a. ak

n

jk; |k| < 3

0 otherwise

x(t) = −2 sin(πt/2) − 4 sin(πt)

for 0 ≤ t < 4.

x(t) = X∞

k=−∞

ake

j

2π

T

kt = −2je−j

2π

4

2t − je−j

2π

4

t + je j

2π

4

t + 2je j

2π

4

2t

= −2 sin(πt/2) − 4 sin(πt)

b. bk =

1; k odd

0; k even

x(t) = 2δ(t) − 2δ(t − 2) for 0 ≤ t < 4.

x(t) = X∞

k=−∞

bke

j

2π

T

kt =

X∞

k = −∞

k odd

e

jπkt/2

Unfortunately, this sum is not easy to close. However, it is closely related to the

synthesis formula for an impulse train,

xδ(t) = X∞

k=−∞

δ(t − kT) = X∞

k=−∞

ake

jπkt/2 =

X∞

k=−∞

1

T

e

jπkt/2

.

If there were two impulses per period instead of one, then

x2δ(t) = X∞

k=−∞

δ(t − kT) + δ(t −

T

2

− kT) = X∞

k=−∞

1

T

e

j2πkt/4 +

1

T

e

j2πk(t−2)/4

=

X∞

k=−∞

1

T

e

jπkt/2

1 + e

jπk

=

X∞

k = −∞

k even

2

T

e

jπkt/2

It follows that x(t) = T xδ(t)−

T

2

x2δ(t) = 4xδ(t)−2x2δ(t) so that x(t) is an alternating

sequence of impulses

x(t) = X∞

l=−∞

2δ(t − 4l) −6 2δ(t − 2 − 4l)

Question 3

```
[h1,f] = freqz(d1,1024,fs);
[h2,~] = freqz(d2,1024,fs);
[h3,~] = freqz(d3,1024,fs);

plot(f,mag2db(abs([h1 h2 h3])))
legend('Steepness = 0.5','Steepness = 0.8','Steepness = 0.95', ...
    'Location','south')
ylim([-100 10])
```