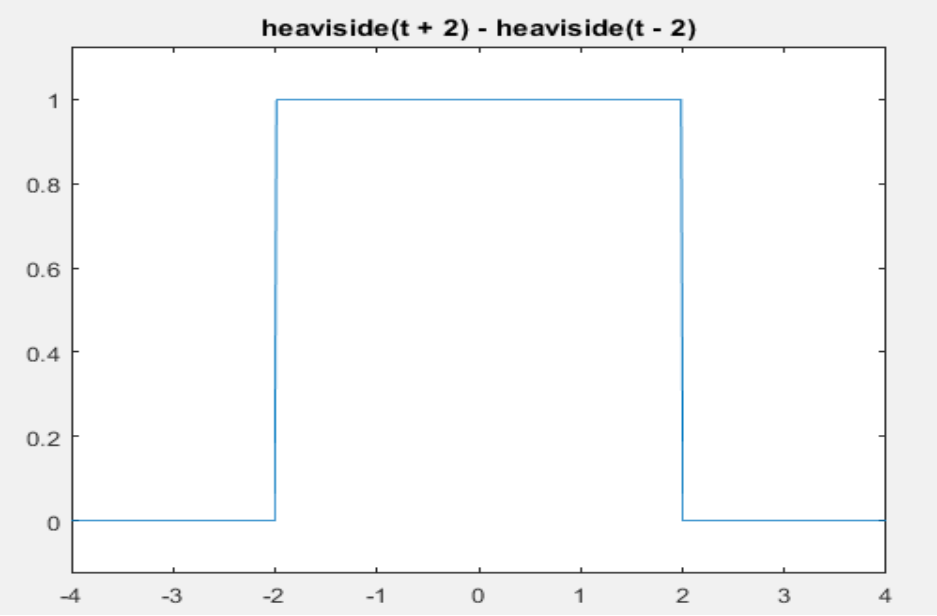
Ερώτημα 3ο

```
%3
syms w t;
x=1;
fourier(x,w)
pretty(ans)
```

```
>> %3
syms w t;
x=1;
fourier(x,w)
pretty(ans)

ans =

2*pi*dirac(w)

2 pi dirac(w)

fx >>
```

Ερώτημα 4ο

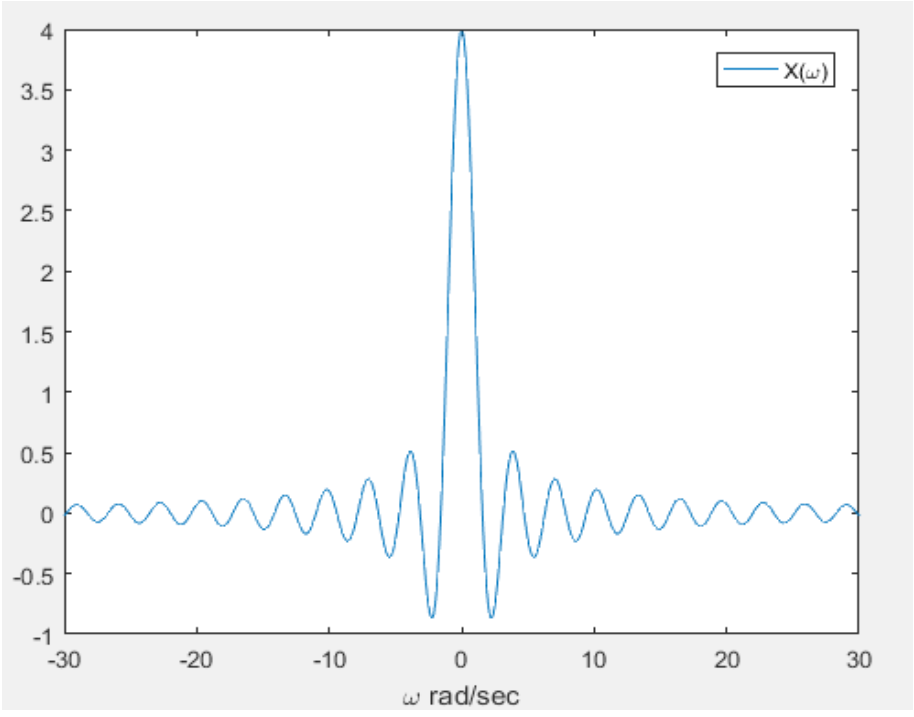
```
%4 sinc
syms t w T;
x=heaviside(t+T/2)-heaviside(t-T/2);
xx=subs(x,T,4);
ezplot(xx,[-4,4])
```



```
X1=fourier(x,w)
pretty(X1)
simplify(X1)
```

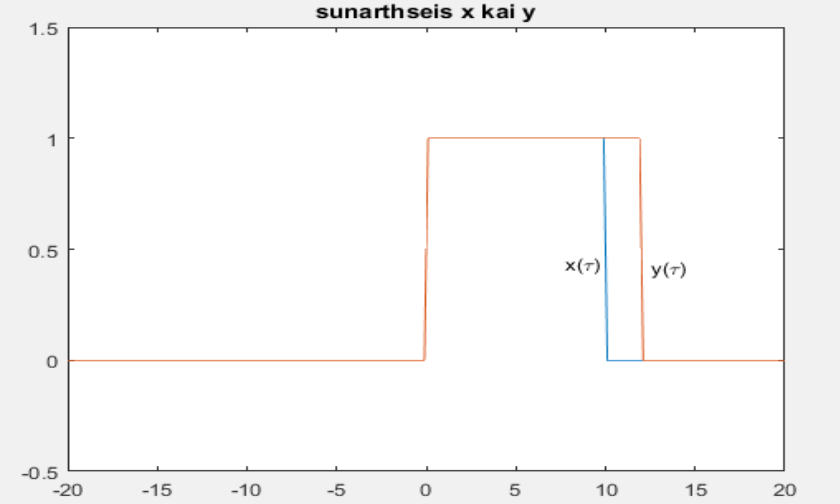
```
>> X1=fourier(x,w)
pretty(X1)
simplify(X1)

X1 =

(cos((T*w)/2)*li + sin((T*w)/2))/w - (cos((T*w)/2)*li - sin((T*w)/2))/w

   / T w \          / T w \       / T w \          / T w \
cos| --- | li + sin| --- |   cos| --- | li - sin| --- |
   \ 2  /          \ 2  /       \ 2  /          \ 2  /
-------------------------- - --------------------------
            w                             w


ans =

(2*sin((T*w)/2))/w

fx >>
```

```
ww=[-30:0.1:-0.1 0.1:0.1:30];
X=subs(X1,w,ww);
X=subs(X,T,4);
plot(ww,X);
xlabel('\omega rad/sec');
legend('X(\omega)');
```



Ερώτημα 5ο

```
%5
t=-20:0.1:20;
x=heaviside(t)-heaviside(t-8-2);
y=heaviside(t)-heaviside(t-8-4);
plot(t,x,t,y)
axis([-20 20 -0.5 1.5]);
title('sunarthseis x kai y');
gtext('x(\tau)');
gtext('y(\tau)');
```



```
syms t w T;
x=heaviside(t)-heaviside(t-8-2);
y=heaviside(t)-heaviside(t-8-4);
X=fourier(x,w)
pretty(X)
Y=fourier(y,w)
pretty(Y)
```

Command Window

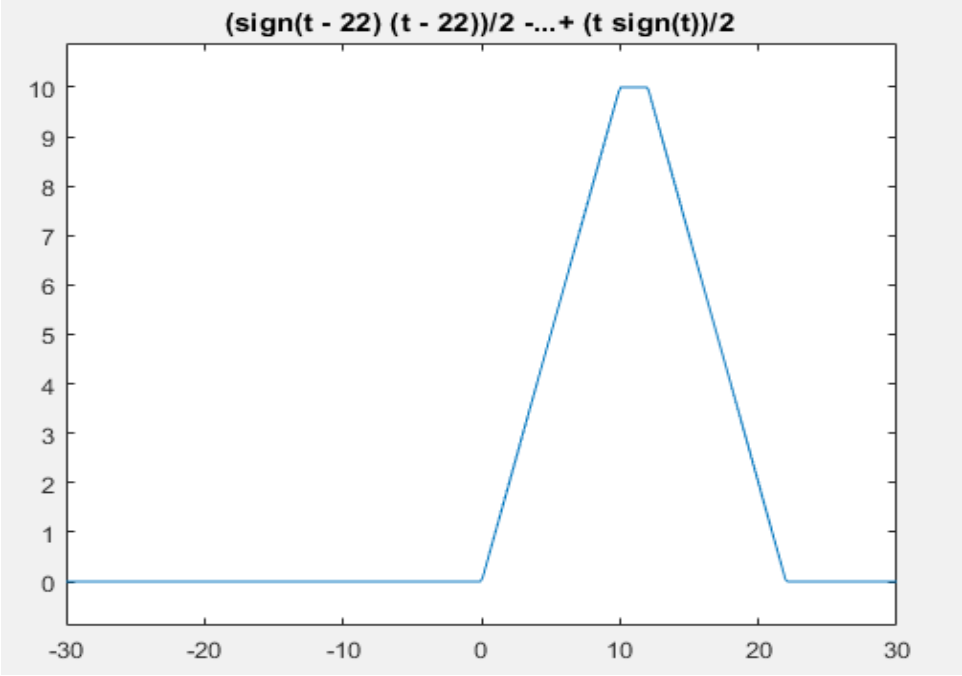
```
>> syms t w T;
x=heaviside(t)-heaviside(t-8-2);
y=heaviside(t)-heaviside(t-8-4);
X=fourier(x,w)
pretty(X)
Y=fourier(y,w)
pretty(Y)

X =

(cos(10*w)*li + sin(10*w))/w - li/w

cos(10 w) li + sin(10 w)    li
------------------------ - --
            w                w


Y =

(cos(12*w)*li + sin(12*w))/w - li/w

cos(12 w) li + sin(12 w)    li
------------------------ - --
            w                w

fx >>
```

```
B=X*Y;
Z=ifourier(B,t);
pretty(Z)
```

```
/                    / cos(10 w)       \         / cos(12 w)       \         / cos(22 w)
| pi t sign(t) + fourier| ---------, w, -t | + fourier| ---------, w, -t | - fourier| ---------,
|                      |     2          |         |     2          |         |     2
\                      \    w           /         \    w           /         \    w

      \         / sin(10 w)       \           / sin(12 w)       \           / sin(22 w)       \    \
  w, -t | - fourier| ---------, w, -t | li - fourier| ---------, w, -t | li + fourier| ---------, w, -t | li |/(2 pi)
      |         |     2          |           |     2          |           |     2          |    |
      /         \    w           /           \    w           /           \    w           /    /
```

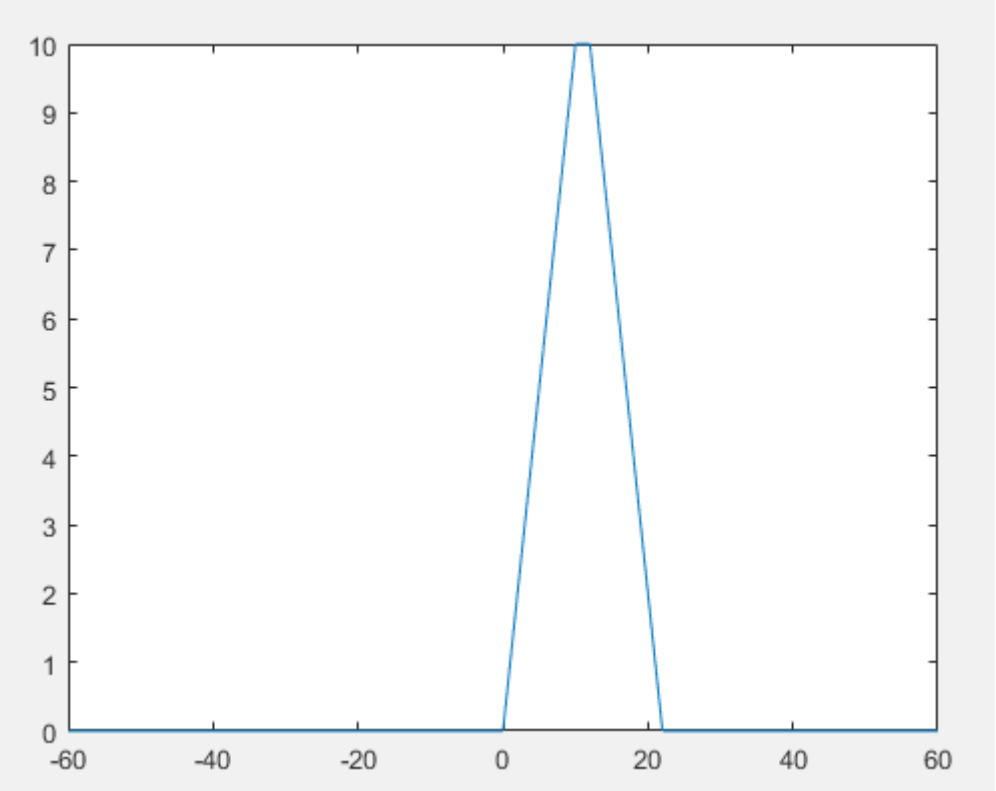
simplify(Z,'steps',20)
ezplot(ans,[-30 30])

```
>> simplify(Z,'steps',20)
ezplot(ans,[-30 30])

ans =

(sign(t - 22)*(t - 22))/2 - (sign(t - 12)*(t - 12))/2 - (sign(t - 10)*(t - 10))/2 + (t*sign(t))/2
```



Ερώτημα 6ο

```
%6
t=-30:0.01:30;
x=heaviside(t)-heaviside(t-8-2);
y=heaviside(t)-heaviside(t-8-4);
plot([-60:0.01:60],conv(x,y)*0.01)
```



Επομένως λαμβάνουμε ίδιο αποτέλεσμα με το ερώτημα 5.