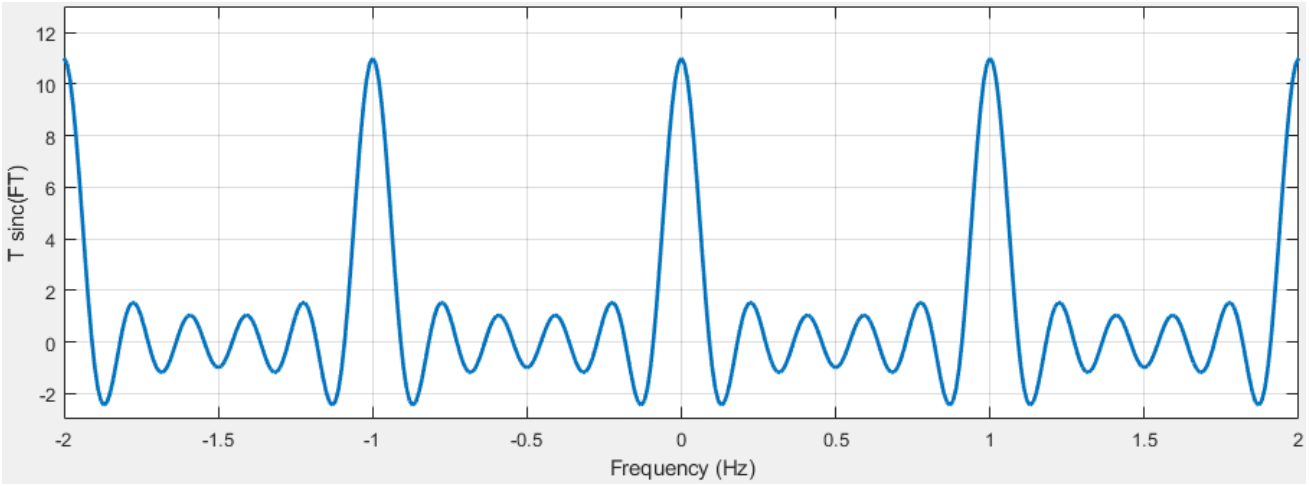
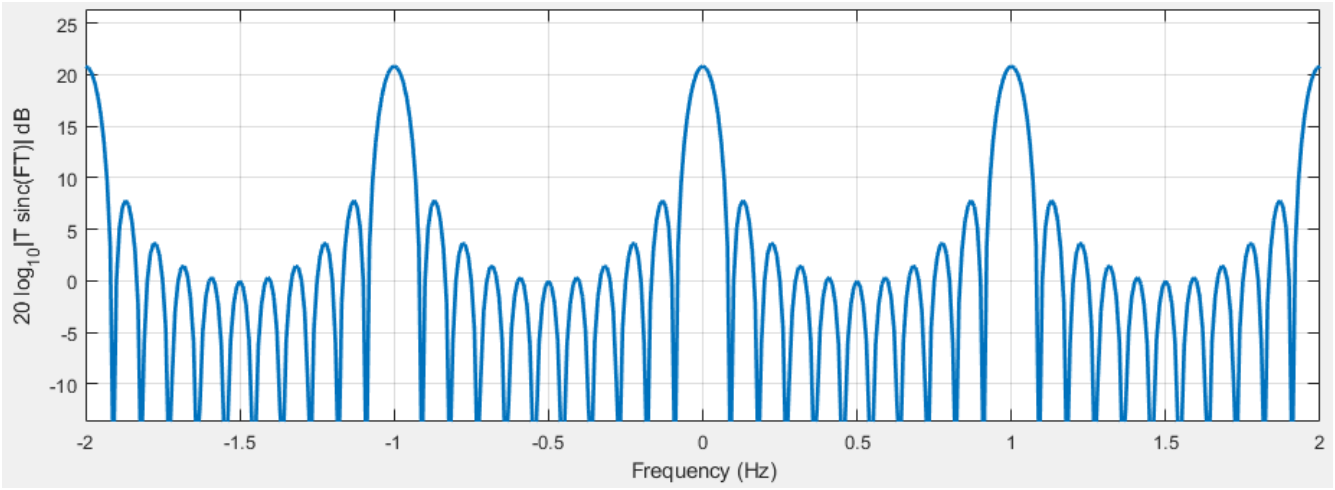
1. $S = [-5, 5] = \{n \in \mathbb{Z}, -5 \leq n \leq 5\}$

$$\sum_{-5}^{5} e^{-j2\pi fn} = \frac{e^{-j2\pi f(-5)} - e^{-j2\pi f(6)}}{1 - e^{-j2\pi f}}$$

$$\frac{(2j)}{(2j)} \frac{e^{j2\pi f\left(\frac{11}{2}\right)} - e^{-j2\pi\left(\frac{11}{2}\right)}}{e^{j2\pi f\frac{1}{2}} - e^{-j2\pi f\frac{1}{2}}} \frac{e^{-j2\pi f\frac{1}{2}}}{e^{-j2\pi f\frac{1}{2}}}$$

$$= \boxed{\frac{\sin(\pi f 11)}{\sin(\pi f)}}$$



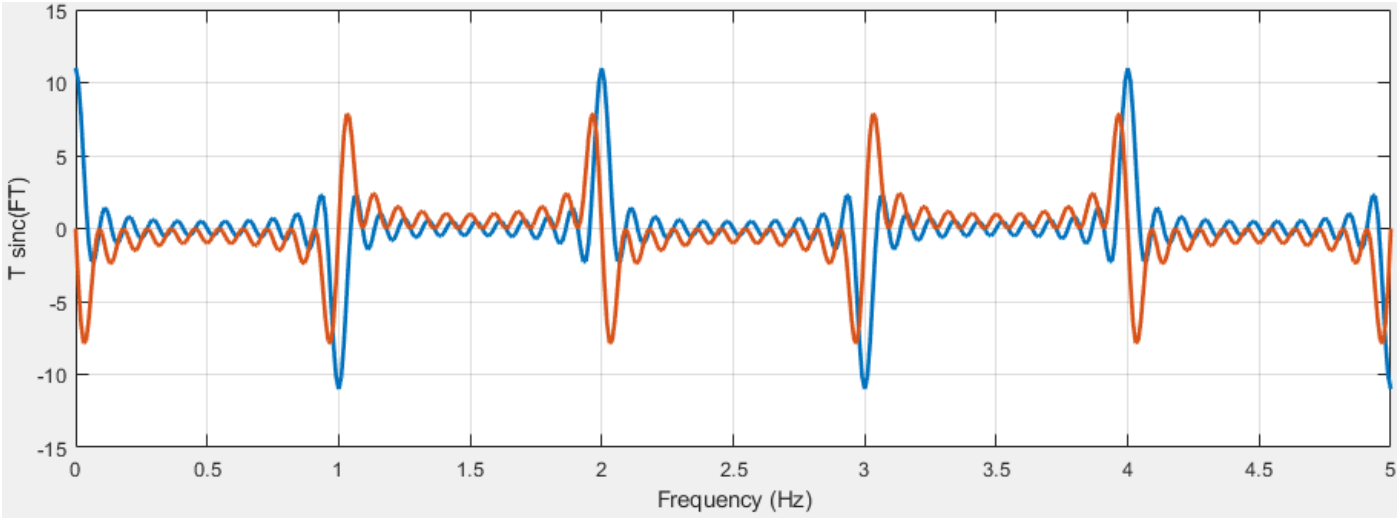



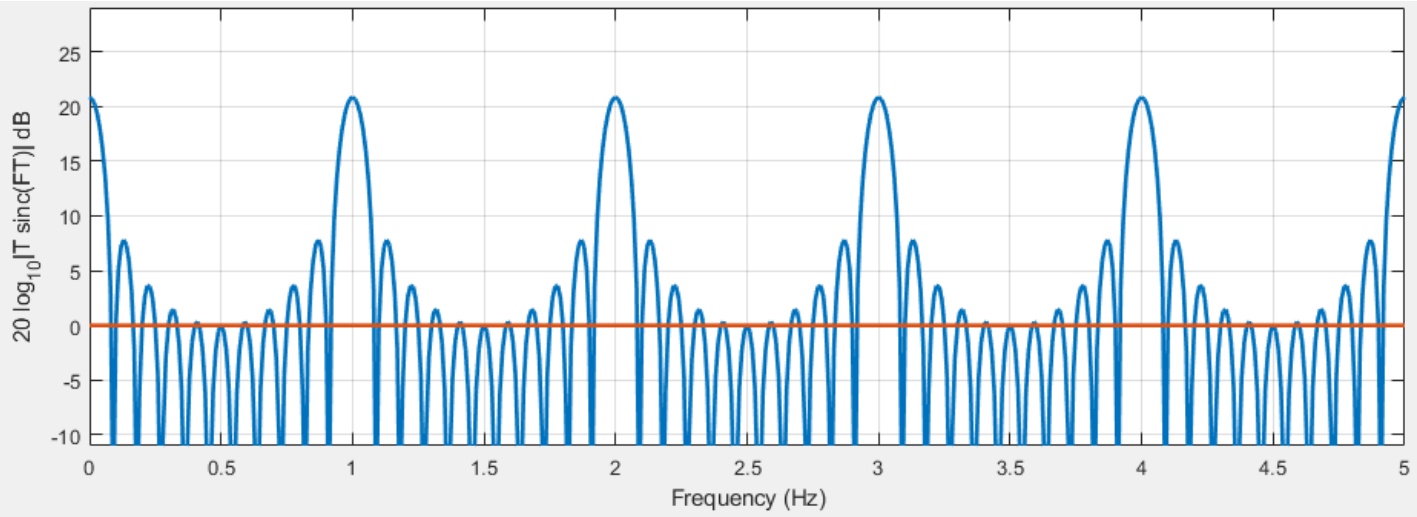
2. $S = [0, 10]$ (plot real and imaginary parts on same axis using Matlab's `hold on` and `hold off` commands)

$$\sum_{0}^{10} e^{-j2\pi fn} = \frac{e^{-j2\pi f(0)} - e^{-j2\pi f(11)}}{1 - e^{-j2\pi f}}$$

$$\frac{e^{j2\pi f\left(\frac{11}{2}\right)} - e^{-j2\pi f\left(\frac{11}{2}\right)}}{e^{j2\pi f\frac{1}{2}} - e^{-j2\pi f\left(\frac{1}{2}\right)}} \quad \frac{e^{-j2\pi f\left(\frac{11}{2}\right)}}{e^{-j2\pi f\left(\frac{1}{2}\right)}}$$

$$\boxed{\frac{\sin(11\pi f)}{\sin(\pi f)} e^{-j\pi f(10)}}$$






3. $S = [-10, -5] \cup [5, 10]$

$$\sum_{-10}^{-5} e^{-j2\pi fn} = \frac{e^{-j2\pi f(-10)} - e^{-j2\pi f(-4)}}{1 - e^{-j2\pi f}}$$

$$\frac{(b+1)-a}{2} = \frac{6}{2}$$

$$\frac{e^{j2\pi f\left(\frac{6}{2}\right)} - e^{-j2\pi f\left(\frac{6}{2}\right)}}{e^{j2\pi f\frac{1}{2}} - e^{-j2\pi f\frac{1}{2}}} \cdot \frac{e^{-j2\pi f\left(\frac{14}{2}\right)}}{e^{-j2\pi f\left(\frac{1}{2}\right)}}$$

$$= \frac{e^{j\pi f(6)} - e^{-j\pi f(6)}}{} \cdot \frac{e^{-j\pi f(14)}}{-j\pi f}$$

$$= \frac{e^{} - e}{e^{j\pi f} - e^{-j\pi f}} \cdot \frac{e}{e^{-j\pi f}}$$

$$= \frac{\sin(6\pi f)}{\sin(\pi f)} \cdot e^{-15j\pi f}$$

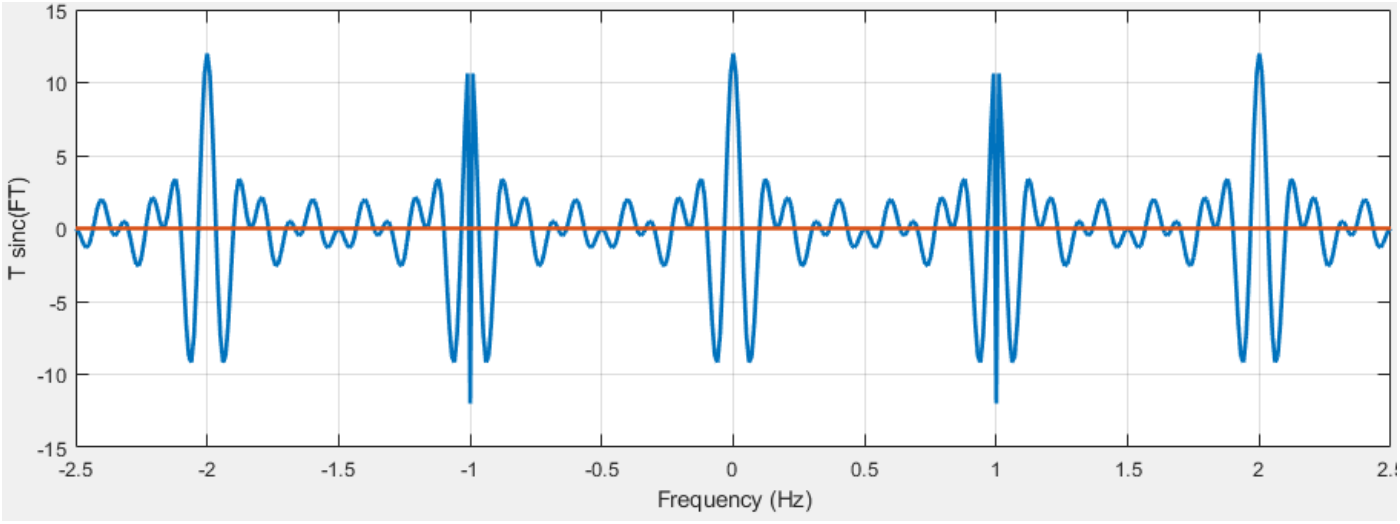
$$\sum_{5}^{10} e^{-j2\pi fn} = \frac{e^{-j2\pi f(5)} - e^{-j2\pi f(11)}}{1 - e^{-j2\pi f}}$$

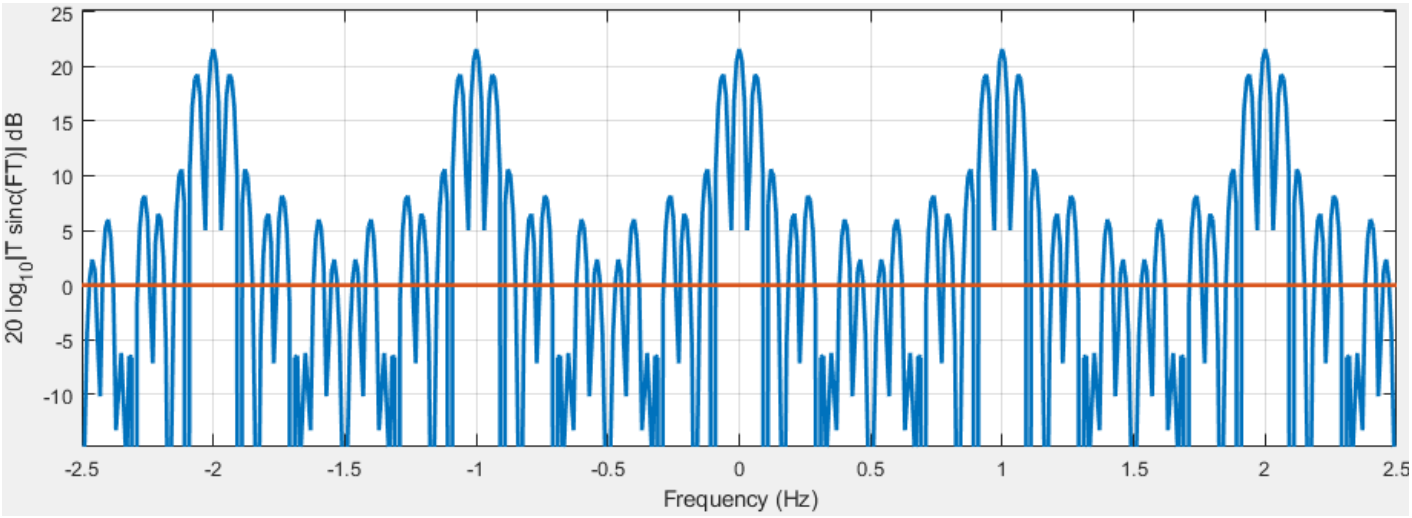
$$\frac{e^{j2\pi f(3)} - e^{-j2\pi f(3)}}{e^{j2\pi f\frac{1}{2}} - e^{-j2\pi f\frac{1}{2}}} \quad \frac{e^{j2\pi f(8)}}{e^{-2\pi f\frac{1}{2}}}$$

$$= \frac{\sin(6\pi f)}{\sin(\pi f)} e^{15j\pi f}$$

$$\frac{\sin(6\pi f)}{\sin(\pi f)} \cdot e^{-15j\pi f} + \frac{\sin(6\pi f)}{\sin(\pi f)} \cdot e^{15j\pi f}$$

$$= \frac{\sin(6\pi f)}{\sin(\pi f)} \left[ e^{15j\pi f} + e^{-15j\pi f} \right]$$




```
% HW1 B question 1
T = 11;
F = [-2:0.01:2];
```

```
S = sincperiodic(F,T);
subplot(321);
plot(F,S,'LineWidth',2);
grid on;
xlabel('Frequency (Hz)');
ylabel('T sinc(FT)');
subplot(322);
plot(F,20*log10(abs(S)),'LineWidth',2);
grid on;
ylim([-40,0]);
xlabel('Frequency (Hz)');
ylabel('20 log_{10}|T sinc(FT)| dB');
orient landscape;


% HW1 B question 2
T = 11;
F = [0:0.01:5];
S = sincperiodic(F,T).*(exp(-1i*pi*F*T));
subplot(323);
plot(F,S,'LineWidth',2);
hold on;
plot(F,imag(S),'LineWidth',2);
hold off;
grid on;
xlabel('Frequency (Hz)');
ylabel('T sinc(FT)');
subplot(324);
plot(F,20*log10(abs(S)),'LineWidth',2);
hold on;
plot(F,imag(20*log10(abs(S))),'LineWidth',2);
hold off;
grid on;
ylim([-40,0]);
xlabel('Frequency (Hz)');
ylabel('20 log_{10}|T sinc(FT)| dB');
orient landscape;
```

```
% HW1 B question 3
T = 6;
F = [-2.5:0.01:2.5];
S = sincperiodic(F,T).*((exp(15*1i*pi*F))+(exp(-15*
1i*pi*F)));
subplot(325);
plot(F,S,'LineWidth',2);
hold on;
plot(F,imag(S),'LineWidth',2);
hold off;
grid on;
xlabel('Frequency (Hz)');
ylabel('T sinc(FT)');
subplot(326);
plot(F,20*log10(abs(S)),'LineWidth',2);
hold on;
plot(F,imag(20*log10(abs(S))),'LineWidth',2);
hold off;
grid on;
ylim([-40,0]);
xlabel('Frequency (Hz)');
ylabel('20 log_{10}|T sinc(FT)| dB');
orient landscape;



function y = sincperiodic(x,N)
i = find(mod(x,1)==0);
x(i) = 0.5;
y = sin(pi*x*N)./sin(pi*x);
y(i) = N;
end
```