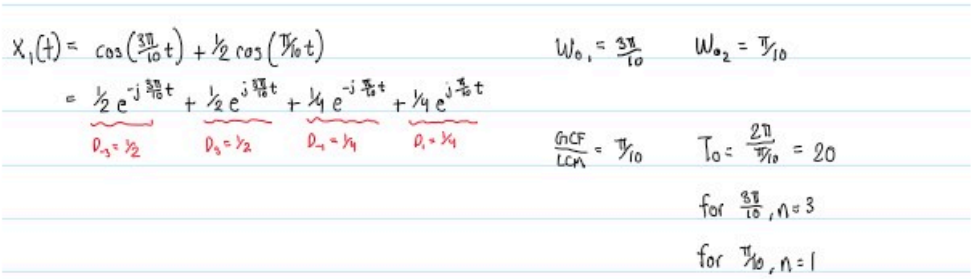
Table of Contents

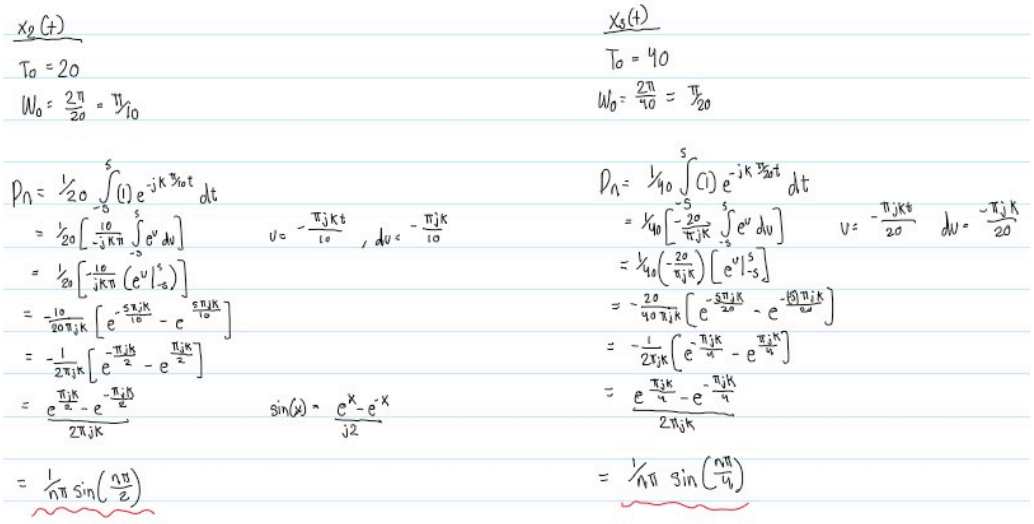
A.1

```
I = imread("A1.jpg");
imshow(I)
```



A.2

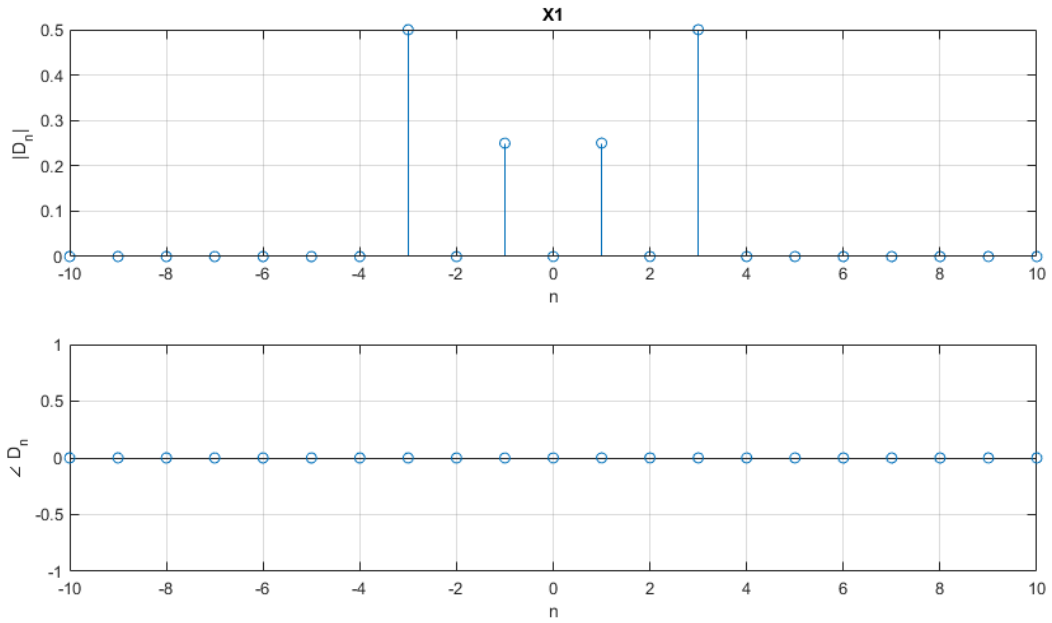
```
I2 = imread("A2.jpg");
imshow(I2)
```



A.3 (x1)

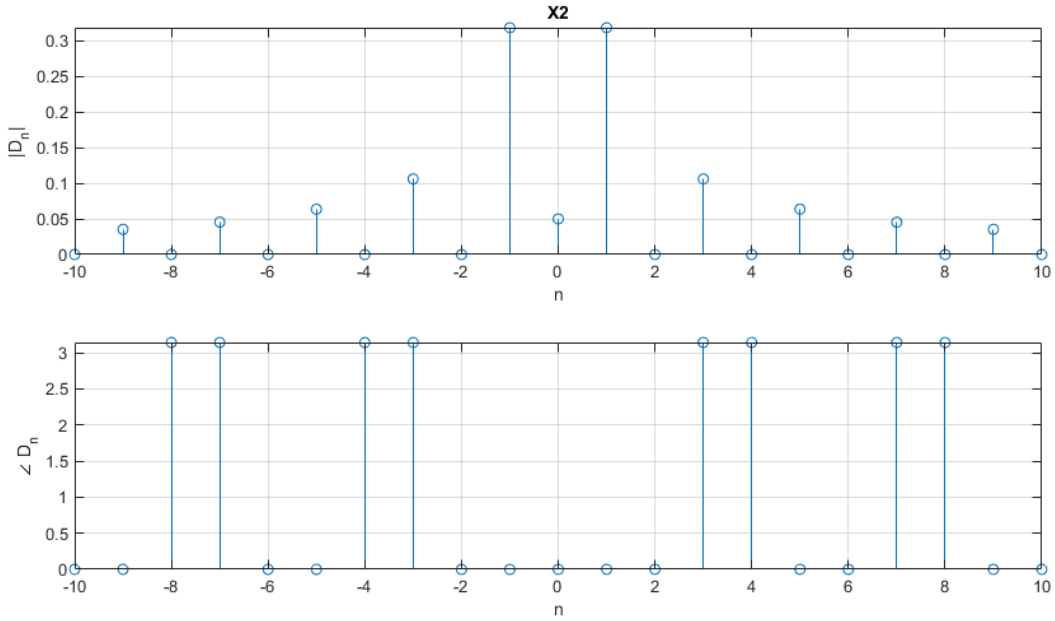
```
n = (-10:10);
D_n = (n==1).*(1/4)+(n==-1).*(1/4)+(n==3).*(1/2)+(n==-3).*(1/2);
subplot(2,1,1);
stem(n,abs(D_n));
title ('X1');
xlabel ('n');
ylabel ('|D_n|');
```

```
grid;
subplot(2,1,2);
stem(n,angle(D_n));
xlabel('n');
ylabel('\angle D_n');
grid;
```



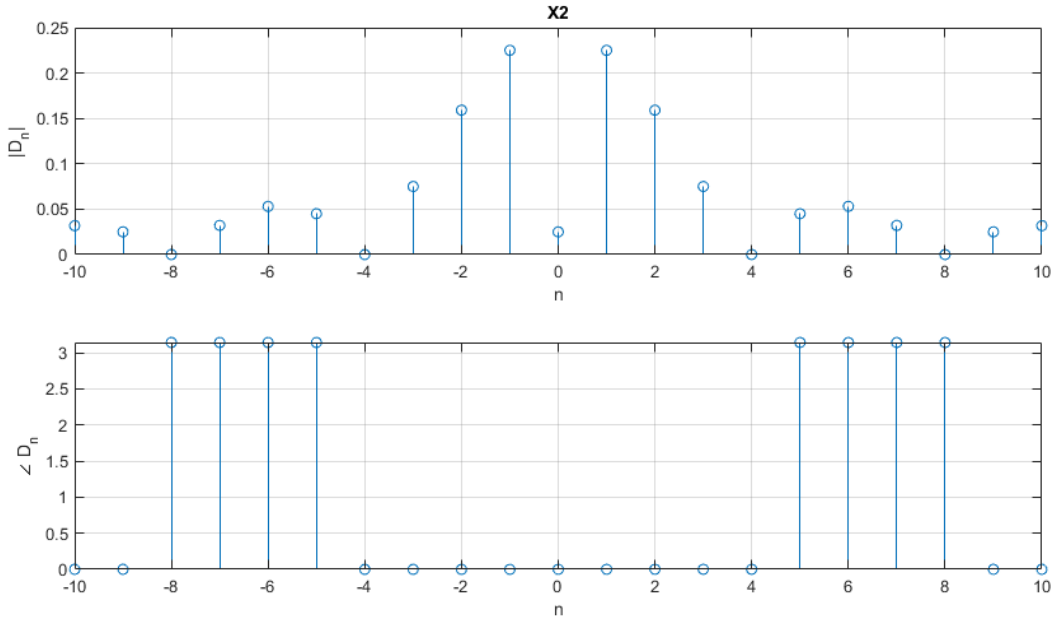
A.3 (x2)

```
n=(-10:10);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.05;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/2))./(i*pi);
end
end
subplot (2,1,1);
stem(n,abs(D_n));
title ('X2');
xlabel ('n'); ylabel ('|D_n|');
grid;
subplot(2,1,2);
stem(n,angle(D_n));
xlabel('n');
ylabel('\angle D_n');
grid;
```



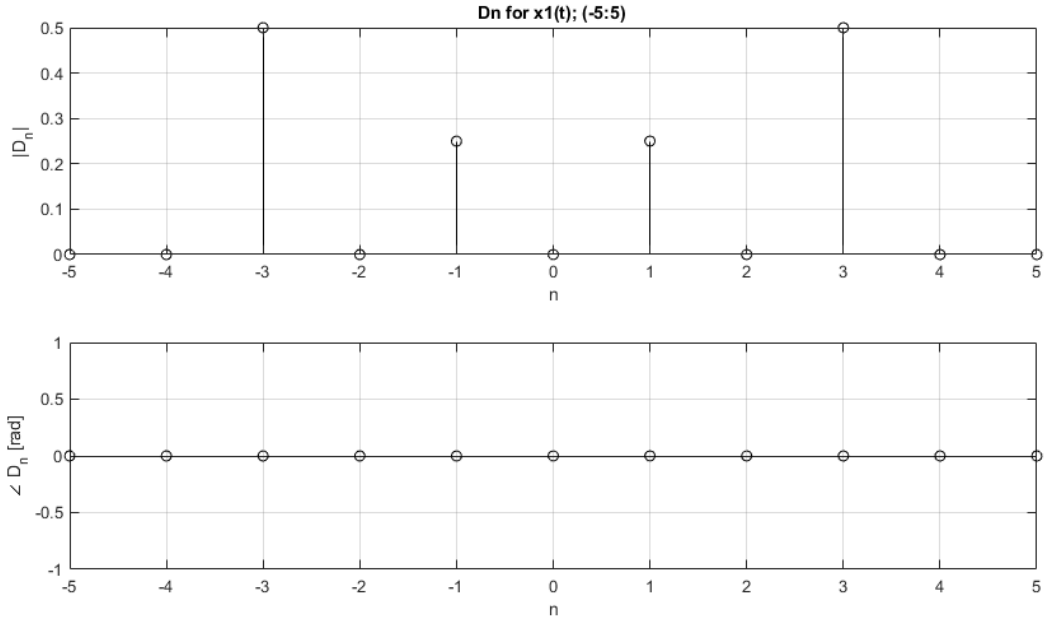
A.3 (x3)

```
n=(-10:10);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.025;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/4))./(i*pi);
end
end
subplot (2,1,1);
stem(n,abs(D_n));
title ('X2');
xlabel ('n'); ylabel ('|D_n|');
grid;
subplot(2,1,2);
stem(n,angle(D_n));
xlabel('n');
ylabel('\angle D_n');
grid;
```



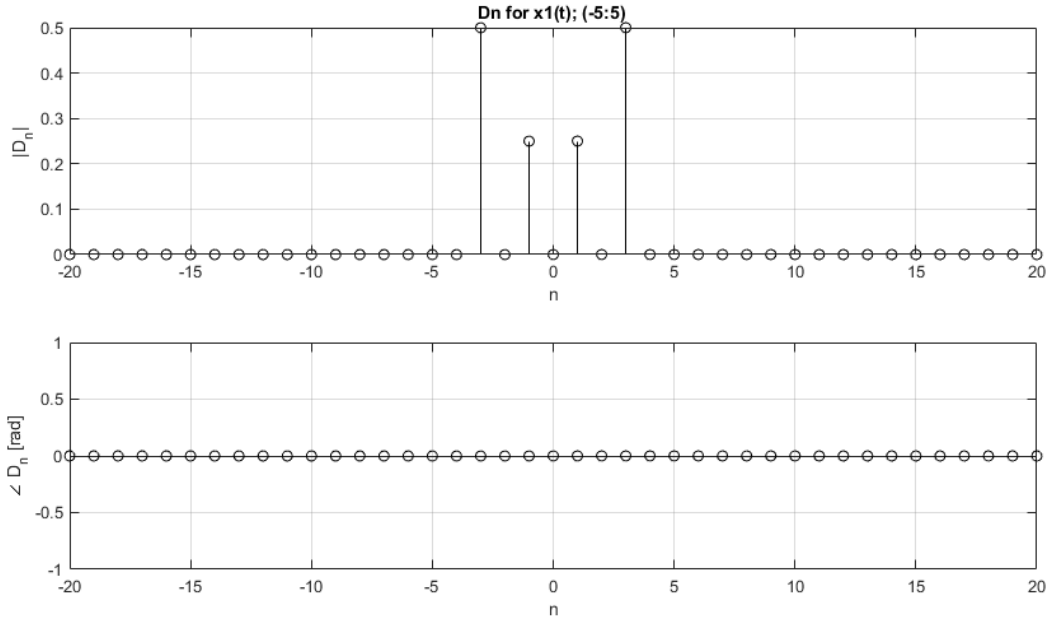
A.4 (x1a)

```
n = (-5:5);
D_n = (n==1).*(1/4)+(n==-1).*(1/4)+(n==3).*(1/2)+(n==-3).*(1/2);
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x1(t); (-5:5) ');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



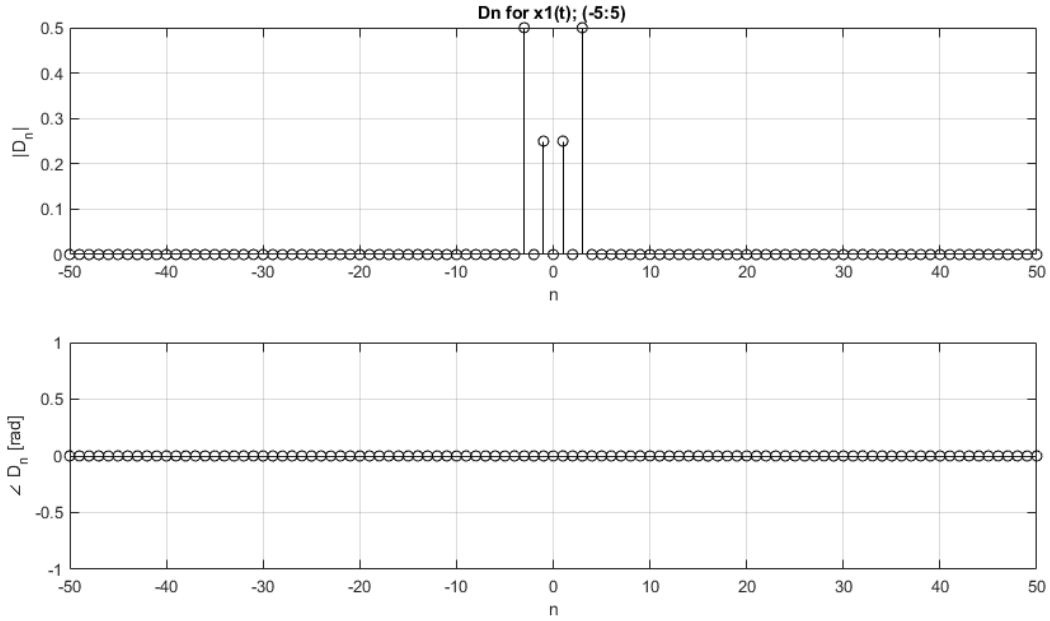
A.4 (x1b)

```
n = (-20:20);
D_n = (n==1).*(1/4)+(n==-1).*(1/4)+(n==3).*(1/2)+(n==-3).*(1/2);
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x1(t); (-5:5) ');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



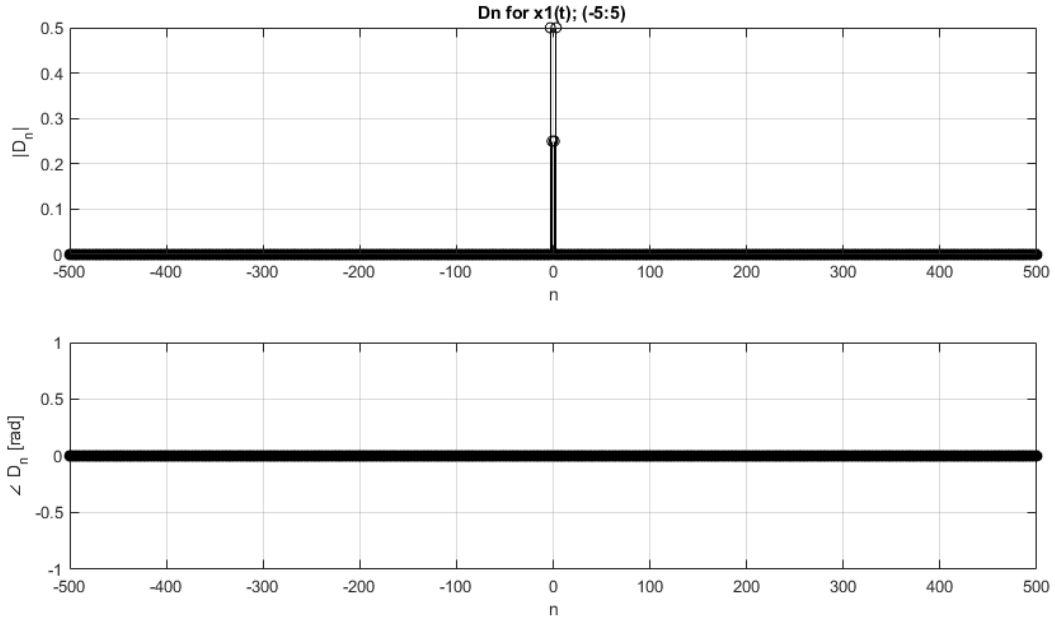
A.4 (x1c)

```
n = (-50:50);
D_n = (n==1).*(1/4)+(n==-1).*(1/4)+(n==3).*(1/2)+(n==-3).*(1/2);
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x1(t); (-5:5) ');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



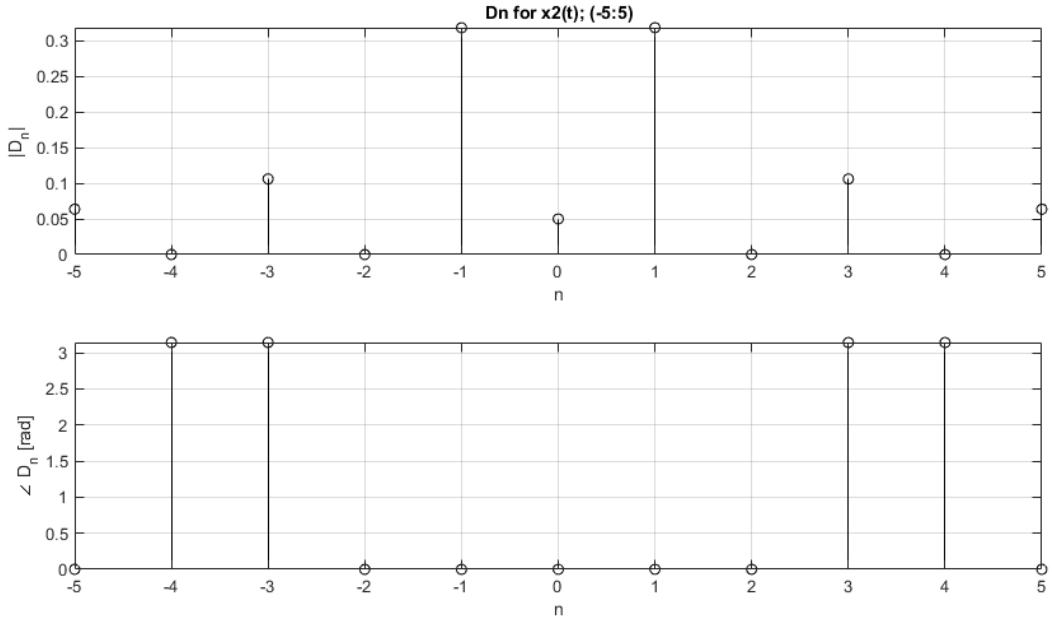
A.4 (x1d)

```
n = (-500:500);
D_n = (n==1).*(1/4)+(n==-1).*(1/4)+(n==3).*(1/2)+(n==-3).*(1/2);
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x1(t); (-5:5) ');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



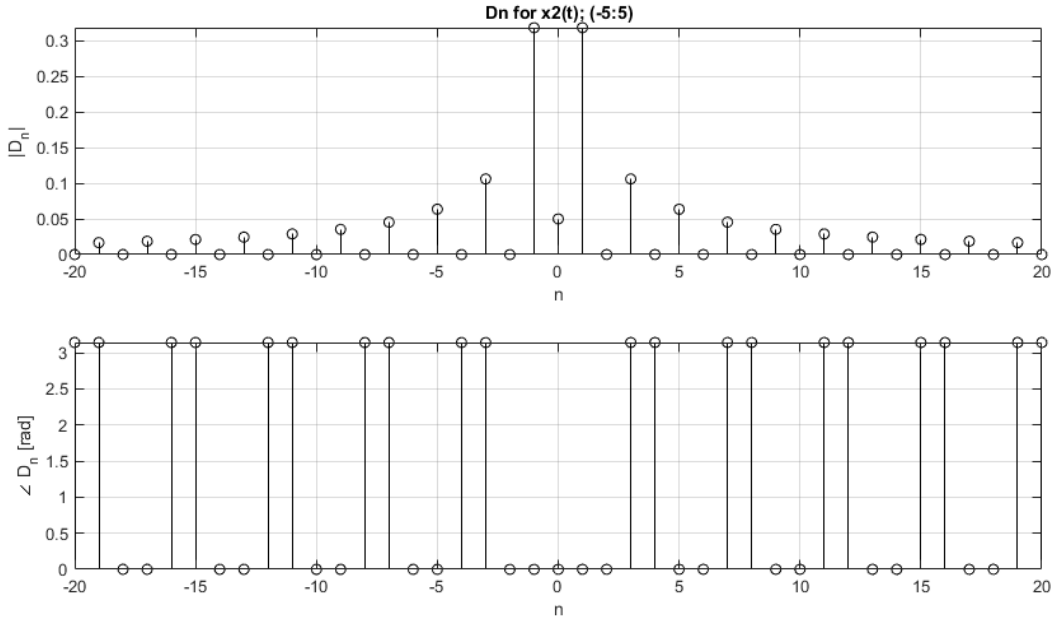
A.4 (x2a)

```
n=(-5:5);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.05;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/2))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x2(t); (-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



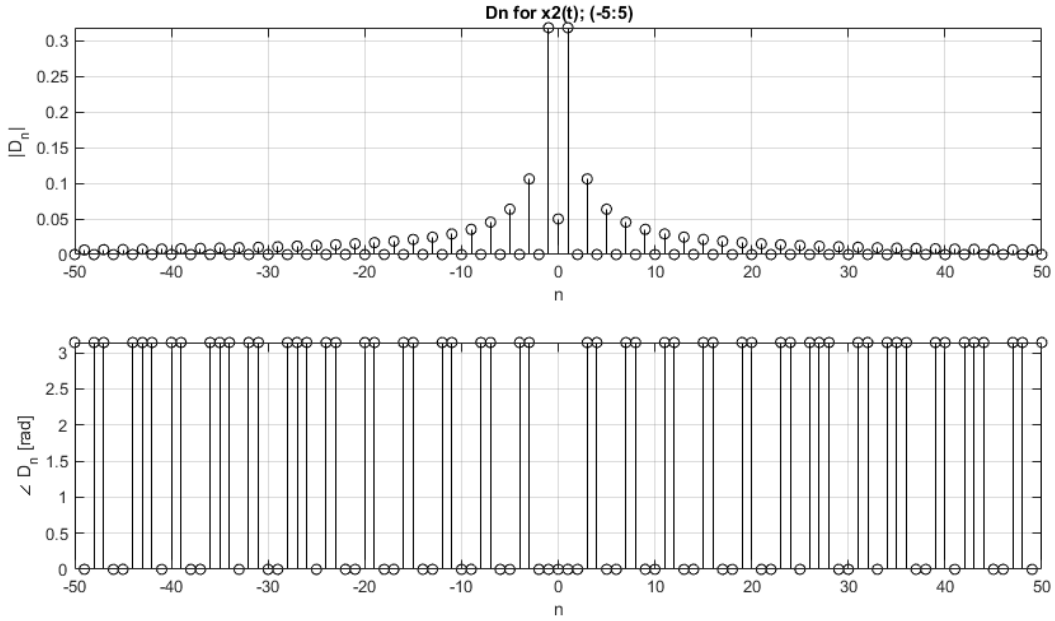
A.4 (x2b)

```
n=(-20:20);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.05;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/2))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x2(t); (-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



A.4 (x2c)

```
n=(-50:50);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.05;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/2))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x2(t); (-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```

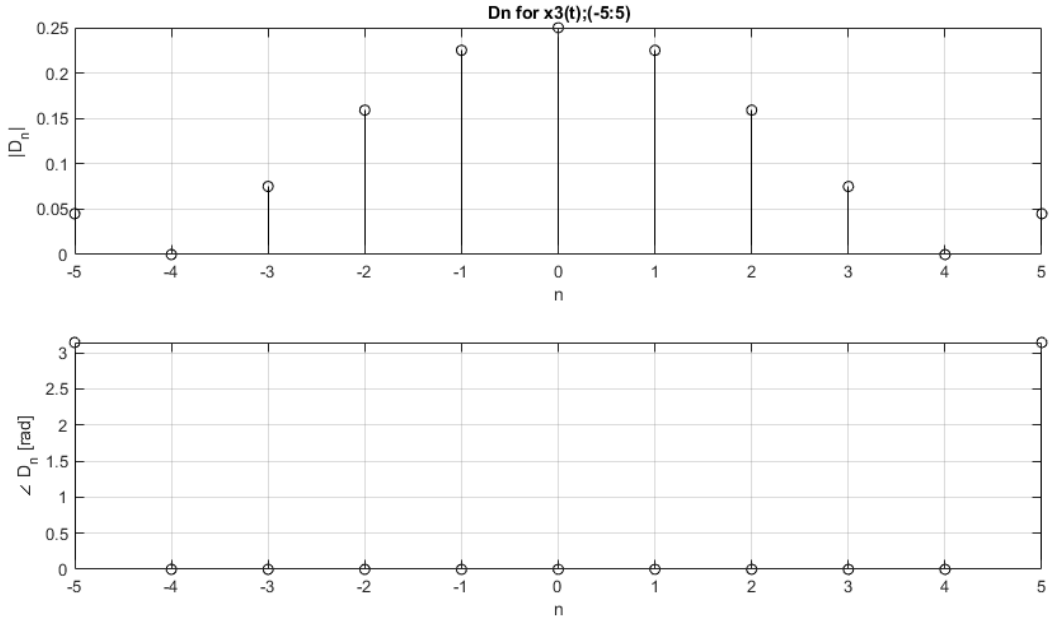


A.4 (x2d)

```
n=(-500:500);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.05;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/2))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x2(t); (-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
clf;
```

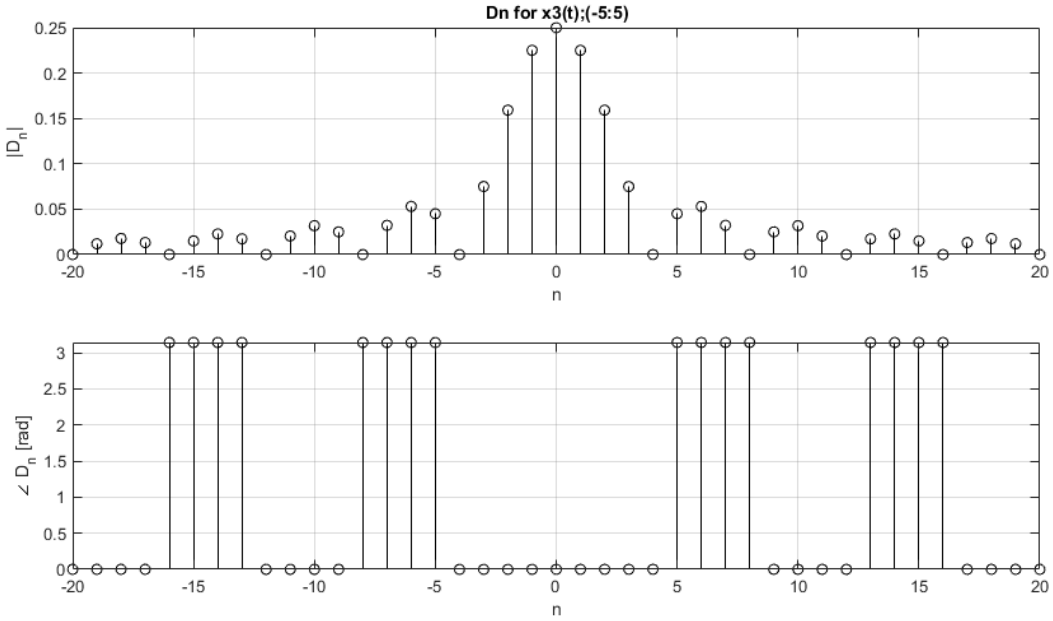
A.4 (x3a)

```
n=(-5:5);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.25;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/4))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x3(t);(-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



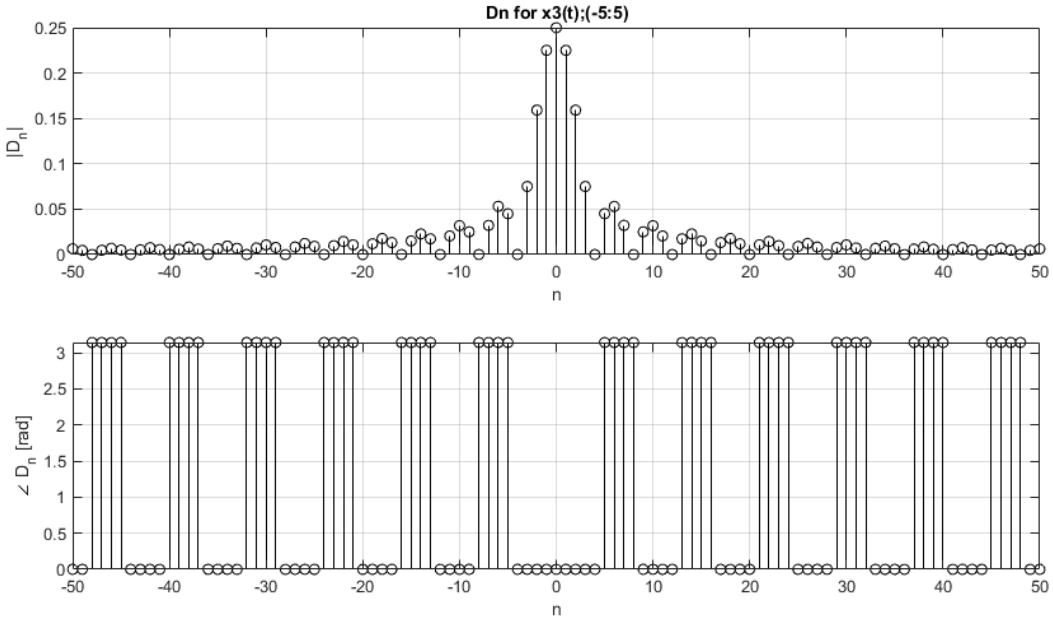
A.4 (x3b)

```
n=(-20:20);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.25;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/4))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x3(t);(-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



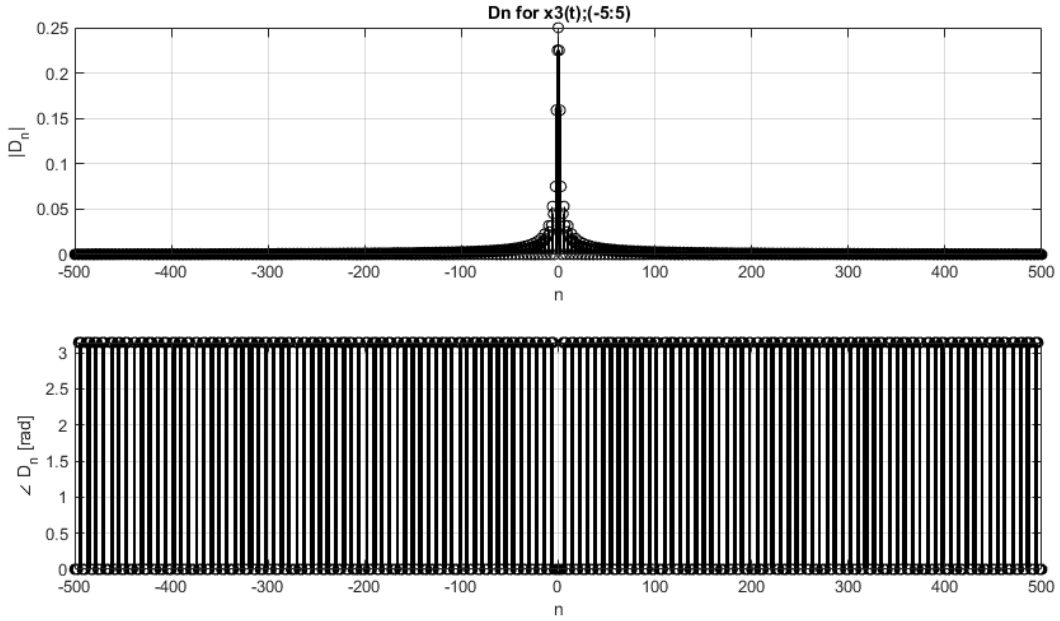
A.4 (x3c)

```
n=(-50:50);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.25;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/4))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x3(t);(-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



A.4 (x3d)

```
n=(-500:500);
D_n = n;
for i=min(n):1:max(n)
if i==0
D_n((i+abs(min(n))+1))=0.25;
else
D_n((i+abs(min(n))+1))=(sin((i*pi)/4))./(i*pi);
end
end
subplot(2,1,1);
stem(n,abs(D_n), 'k');
xlabel('n');
ylabel('|D_n|');
title('Dn for x3(t);(-5:5)');
grid;
subplot(2,1,2);
stem(n,angle(D_n),'k');
xlabel('n');
ylabel('\angle D_n [rad]');
grid;
```



A5 (x1)

```
t = -300:1:300;
x = 0;
for n = -5:5
D_n = 0;
if (n==3 || n==-3)
D_n=(1/2);
end
if (n==1||n==-1)
D_n=(1/4);
end
x=x+D_n.*(exp(sqrt(-1)*n*(pi/10)*t));
end
```

A5 (x2)

```
D_n=[-50:50];
nleftlim = -50;
nrightlim = 50;
x = 50+1;
if n == 0,
D_n(x) = 0.5;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.5)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/10; t = -300:300;
s = 300+1;
b=length(t);
```

```
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
```

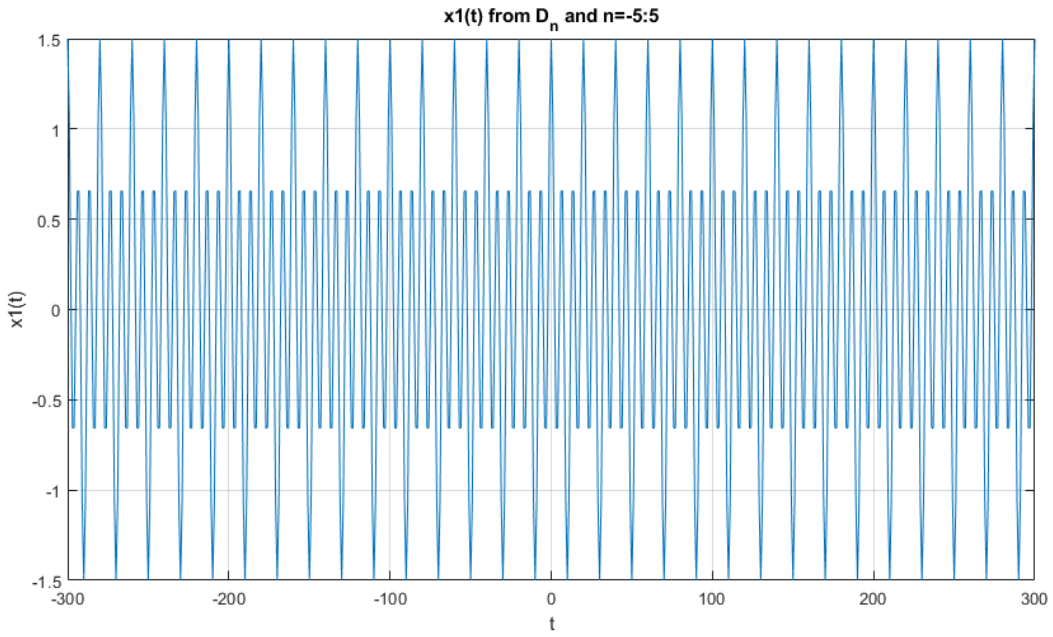
A5 (x3)

```
D_n=[-500:500];
nleftlim = -500; nrightlim = 500; x = 500+1;
if n == 0,
D_n(x) = 0.5;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.25)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/20; t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
```

A6 (x1a)

```
clf;
t = -300:1:300;
x = 0;
for n = -5:5
D_n = 0;
if (n==3 || n==-3)
D_n=(1/2);
end
if (n==1||n==-1)
D_n=(1/4);
end
x=x+D_n.*(exp(sqrt(-1)*n*(pi/10)*t));
end
plot(t,x);
xlabel('t');
ylabel('x1(t)');
title('x1(t) from D_n and n=-5:5');
grid;
```

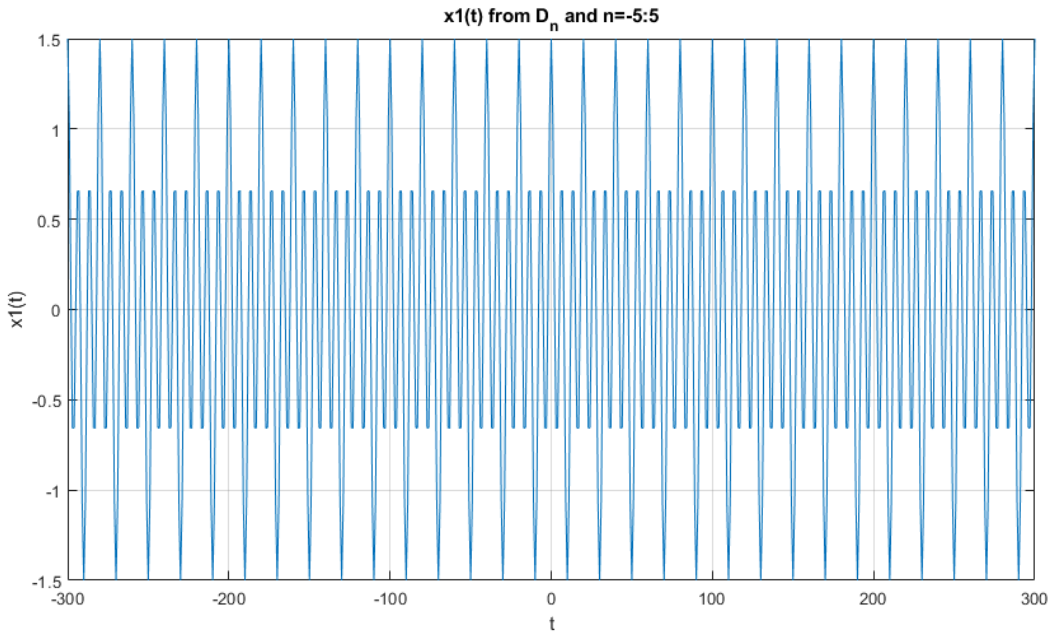
Warning: Imaginary parts of complex X and/or Y arguments ignored.



A6 (x1b)

```
t = -300:1:300;
x = 0;
for n = -20:20
D_n = 0;
if (n==3 || n==-3)
D_n=(1/2);
end
if (n==1||n==-1)
D_n=(1/4);
end
x=x+D_n.*(exp(sqrt(-1)*n*(pi/10)*t));
end
plot(t,x);
xlabel('t');
ylabel('x1(t)');
title('x1(t) from D_n and n=-5:5');
grid;
```

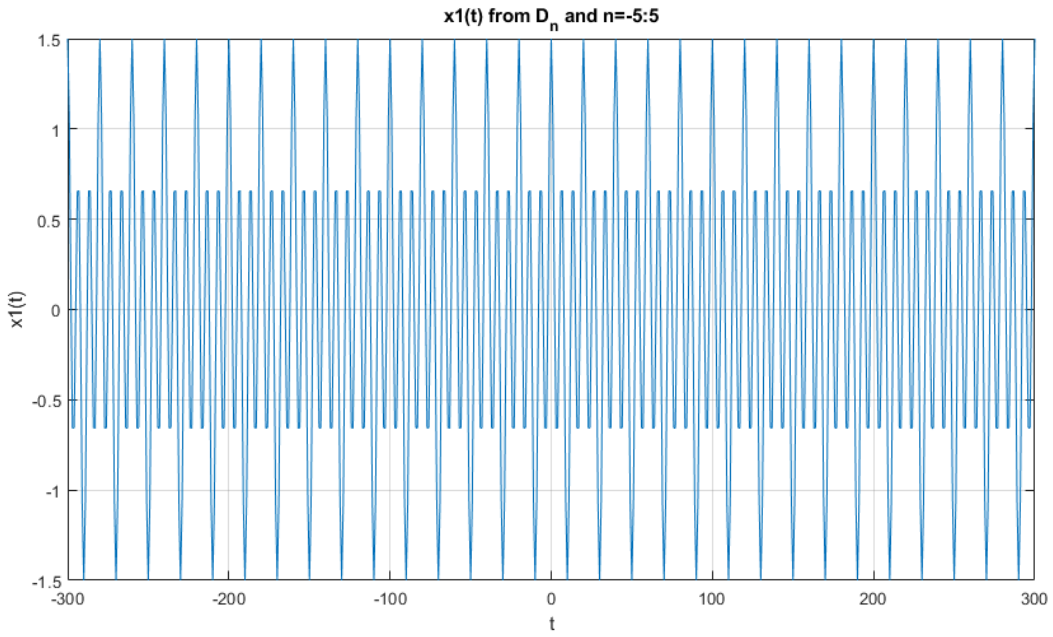
Warning: Imaginary parts of complex X and/or Y arguments ignored.



A6 (x1c)

```
t = -300:1:300;
x = 0;
for n = -50:50
D_n = 0;
if (n==3 || n==-3)
D_n=(1/2);
end
if (n==1||n==-1)
D_n=(1/4);
end
x=x+D_n.*(exp(sqrt(-1)*n*(pi/10)*t));
end
plot(t,x);
xlabel('t');
ylabel('x1(t)');
title('x1(t) from D_n and n=-5:5');
grid;
```

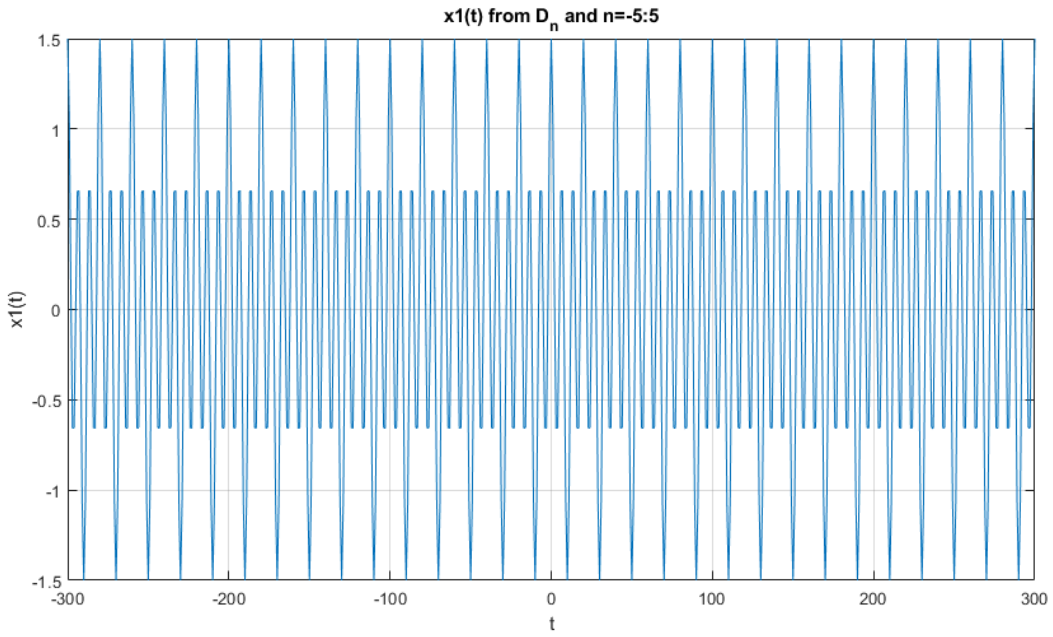
Warning: Imaginary parts of complex X and/or Y arguments ignored.



A6 (x1d)

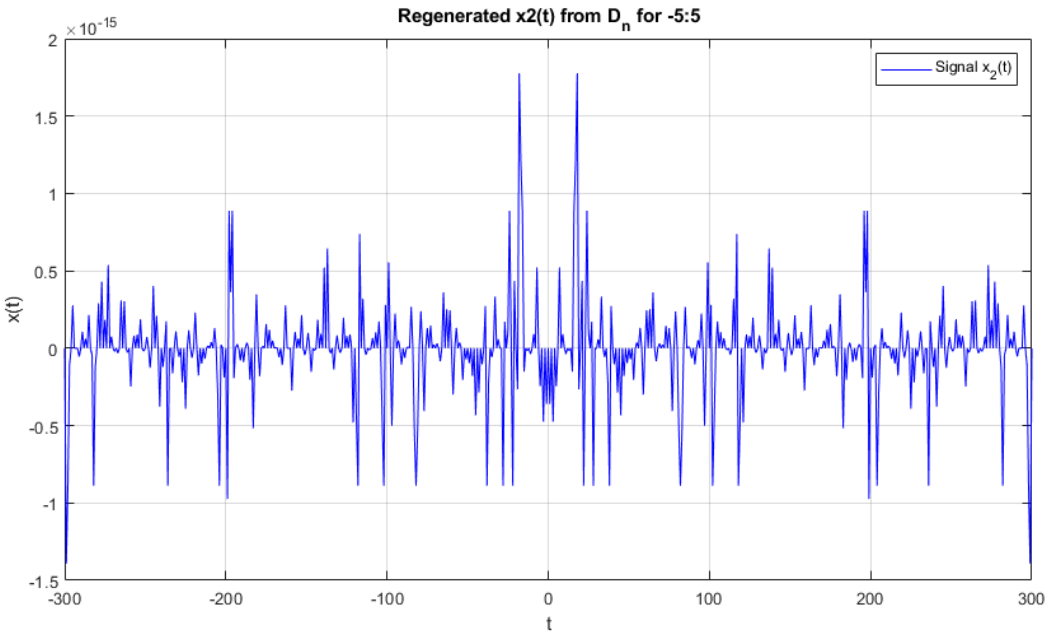
```
t = -300:1:300;
x = 0;
for n = -500:500
D_n = 0;
if (n==3 || n==-3)
D_n=(1/2);
end
if (n==1||n==-1)
D_n=(1/4);
end
x=x+D_n.*(exp(sqrt(-1)*n*(pi/10)*t));
end
plot(t,x);
xlabel('t');
ylabel('x1(t)');
title('x1(t) from D_n and n=-5:5');
grid;
```

Warning: Imaginary parts of complex X and/or Y arguments ignored.



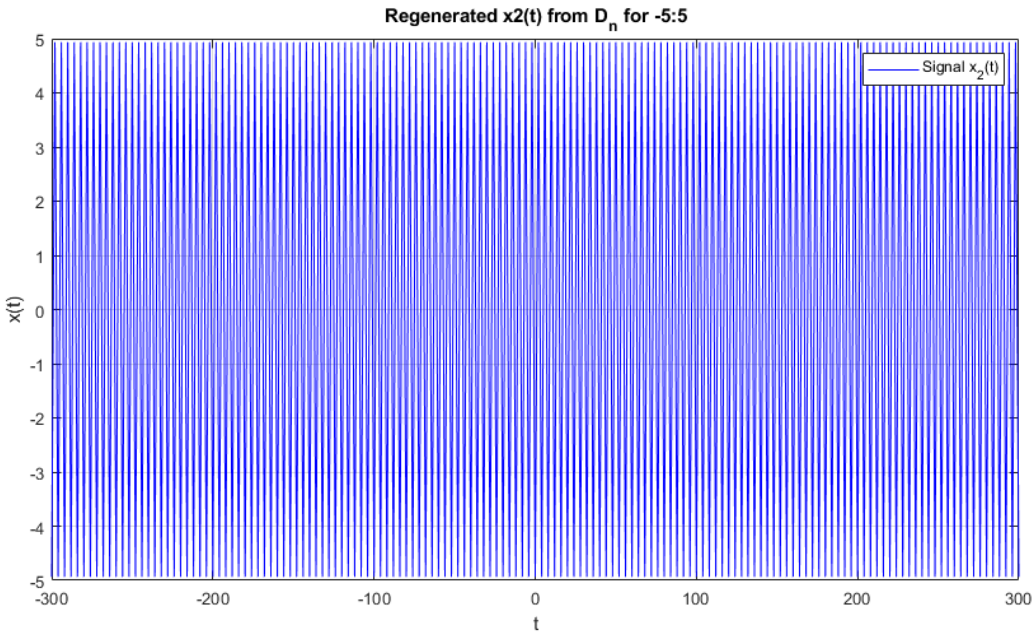
A6 (x2a)

```
D_n=[-5:5]; nleftlim = -5;
nrightlim = 5;
x = 5+1;
if n == 0,
D_n(x) = 0.05;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.5)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/10;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x2(t) from D_n for -5:5');
legend('Signal x_2(t)');
grid;
```



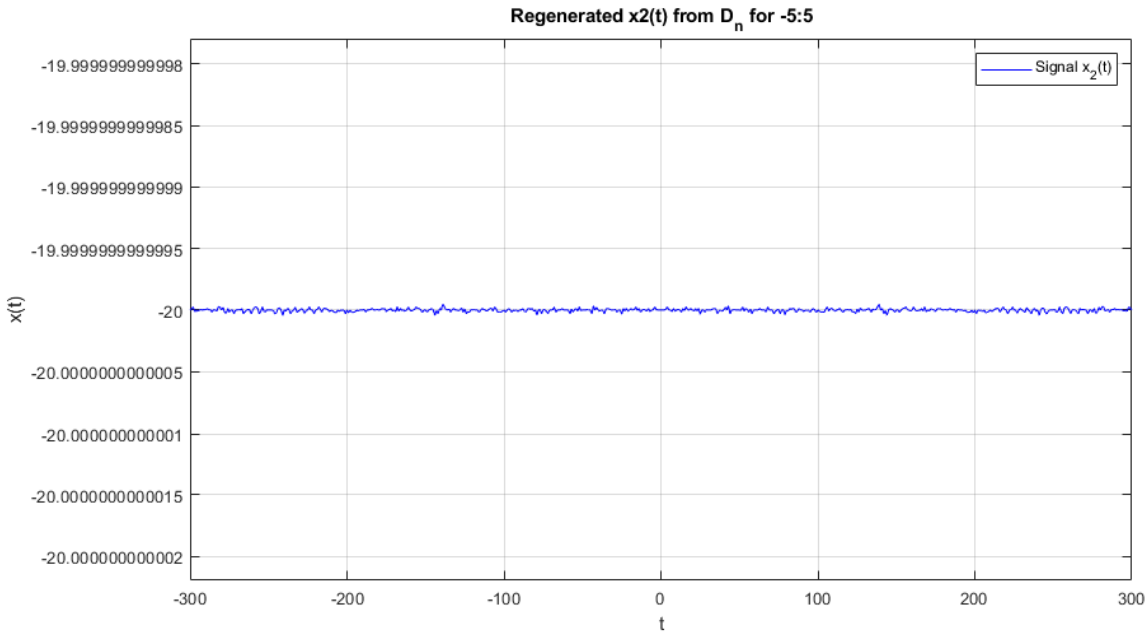
A6 (x2b)

```
D_n=[-20:20]; nleftlim = -20;
nrightlim = 20;
x = 20+1;
if n == 0,
D_n(x) = 0.05;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.5)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/10;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x2(t) from D_n for -5:5');
legend('Signal x_2(t)');
grid;
```



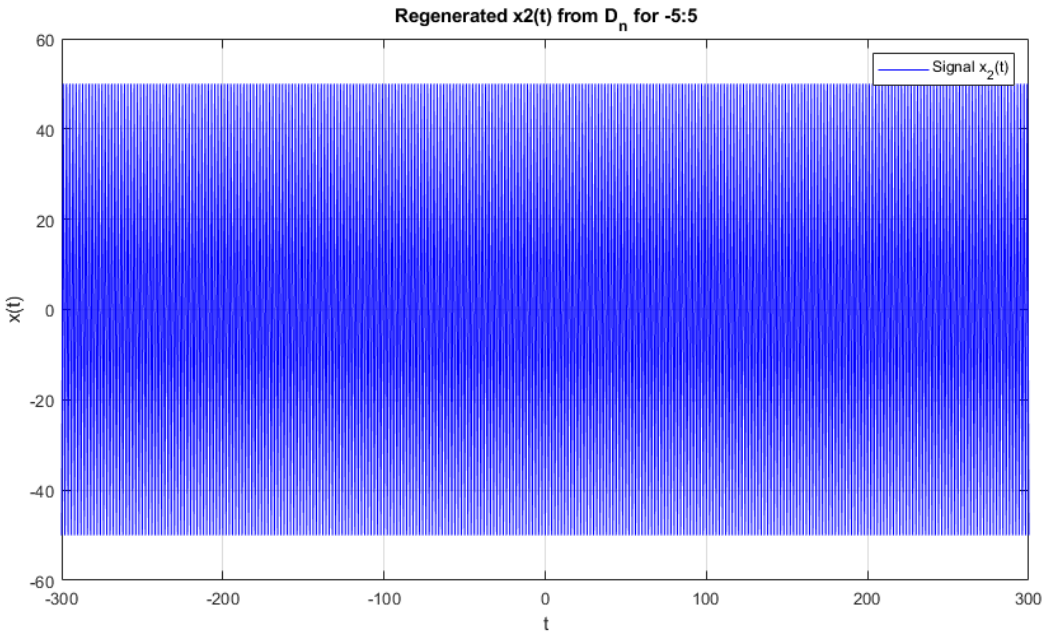
A6 (x2c)

```
D_n=[-50:50]; nleftlim = -50;
nrightlim = 50;
x = 50+1;
if n == 0,
D_n(x) = 0.05;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.5)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/10;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x2(t) from D_n for -5:5');
legend('Signal x_2(t)');
grid;
```



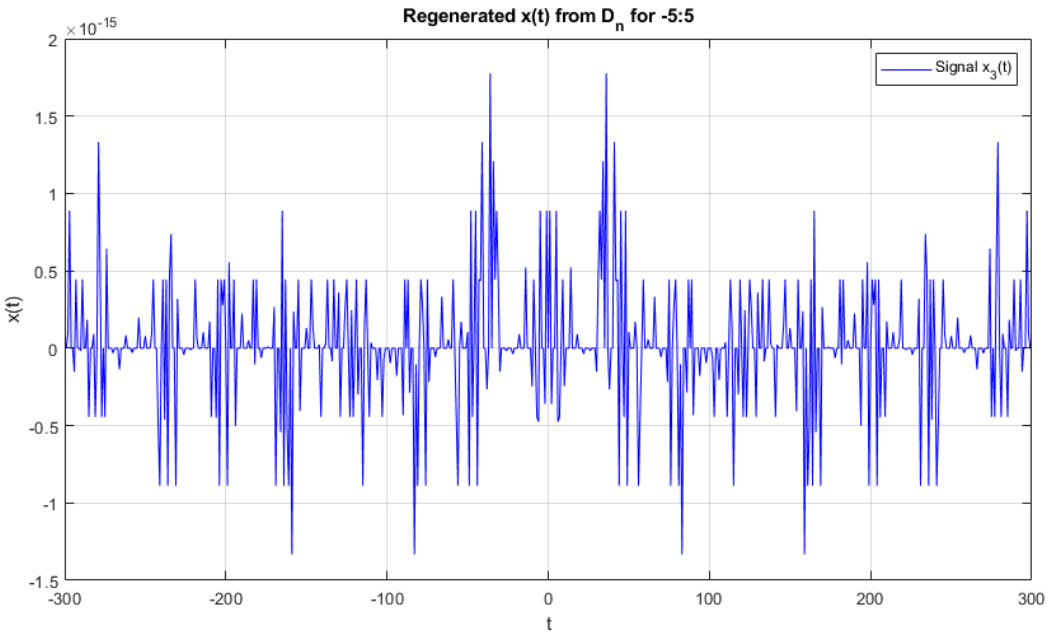
A6 (x2d)

```
D_n=[-500:500]; nleftlim = -500;
nrightlim = 500;
x = 500+1;
if n == 0,
D_n(x) = 0.05;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.5)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/10;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x2(t) from D_n for -5:5');
legend('Signal x_2(t)');
grid;
```



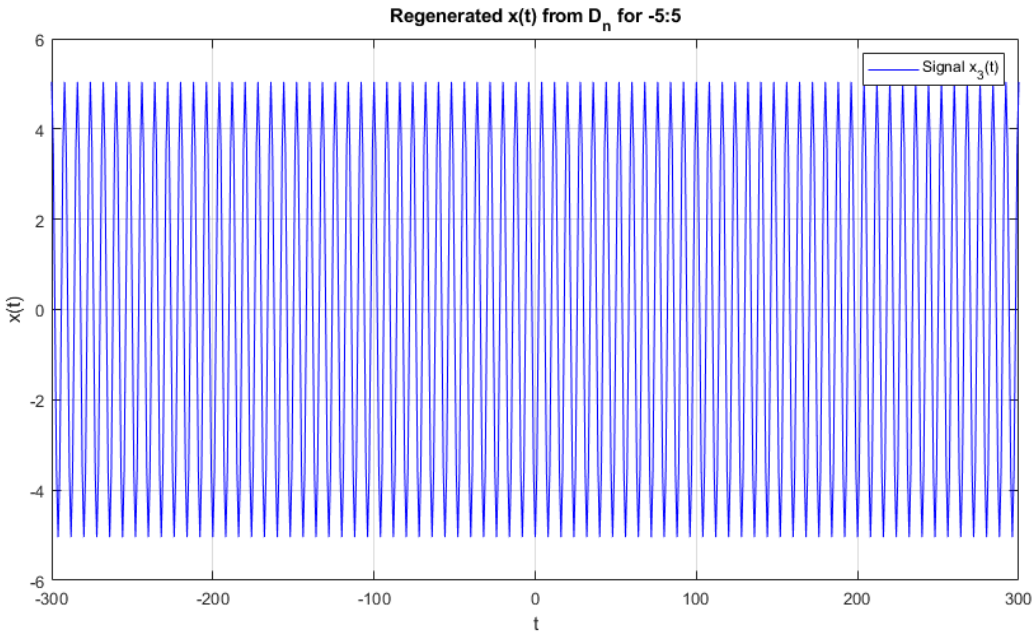
A6 (x3a)

```
D_n=[-5:5];
nleftlim = -5;
nrightlim = 5;
x = 5+1;
if n == 0,
D_n(x) = 0.025;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.25)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/20;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x(t) from D_n for -5:5');
legend('Signal x_3(t)');
grid;
```



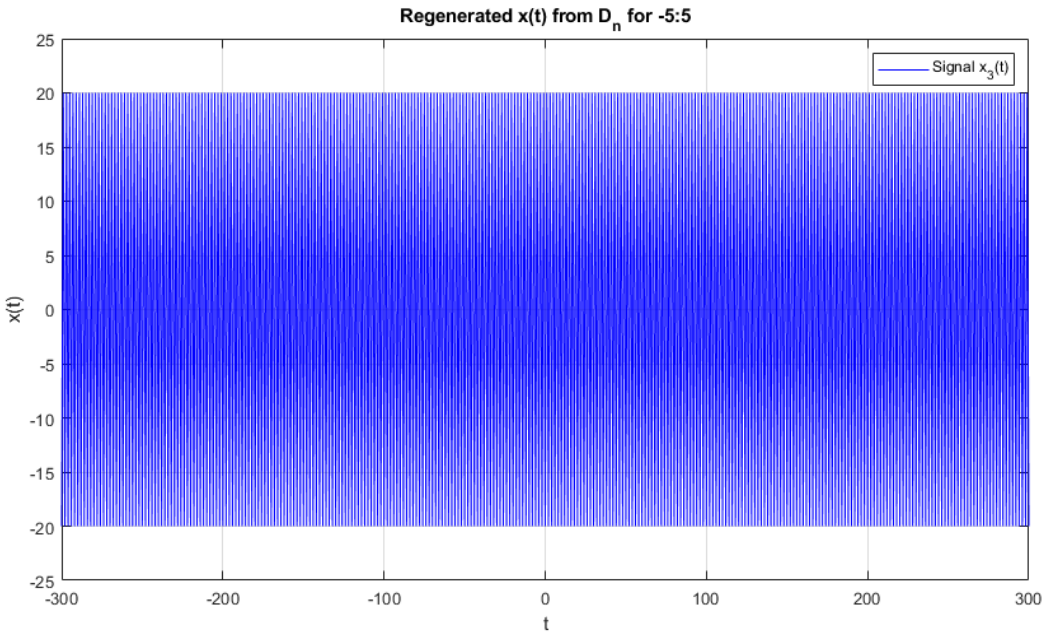
A6 (x3b)

```
D_n=[-20:20];
nleftlim = -20;
nrightlim = 20;
x = 20+1;
if n == 0,
D_n(x) = 0.025;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.25)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/20;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x(t) from D_n for -5:5');
legend('Signal x_3(t)');
grid;
```



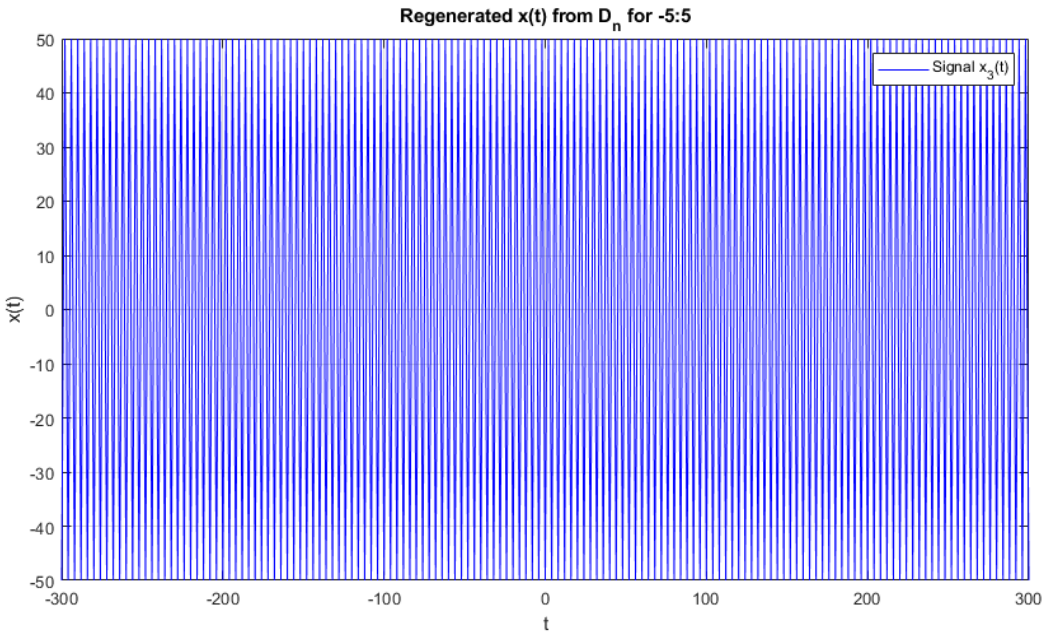
A6 (x3c)

```
D_n=[-50:50];
nleftlim = -50;
nrightlim = 50;
x = 50+1;
if n == 0,
D_n(x) = 0.025;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.25)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/20;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x(t) from D_n for -5:5');
legend('Signal x_3(t)');
grid;
```



A6 (x3d)

```
D_n=[-500:500];
nleftlim = -500;
nrightlim = 500;
x = 500+1;
if n == 0,
D_n(x) = 0.025;
else
D_n(n-nleftlim+1) = (sin(n.*pi*0.25)./(n.*pi));
end
n = [nleftlim:nrightlim];
W0 = pi/20;
t = -300:300;
s = 300+1;
b=length(t);
x = zeros(1,b);
for t=-300:300
for n=nleftlim:nrightlim
x(t+s) = x(t+s) + real(D_n(n-nleftlim+1).*exp(n.*1i*W0*t));
end
end
t=-300:300;
plot(t,real(x),'b');
ylabel('x(t)');
xlabel('t');
title('Regenerated x(t) from D_n for -5:5');
legend('Signal x_3(t)');
grid;
```



B1

```
% From A.1 and A.2 ;
% wo for x1(t) : pi/10
% wo for x2(t) : pi/10
% wo for x3(t) : pi/20
```

B2

```
% The difference between the fourier coefficients of x1 and x2 is
% that from n = (-inf:inf), for x2, there are infinite coefficeints and
% for x1, there will always be only 4 coefficients.
```

B3

```
% The fourier coefficients are similar except for x3, the sin function
% is dilated by 4pi and for x2 the sine function is dilated by pi/2
```

B4

```
% For x2, D0 is 1/2 and since x4 is just x2 shifted down by 1/2, D0 for
% x4 is 0
```

B5

```
% x1 would not change since there are distinct number
% for x2 and x3 the higher the value of n, the more accurate
% the functions become
```

B6

```
% for x2 and x3, you would need n to be from (-inf:inf) to reconstruct the
% functions properly
```

B7

```
% storing the coeffecients would not work as x(t) is arbritary, so we don't
% know how many coeffecients are there
```

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