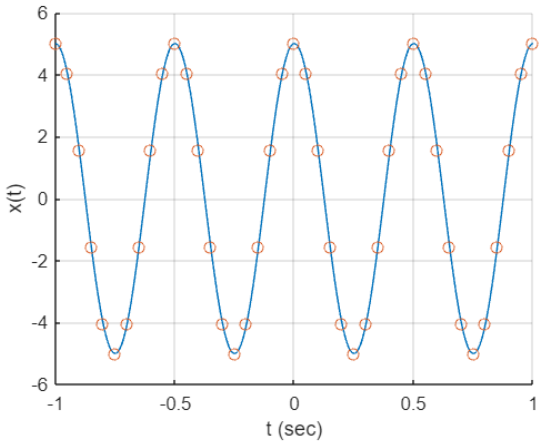
Problem 1

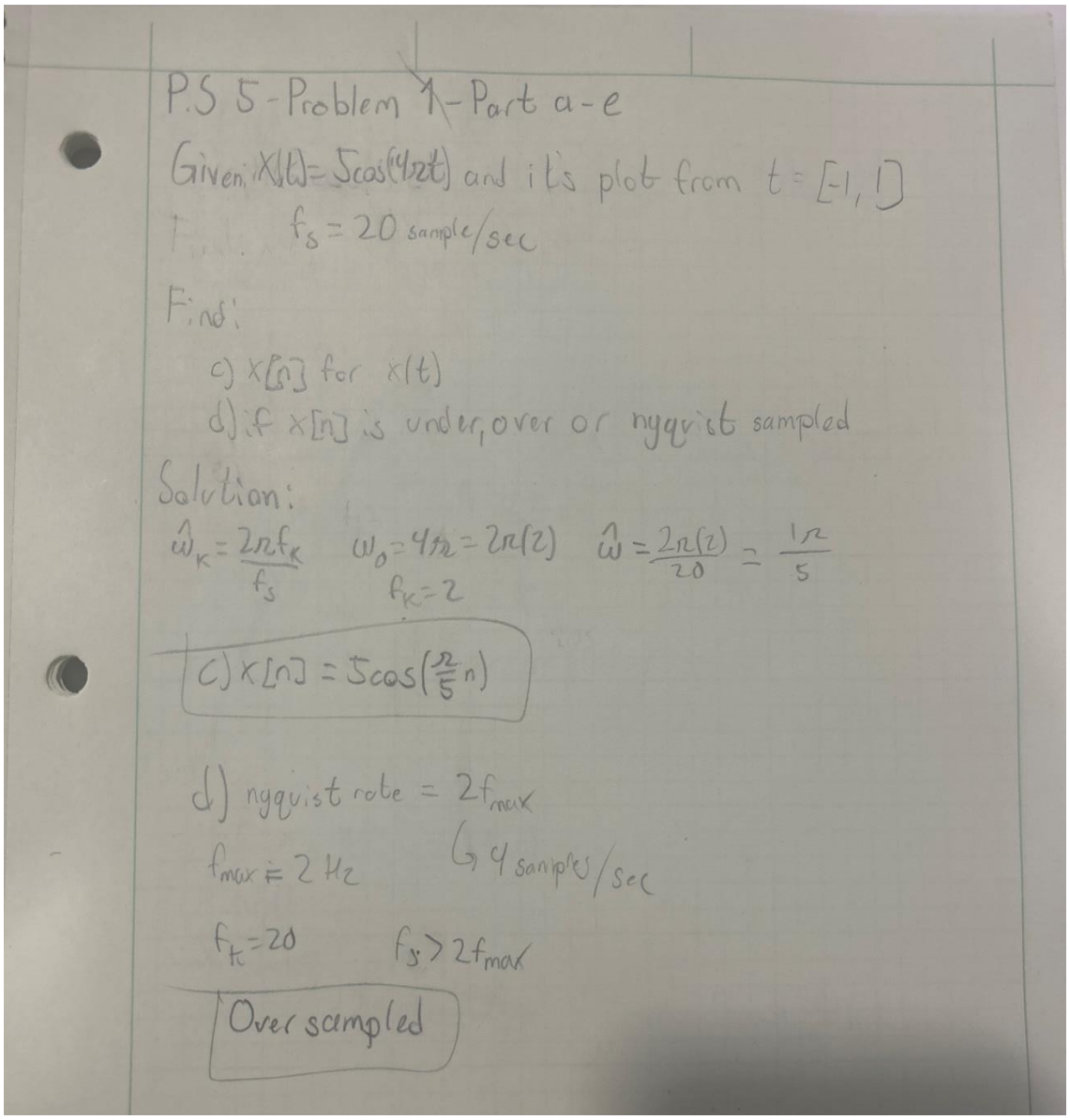
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on;
grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



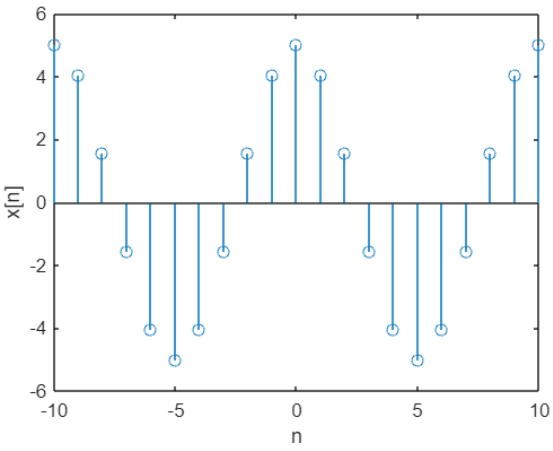
part b

```
f_s = 20
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



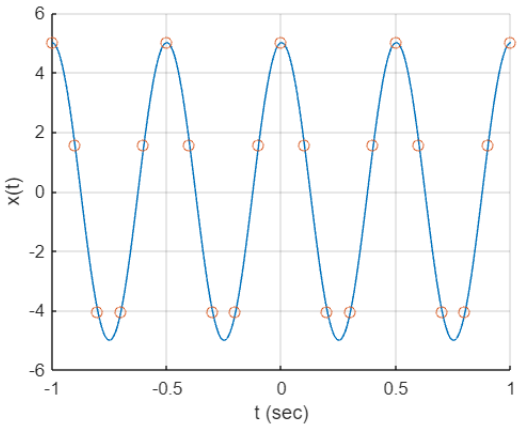
part e

```
tt_s = -10:1:10
omega_hat = 2 * pi * 2 / f_s
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



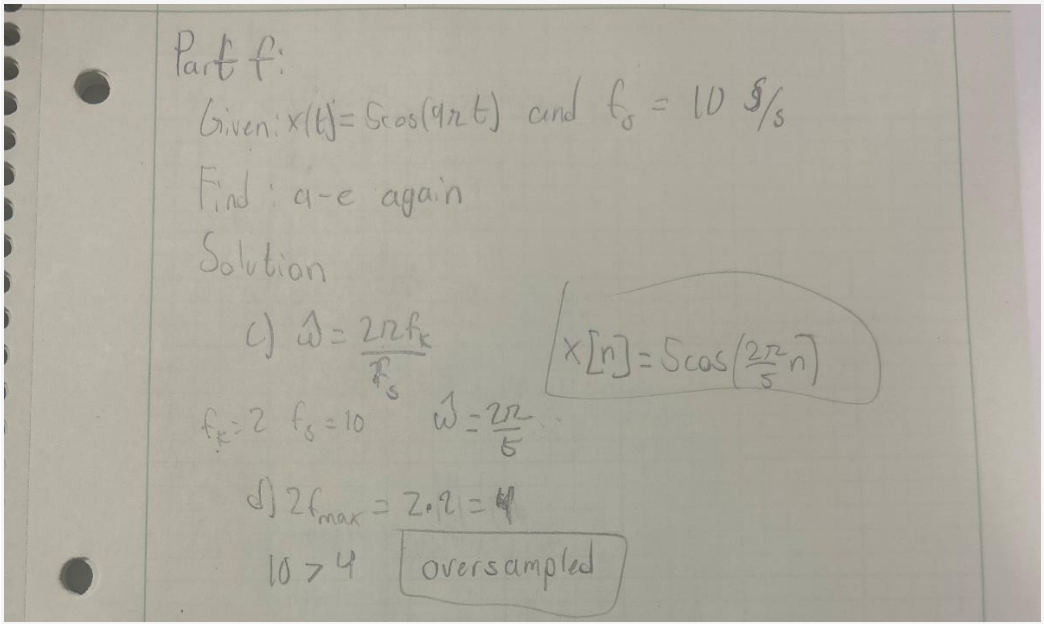
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



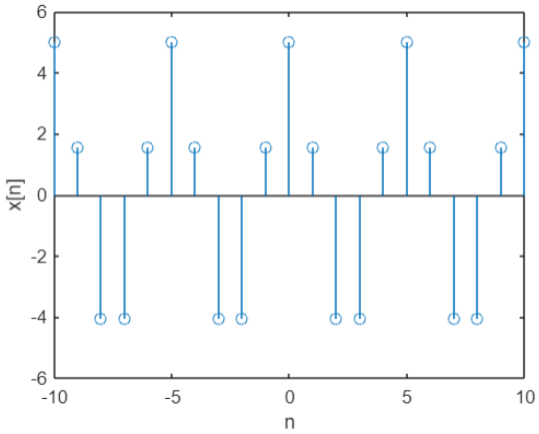
part b

```
f_s = 10
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



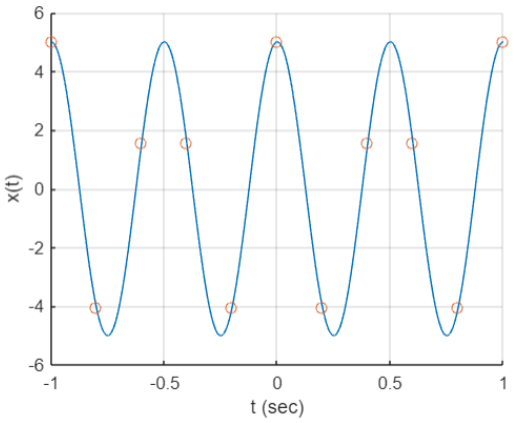
part e

```
tt_s = -10:1:10
omega_hat = 4 * pi / f_s
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



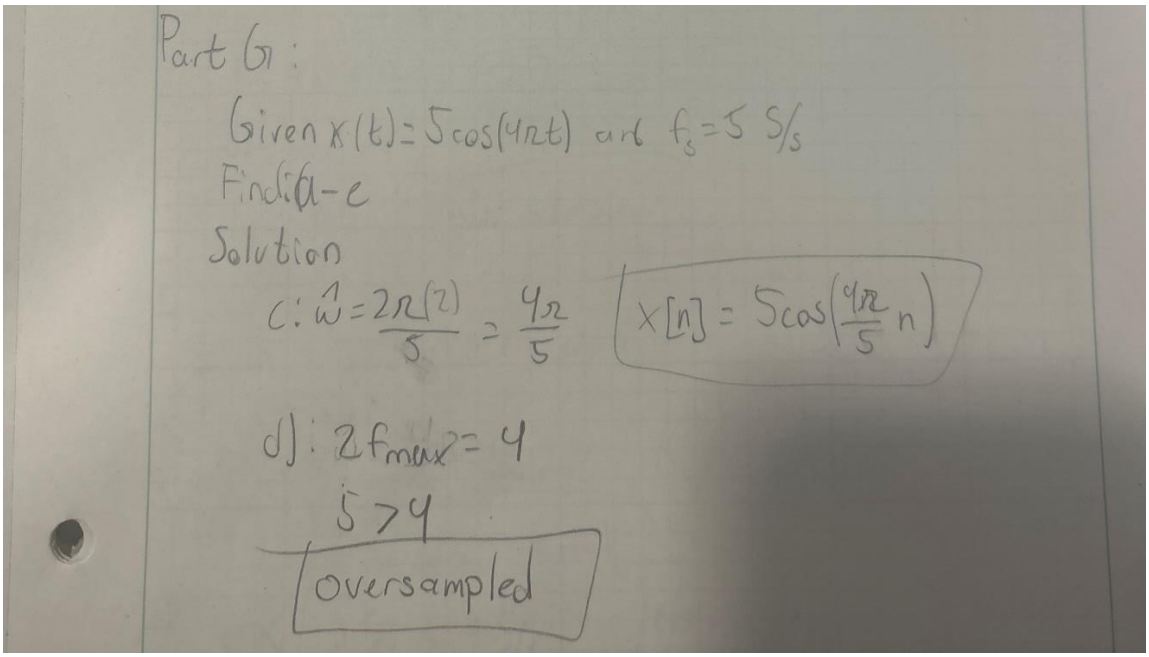
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



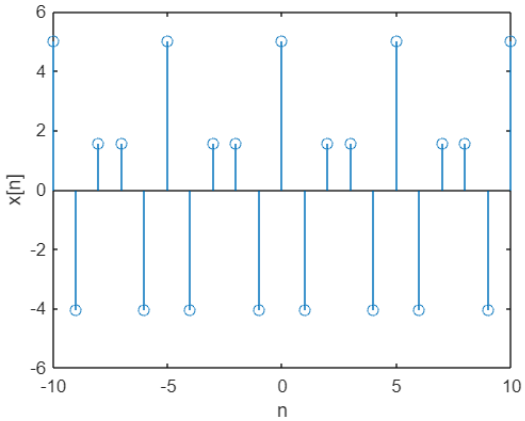
part b

```
f_s = 5
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



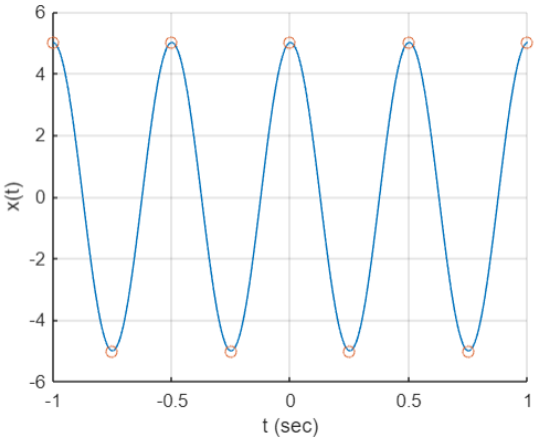
part e

```
tt_s = -10:1:10
omega_hat = 4 * pi / f_s
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



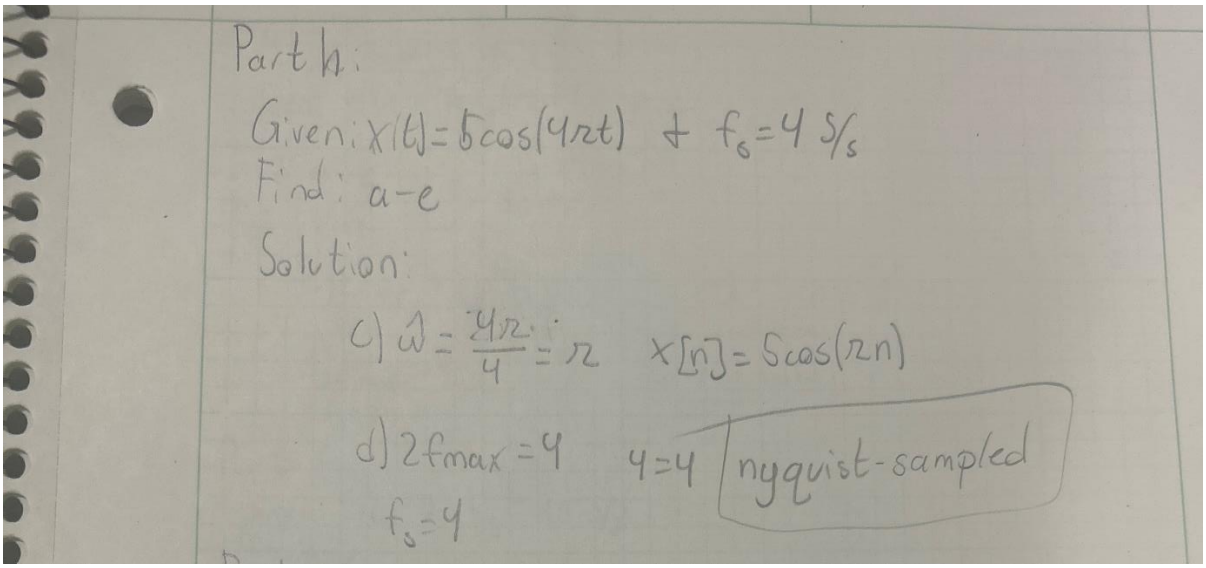
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



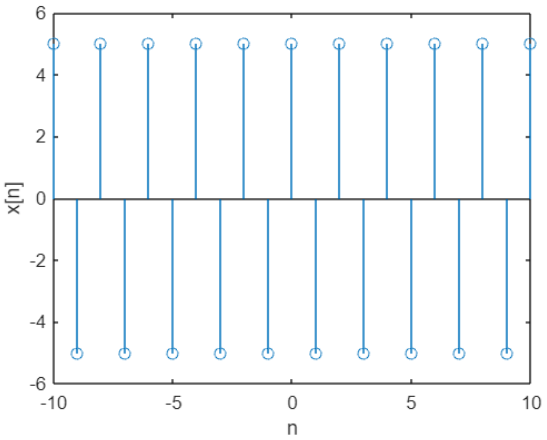
part b

```
f_s = 4
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



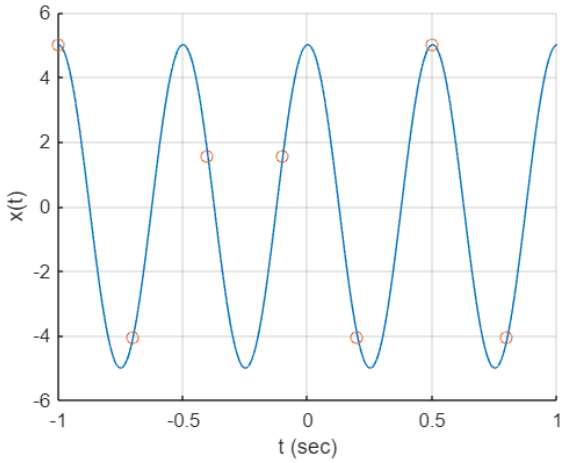
part e

```
tt_s = -10:1:10
omega_hat = 4 * pi / f_s
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



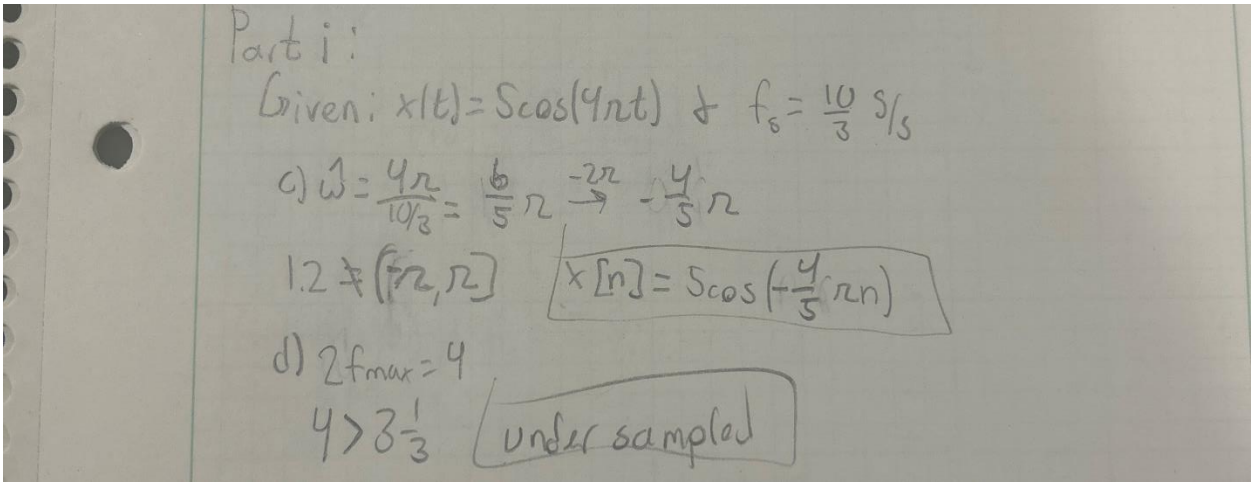
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



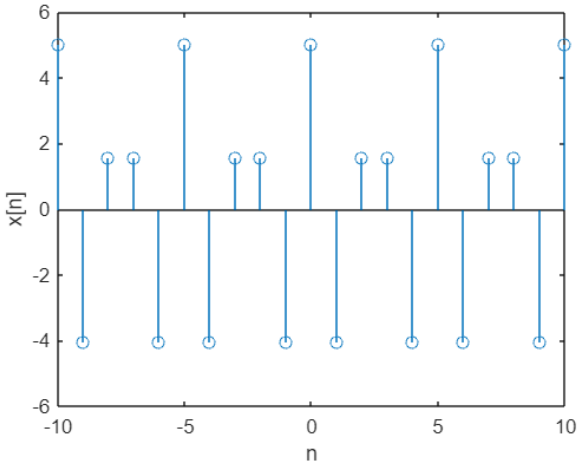
part b

```
f_s = 10/3
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



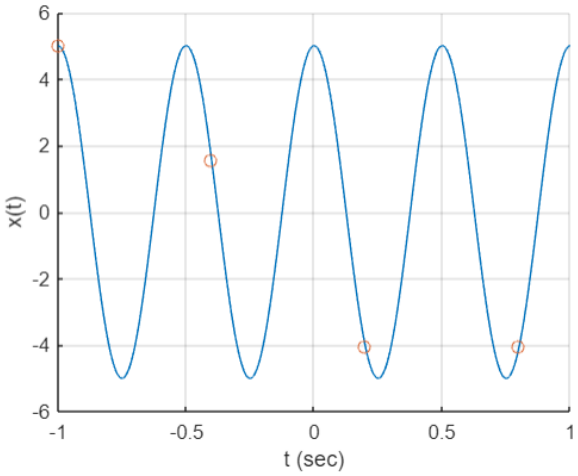
part e

```
tt_s = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



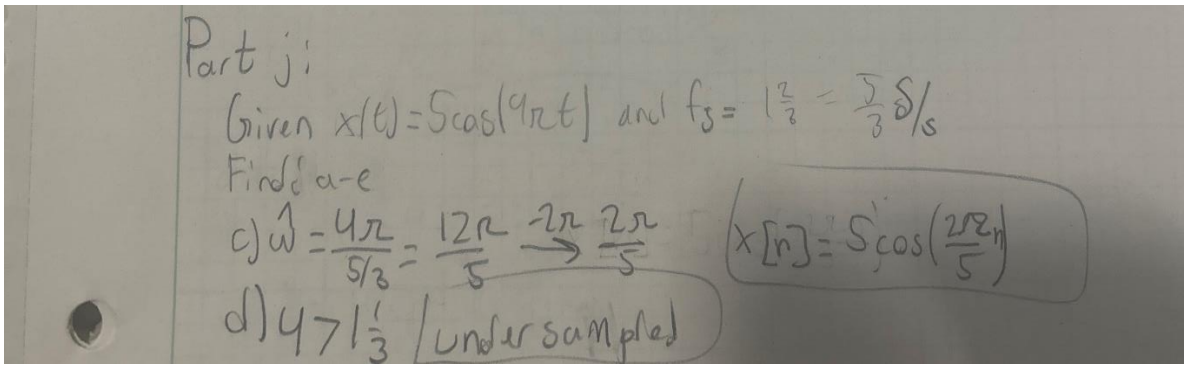
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
x = 5 * cos(4 * pi * tt)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



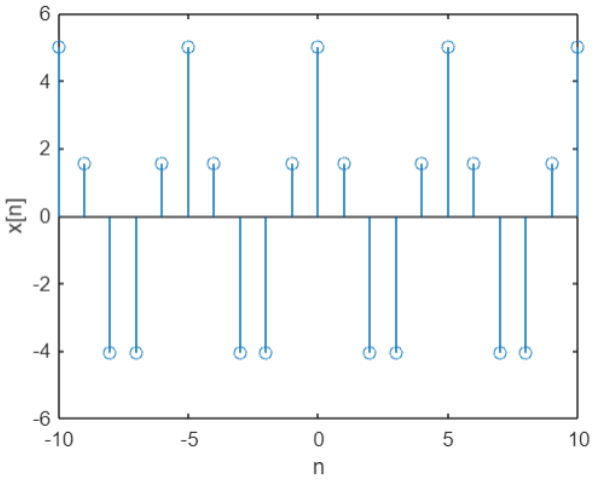
part b

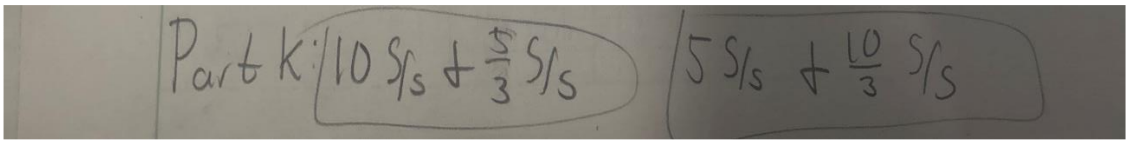
```
f_s = 5/3
tta = start:1/f_s:final
xa = 5 * cos(4 * pi * tta)
scatter(tta, xa)
hold off;
```



part e

```
tt_s = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos(omega_hat * tt_s)
stem(tt_s, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```

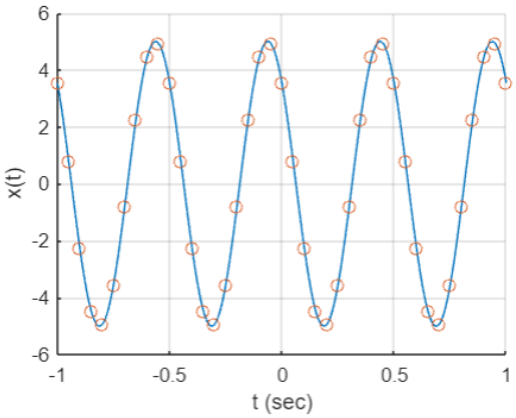




Problem 2

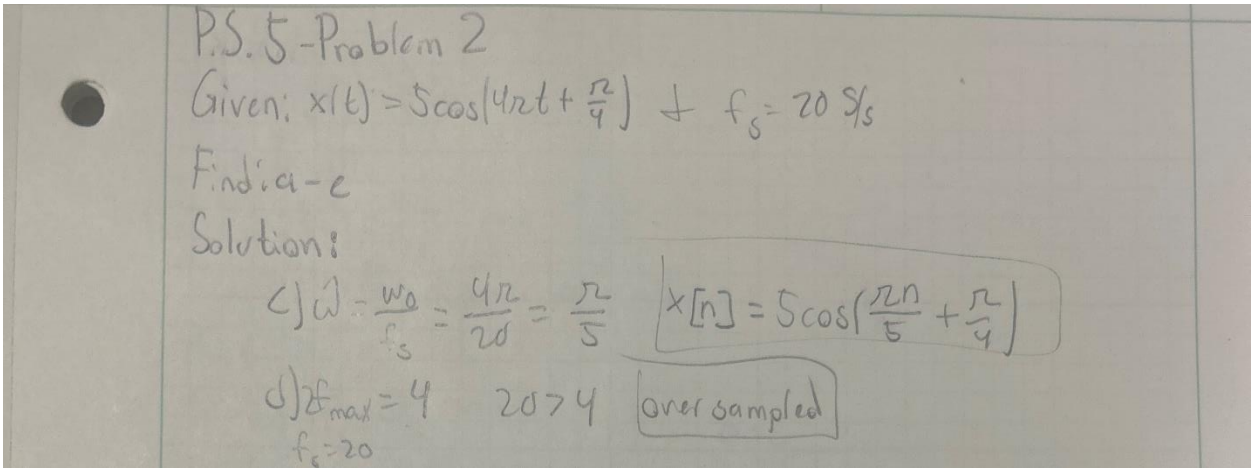
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



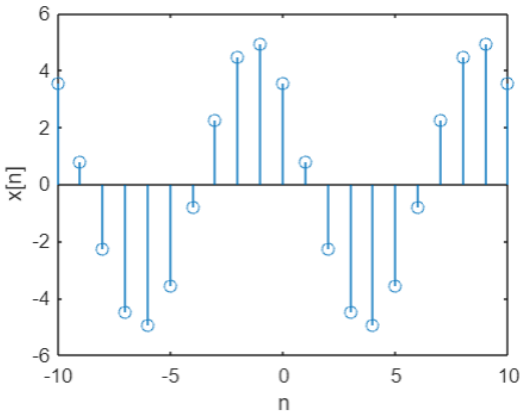
part b

```
f_s = 20
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



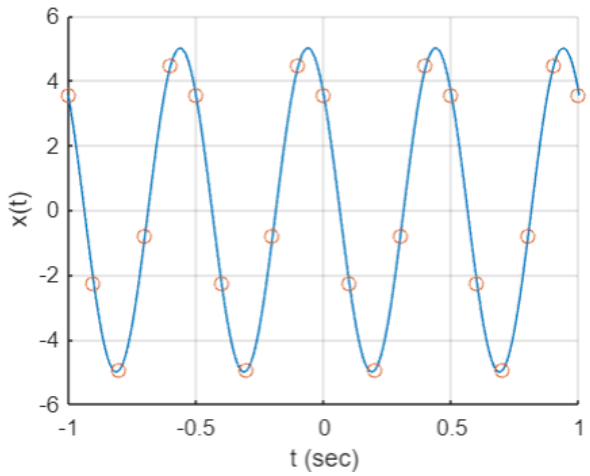
part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



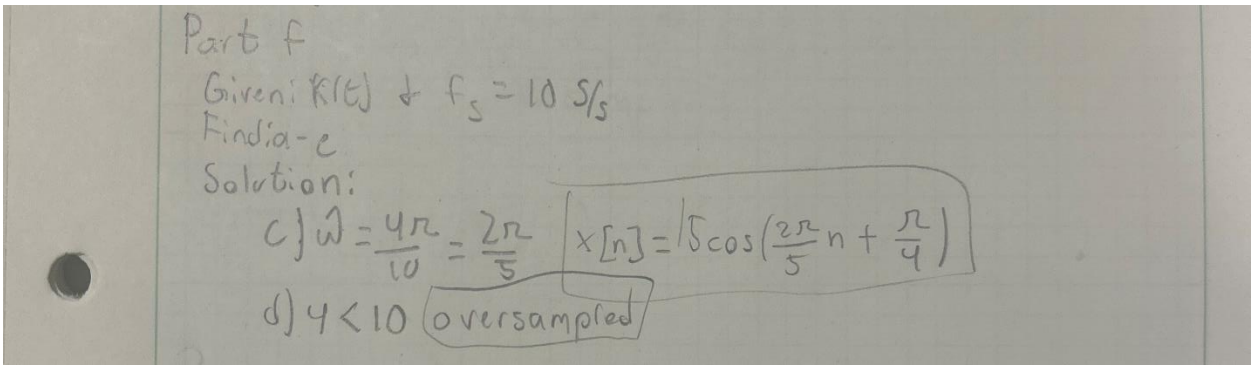
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



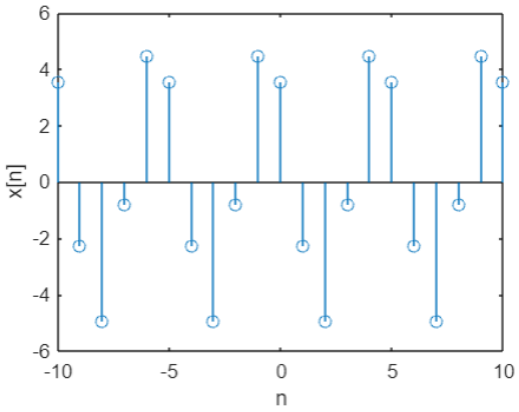
part b

```
f_s = 10
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



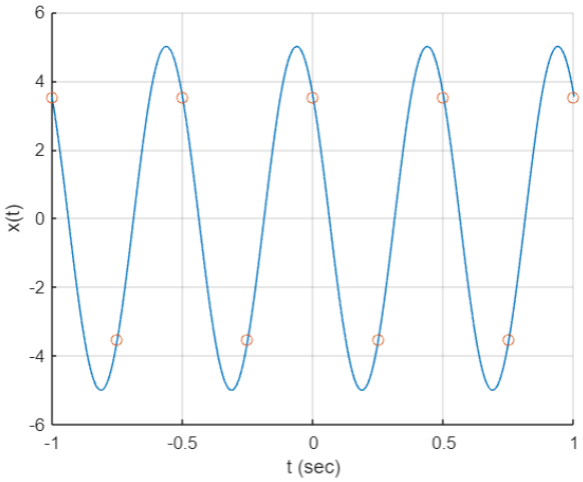
part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



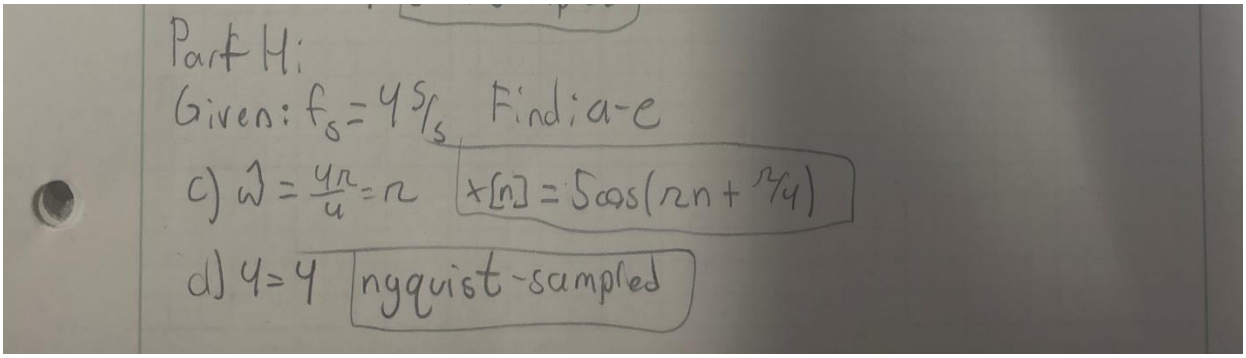
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



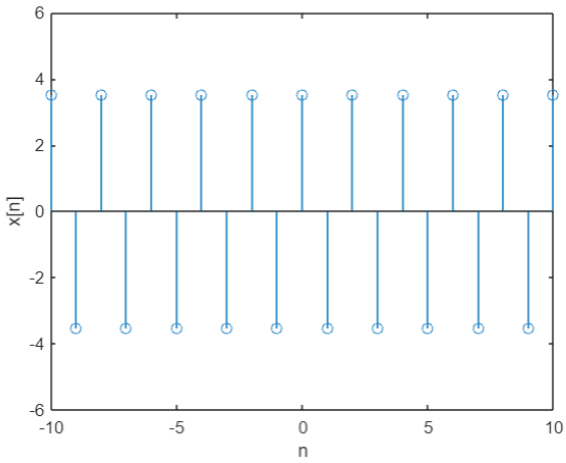
part b

```
f_s = 4
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



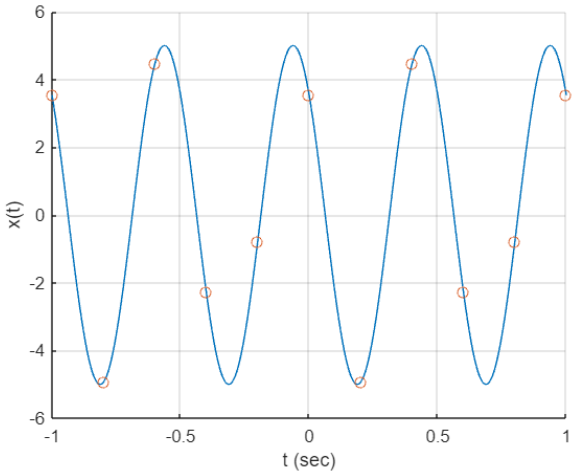
part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



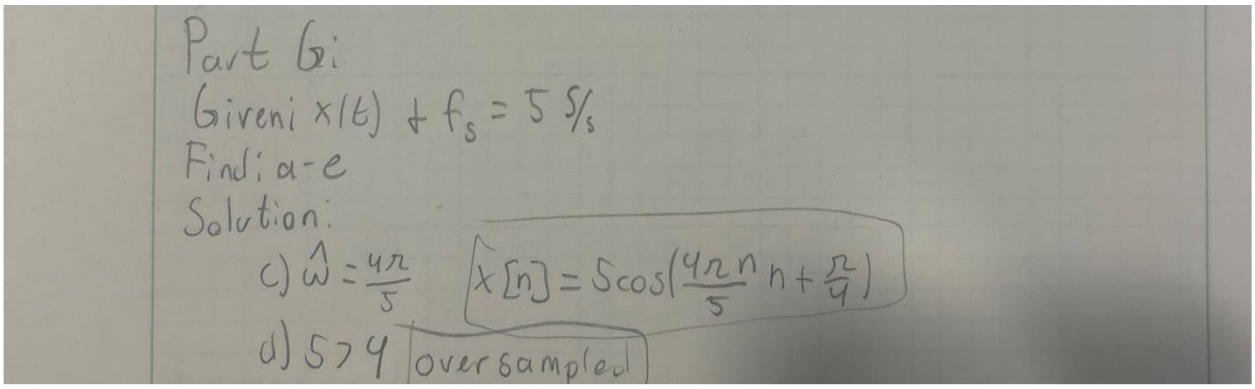
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



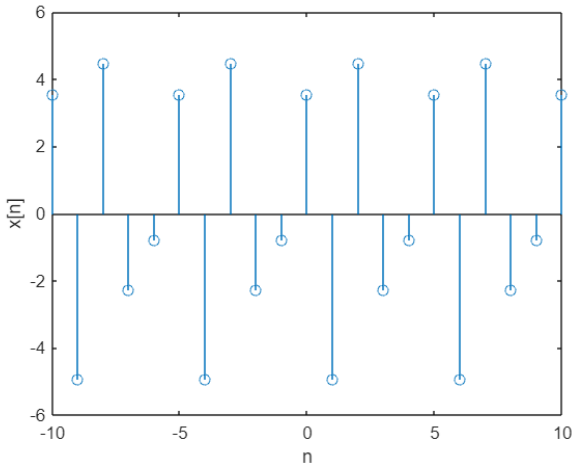
part b

```
f_s = 5
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



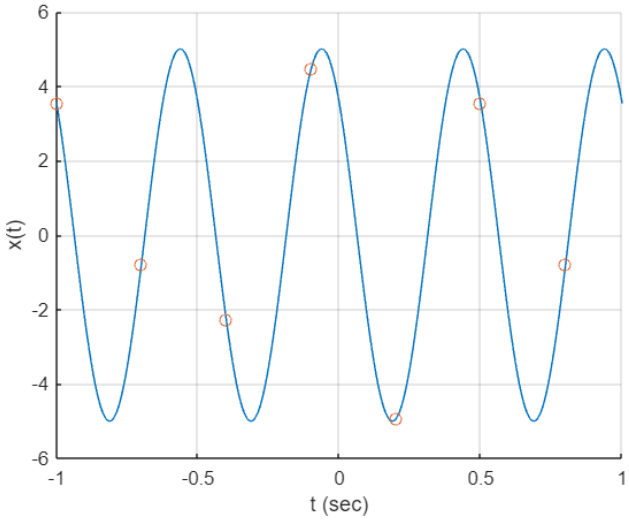
part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



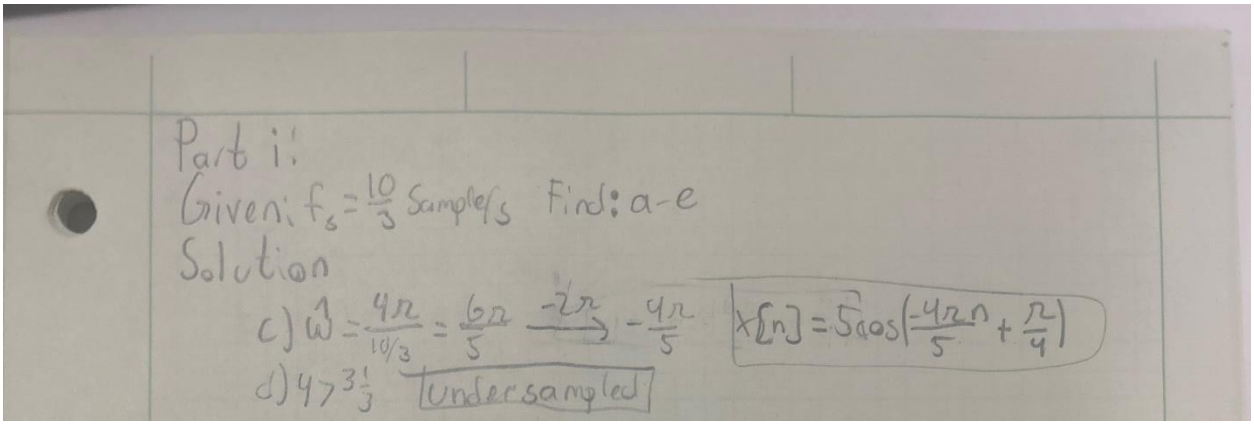
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



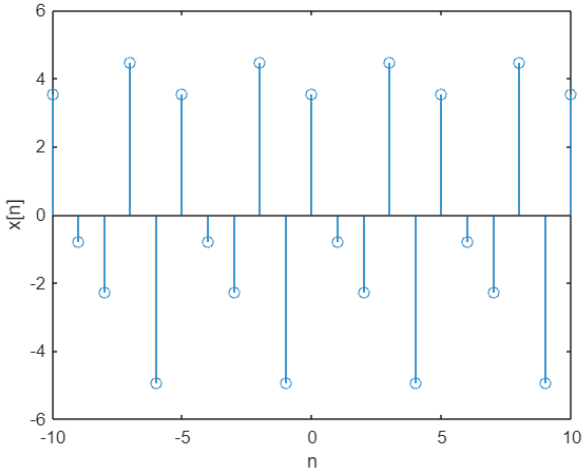
part b

```
f_s = 10/3
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



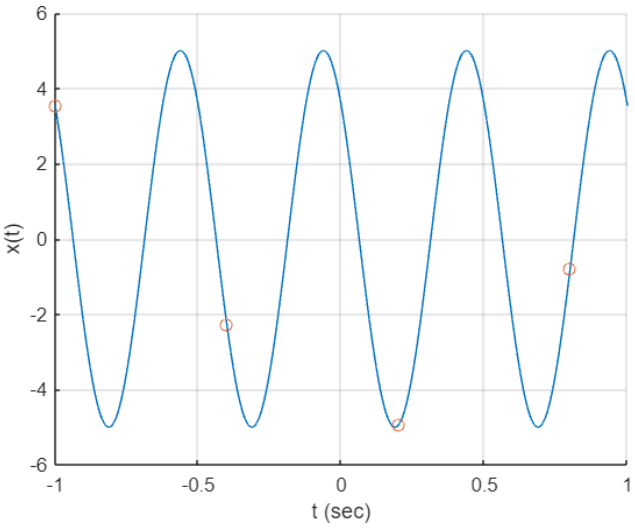
part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```



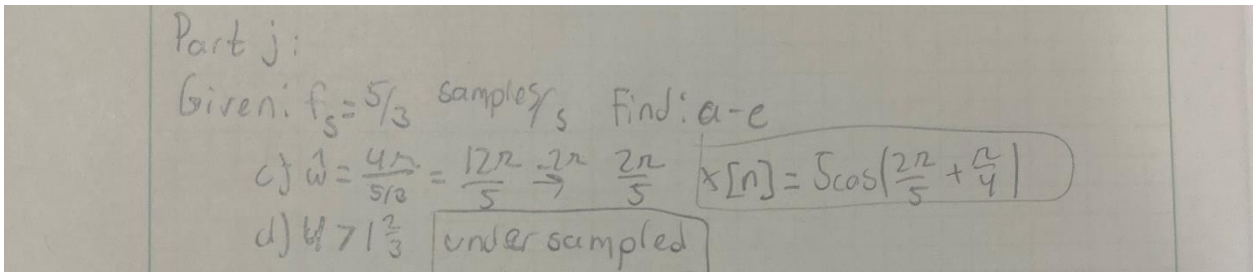
part a

```
start = -1
final = -1 * start
tt = start:1/1000:final
p = pi / 4
x = 5 * cos((4 * pi * tt) + p)
hold on; grid on;
plot(tt,x)
xlim([-1 1]); ylim([-6 6]);
xlabel('t (sec)'); ylabel('x(t)');
```



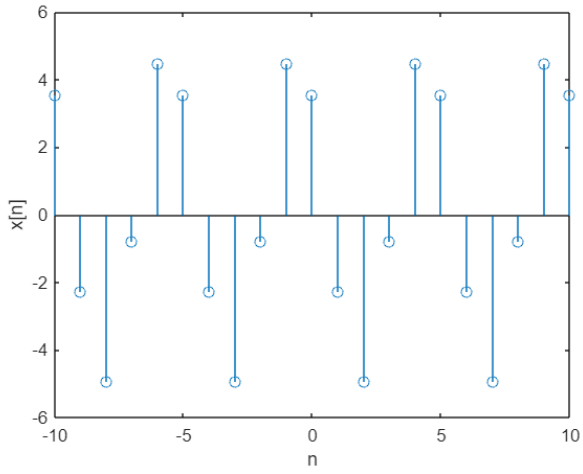
part b

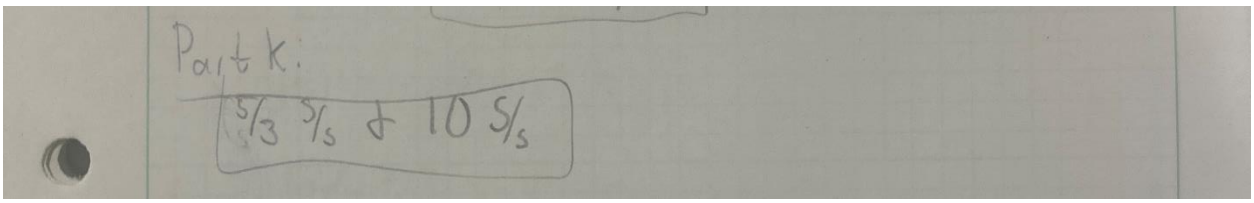
```
f_s = 5/3
tta = start:1/f_s:final
xa = 5 * cos((4 * pi * tta) + p )
scatter(tta, xa)
hold off;
```



part e

```
n = -10:1:10
omega_hat = 4 * pi / f_s
while omega_hat > pi
    omega_hat =  omega_hat - (2 * pi)
end
while omega_hat <= -1 * pi
    omega_hat =  omega_hat + (2 * pi)
end
x_s = 5 * cos((omega_hat * n) + p)
stem(n, x_s);
xlim([-10 10]); ylim([-6 6]);
xlabel('n'); ylabel('x[n]');
```





PS 5 - Problem 3 - P-4.3

Given:

a) $y[n] = 8\cos(0.6\pi n - \pi/3)$

b) $y[n] = 4\cos(1.2\pi n - \pi/4)$

c) $y[n] = 2\cos(2.4\pi n - \pi/5)$

$f_s = 3600$

Find: $y(t)$ for a-c given f_s

Solution:

a) $\hat{\omega} = \frac{\omega_0}{f_s}$ $\quad 0.6\pi = \frac{\omega_0}{3600}$ $\quad \omega_0 =$

$y(t) = 8\cos(2160\pi t - \pi/3)$

b) $1.2\pi > \pi$

$(-2\pi \rightarrow -\frac{4}{5}\pi)$

$-\frac{4}{5}\pi = \frac{\omega_0}{3600}$ $\quad -2880\pi = \omega_0$

$= 2880\pi$

$y(t) = 4\cos(2880\pi t + \pi/4)$

$\cos(-x) = \cos(x)$

c) $2.4\pi > \pi$ $\quad 0.4\pi = \frac{\omega_0}{3600}$ $\quad \omega_0 = 1440\pi$

$(-2\pi \rightarrow 0.4\pi)$

$y(t) = 2\cos(1440\pi t - \pi/5)$

P.S. 5 - Problem 4 - 4.13

a)

Given:

```
nn = 0:21900-99;
xx = (7/pi) cos(1.8pi(nn + 203))
soundsc(xx, 16000)
```

Find: the freq. that will be heard

Solution:

$f_s = 16000$ $\quad \hat{\omega} = \frac{2\pi f_k}{f_s}$ $\quad 0.2\pi = \frac{2\pi f_k}{16000}$ $\quad \boxed{f_k = 1600\ Hz}$

$\hat{\omega} = 1.8\pi \rightarrow -0.2\pi$

b) Given:

```
tt = 0:1/2400:10000
xx = cos(2*pi*1600*tt + pi/3)
soundsc(xx, fsamp)
```

Find: fsamp so the output is in 2400 Hz

Solution:

$\hat{\omega} = \frac{2\pi(1600)}{2400} = 1.5\pi \rightarrow -0.5\pi \rightarrow 0.5\pi$

$f_s = 2400$

$f_k = 1600$ $\quad 0.5\pi = \frac{2\pi(2400)}{f_s}$ $\quad \boxed{f_s = 9600\ Hz}$

c) Given:

```
tt = 0:1/8000:64
xx = 1.23*cos(2*pi*440*tt)
soundsc(xx, 40000)
```

Find: the frequency and duration

$f_k = 440$ $\quad \hat{\omega} = 0.011\pi$ $\quad \boxed{f_k = 2200\ Hz}$

$f_s = 8000$

$\hat{\omega} = \frac{2\pi 440}{8000} = 0.011\pi = \frac{2\pi f_k}{40000}$

$\frac{\text{total samples}}{\text{samples/sec}} = \text{sec}$

$\frac{8000 \cdot 64}{40000} = 12.8\ sec$