	ECE 102 HW5
1. a)	If fet) is imaginary: fet) = jx(t) if x(t) is real ()
	Fourier Series and many of Whole mandenant would get
	Fourier Series: $C_{k} = \frac{1}{T_{0}} \int_{t_{0}}^{t_{0}+T_{0}} f(t) \left[\cos\left(\frac{2\pi kt}{T_{0}}\right) - j\sin\left(\frac{2\pi kt}{T_{0}}\right) \right] dt$
	$C_{t} = \frac{1}{10} \int_{0.07}^{30.470} iy(t) \left[\cos\left(\frac{2\pi kt}{T_{t}}\right) - i\sin\left(\frac{2\pi kt}{T_{0}}\right) \right] dt$
	$C_{K} = \frac{1}{10} \int_{10}^{30+70} j \chi(t) \left[\cos \left(\frac{2\pi Kt}{T_{0}} \right) - j \sin \left(\frac{2\pi Kt}{T_{0}} \right) \right] dt$ $C_{K} = j \frac{1}{10} \int_{10}^{30+70} j \chi(t) \cos \left(\frac{2\pi Kt}{T_{0}} \right) dt + \frac{1}{10} \int_{10}^{40+70} j \chi(t) \sin \left(\frac{2\pi Kt}{T_{0}} \right) dt$
	Imaginary (CE) Real (CK)
	$Real(C_K) = -Real(C_K)$ $Im(C_K) = Im(C_K)$ $Im(C_K) = Im(C_K)$
	the mitthed of CKR = C-K of many matel with 1 does
	TRUET blook K perion of shotiuposis.
	1) The construction Lick = - Lick + Transce sales)
	There is a slight difference, as the version discussed
	m class was I Com = - 4 Com to the man of 18/1
	Comment of the Commen
b)	
	one positive frequency component (Cx box >0)
	power (of Agent of Mary down house and blade (160)x
	power of 9 m 20 160 cke jkwot
	[Wo = 21] x(t) = E GRE SKENT VIDAIPANI A (1) (W)
63	Fourier coefficients should be odd and imaginary for xct)
	$\chi(t) = C_0(e^{j2nt} - e^{-j2nt})$
	Co is imaginary, replace it with jx [x is real] and simplify it
	$\dot{x}(t) = -2x\sin(2\pi t)$
	The exponent is 9, and according to Parseval's Theorem
7043 0A	$1001 \times 1001 \times 1000 \times 2000 \times 1000 \times $
	$x(t) = -3-\sqrt{2}\sin(2\pi t)$ $x(t) = 3-\sqrt{2}\sin(2\pi t)$
	se, shifting a singlet own creater a vigil exemplement
c)	Y(jw) = Say(+) e -jwt dt John Homer Series y(+)
	YR = To Say(t) e - j (= To) dt Fourier Series Coefficients 47(t)
	Determine relation between these two equations
	$Y_k = \frac{1}{T_0} Y(j_W) \left[W = \frac{Z\pi k}{T_0} \right]$

	1 CC 102 Nov 5
2. a)	i) (x(+) is even as a substant of the substant
	The fourier fransform should be even as well.
	IAD El are all even based on their graphs
	ii) x(t) is odd
	The Fourier transform should be odd as well
	OFEL Vast Baker of the Sail Control of the Sai
	iii) x(t) is real and a lange (a) mil (b) x(t) is real (a) lange (b) x (iii)
	real [X(jw)] is even Im [X(jw)] is odd
	Magnitude is even phase is odd
	CEL MATANA MON
	iv) x(+) is complex (neither real, nor pure imaginary)
	X()w) is neither Hermitian, anti-Hermitian
	excludes answer from 115)
	[AB] one complex
	v) x(+) is real and even
	X()w) shald be real and even as well
	E SAME SAME SAME SAME SAME SAME SAME SAM
	vi) x(+) is imaginary and odd
	X(jw) should be real and odd
	THE THE STEET OF THE SON COLX
414	vii) x(t) is imaginary and even
	x(jw) is imaginary and even as well
	The expansion of and acquision of assemble the formation of the Designation of the Design
	viii) there exists a non zero wo such that e Two tx(t) is real, even
	X() (w-wo)) is also real and even
	i.e. shifting a signal can create a real, even signal
	look for an off center one to start
Old the	A) of B) was some former some B of B)
	Beismann related between these two constructs
	The total law to at

b)	i) The convolution of a real and even signal and a real and
	odd signal, is odd a see addag X (a) & (a) ax
	a(t): real and even b(t): real and odd
	convolution: $c(t) = a(t) + b(t)$
	Fourier transform: ((jw) = A(jw)B(jw) maginary real real odd even odd
	Since the Fourier transform is imaginary and odd,
	the original function c(t) is real and odd then
	TRUE WOOD THE MAN TANK OF THE CONCLERE
	is) The convolution of a signal and the same signal
	reversed is an even signal. Wax and all will smill
	a(t): signal b(t): reversed version of alt)
	convolution: c(t) = a(t) + b(t)
	Fourier transform: (()w) = a(jw) a(-)w) = a(jw) b(jw)
and the second section of the second	Since the Fourter transform is even, the original
e_)	function c(t) is even as well,
	TRUE (1) I'm read and even the Marin Pala (1)
	tould also be real and from for the thirty
c)	i) If x(t) = x*(-t), then X(jw) is real
	X(jw) will be real if Xx(jw) = X(jw)
	Try to check the above statement
	X*()w)= 5-00 [x(+)e-jw+]*d+
	X*(jw) = for x*(t) e jart dt
	Variable substitution $-t = T$
	$\chi^{\star}(j\omega) = \int_{-\infty}^{\infty} \chi^{\star}(-\overline{\nu})e^{-j\omega} d\overline{\nu}$
	Xx(jw)= 5-00 x(T)e-jwtdv
	Xx(jw) = X(jw) mas agree all best
	Therefore, X()w) is real
	Each Triumle & 1
· · · · · · · · · · · · · · · · · · ·	
•	1 1 X 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2

```
ii) x(t) is real Fourier transform X(jw)
        Xe ()w) = Re { X()w) }
         Xo()w) = ) Im {X()w)}
        X ()w) = Xe()w) + Xo()w)
         X()w) = 5-00 xeltle-jut at + 5-00 xoltle-jut at
         Simplify with Euler
         X(jw) = 5-00 Xelt) cas(w+)dt - j5-00 Xolt) sin(wt) dt

Xeljw): real Yo(jw): imaginary
       Real { X(Jw)} = S-00 Xe(+) cos(wt)d+ = Xe(jw)
       Im { X(jw)} = 500 Xo(+) str(w+) d+ = -j Xo(jw)
3, a) 50 X(jw)dw
       X(+) = ZT 5-00 X(JW)e Jut dw [Inverse Fourter]
        Observe what happens at += 0
        X(0) = 27 5-00 X(JW)dW
        Because x(+) is real and even, the Fourier transform
        should also be real and even
        Therefore: x(0) = IT So X()w) dw
        Reevaluate: 50 X(DW) dw = T . X(O) = T
        ( X() w) dw = TT
 b) X()w) | w=0
       X(jw) = S. o x(+) e-ja+d+
        Since w=0, the exponential can be ignored
        fox x(+)d+
        Find the area of the trapezord in the graph
        Rectangle: 4
         Each Triangle ! }
             4 + [ 2 x 2] = 5
       X(jw) | w=0 = 5
```

c)	/X(yw)
	The given signal is even and real.
	Therefore, its Fourier Transform is real and even as well.
NO. (1997)	This means that [sphase of X(jw) =0 X(jw) >0]
	(phase of X(jw) = TI X(jw) <0
	Compatible fragment (with the compatible of the
(1)	J-00 E J X (Ju) dw = 12 1 (00 10) 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Inverse Fourser Transform & Marie and Marie an
	x(t) = 211 Loo X(jw)e jut div
	Day that t=- steek (=) some + (=) and = (= (=))
	x(·1) = 27) 00 x() w) e - 3 dw
	J-w X(jw)e-jwdw
	Reevaluate: 2 T x x(-1) = 2T
	∫ -∞ e -; w X(; w) d w (== 2π / 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1 = 1
	The state of the s
e)	Plot the inverse Fourier transform of Re {e-3) w X(jw)}
	If Y(jw) = e -5ju X(jw) =
	y (+) = x(+-3)
	Based on this, we can see that y(t) is real
	Since y(t) is real it means that the Real component
	of Y(jw) is equivalent to the even component
	of 100).
	Re EY (jw) = Ye (jw) = Ye(t)
	The graph would be the even component of y(t)
	then, because it is an inverse Fourier fransform Yell) Yell
	0.5 4 2 - = (44) 3 /
_	(1 2 3 3 5 - 2 (W)
-6	-5 -4 -3 -2 -1 1 2 3 4 5 6 X

4. a)	i) X(+) = { 1 + cos (n+) 1+1<1
	of herwise
	$X(j_{N}) = \int_{-1}^{1} \left[1 + \cos(\pi t)\right] e^{-jNt} dt$
	= - 1 [e-iw -eiw] + 25(n-w) [-e-)(n-w) + e i(n-w)]
	2)(n+w) [e-)(n+w) -e)(n+w)]
	= 2 sin(w), sin(n-w), sin(n+w)
	$= \frac{2\sin(\omega)}{\omega}, \sin(\pi-\omega), \sin(\pi+\omega)$ $= \frac{1}{2}\sin(\omega), \sin(\pi-\omega), \sin(\pi+\omega)$
	Remember $sinc(t) \stackrel{\triangle}{=} \frac{sin(nt)}{nt}$
	Simplify and the standard of t
	$X(j\omega) = 2 \operatorname{sinc}(\frac{\pi}{\omega}) + \operatorname{sinc}(\frac{\omega + \pi}{\pi}) + \operatorname{sinc}(\frac{\omega - \pi}{\pi})$
	The State of the work of the State of the St
	ii) $X_2(+) = e^{(1-3)} + u(-+-1)$
	Rewrite X2 (+) so it can be split up easily
	X2(+) = (e)3+) (e+1) (e1) [u(-+1)]
	e+·u(-+) = 1-jw
	e(+-1) = a(-+11) = 1-jw 20100 201001 34 409 (3
	$= e^{(t-1)} \cdot u(-t+1) \cdot e^{33t} = e^{-3(w-3)}$
	$e^{(t-1)} \cdot \mu(-t+1) \cdot e^{j3t} \cdot e^{j} = \frac{e^{j-3(w-3)}}{j-j(w-3)} + i$
	$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
	1=1; (w-3)
	of the se appreciated to the event was the
	111) X3(t) = 2te-2+ u(t)
6	From lecture: F'(jw) = -j+[f(+)]
Y	Simplify: e-2+ult) = 1
	Remute X5(+)
	$X_3(t) = -\frac{1}{3} \cdot Z \cdot \left[-\frac{1}{3} + f(t) \right]$
	Fourier
	$\chi_3(j\omega) = -\frac{2}{5} \cdot F'(j\omega)$
	X3(jw) = - = 0 [d (1)]
•	$\chi_3(j\omega) = \frac{2}{(2+j\omega)^2}$
	$(2+j\omega)^2$

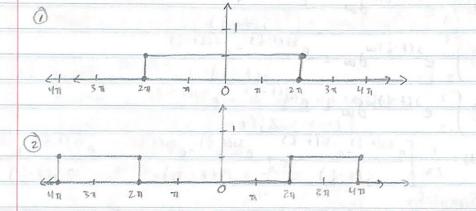
b) Inverse Fourier Transform $ \chi(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \chi(u) e^{j\omega t} du $ $ \chi(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \chi(u) e^{j(x)} du $ $ \chi(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \chi(u) e^{j(x)} du $
$\chi(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} \chi(\omega) e^{j\omega t} d\omega$
111 - I COO LV 11) CX(W)) W+1
X(t) - 7 n l-on \(\lambda(\mu)\) e o dw
Set up integrals based on the different sections of 1x(w)
$x(t) = \frac{1}{2\pi} \left[\int_{-3}^{-2} e^{-\frac{1}{2}w} e^{3wt} dw + \int_{2}^{3} e^{-\frac{1}{2}w} e^{3wt} dw + \int_{-2}^{2} \frac{1}{2} e^{-\frac{1}{2}w} e^{3wt} dw \right]$
Simplify the state of the state
V(1) = 1 [[-2] i(+-2)w + [3] v(1-2)w + [2] = o(+-2)w dw
(I) and (I) and (I) bear (I) bear (I) (I)
$ e^{-2j(4-\frac{1}{2})} - e^{-3j(4-\frac{1}{2})} $
j(+-\frac{1}{2})
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$
(3) (2 e) (+ = 2) W = e 25 (1 = 2)
$x(t) = \frac{1}{2\pi} \left(\frac{e}{1 - e} + \frac{e}{1 - e} + \frac{e}{1 - e} \right)$
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$
$\frac{3i(t-\frac{1}{2})}{1-\frac{3}{2}} = \frac{-3i(t-\frac{1}{2})}{1-\frac{3}{2}} = \frac{2i(t-\frac{1}{2})}{1-\frac{3}{2}} = \frac{2i(t-\frac{1}{2})}{1-\frac{3}{2}}$
Simplify $ \frac{1}{2\pi} \left[\frac{e^{3i(t-\frac{1}{2})} - e^{-3i(t-\frac{1}{2})}}{2i(t-\frac{1}{2})} + \frac{e^{-2i(t-\frac{1}{2})} - e^{2i(t-\frac{1}{2})}}{2i(t-\frac{1}{2})} \right] $ Simplify (Filen)
)1)1101111 (2.11.3)
$\chi(t) = \frac{1}{2\pi} \left[\frac{2\sin(3t - \frac{2}{2})}{(t - \frac{1}{2})} \frac{\sin(2t - 1)}{(t - \frac{1}{2})} \right]$
Contract of the contract of th
The and a global had been been all the second and t
the way that the table 12 to 1
[/ WILL S = 3 ff year(1961) - WILL = 3 fm O A M M M M M M M M M M M M M M M M M M
The second secon
The second secon
Ashanina mana halama halama Mana Gala Ina

c) $f_1(t) = sinc(2t)$ $f_2(t) = sinc(t) cos(3\pi t)$ $sinc(t) = \frac{sin(\pi t)}{\pi t}$ $f(t) = (f_1 * f_2)(t)$

- 1) Fourier Transform Form)
- () F. (jw) = 1/2 rect (1/47 W)
- @ F2 ()w) = { [rect(2 W-3 T) + rect(2 BT+W)]

F, (jw) . Fz (jw) = F(jw)

Graph O and @ to observe how they overlap



Miracularsty, there is no overlap at all. Therefore, (FL)w) = 0]

since the Fourier transform of flt was 0,
that must mean that flt is also 0.

[flt) = 0