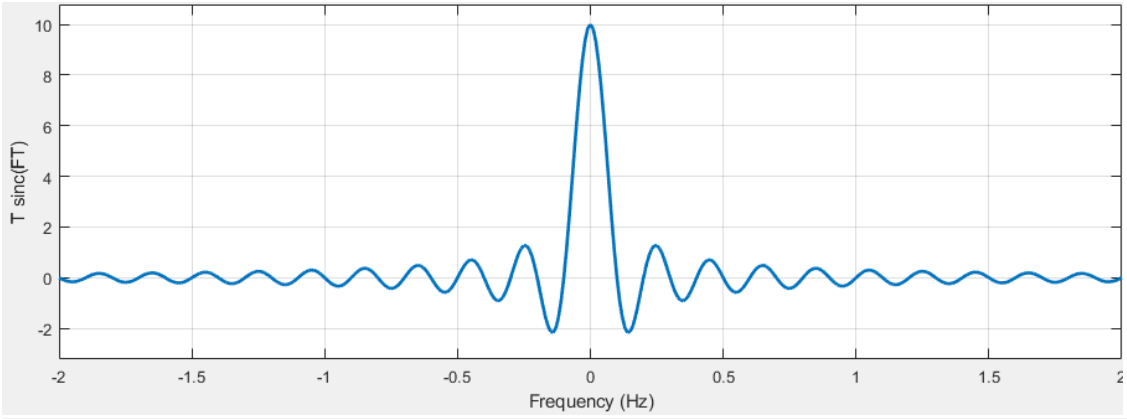
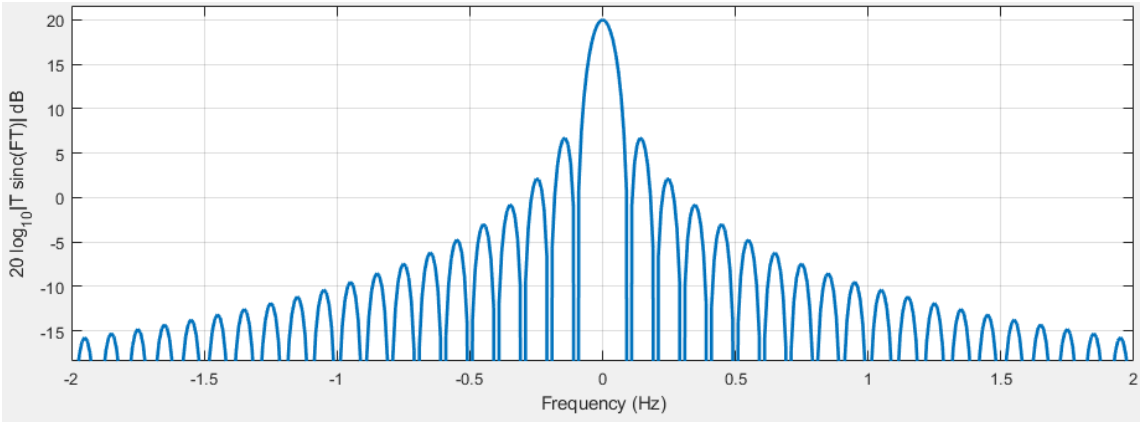
1. $S = [-5, 5] = \{t \in \mathbb{R}, -5 \leq t \leq 5\}$

$$\int_{-5}^{5} e^{-j2\pi Ft}\, dt = \frac{-e^{-j2\pi F5} + e^{j2\pi F5}}{tj2\pi F}$$

$$\boxed{\frac{\sin(10\pi F)}{\pi F}} \Rightarrow 10\left[\frac{\sin(10\pi F)}{10\pi F}\right]$$



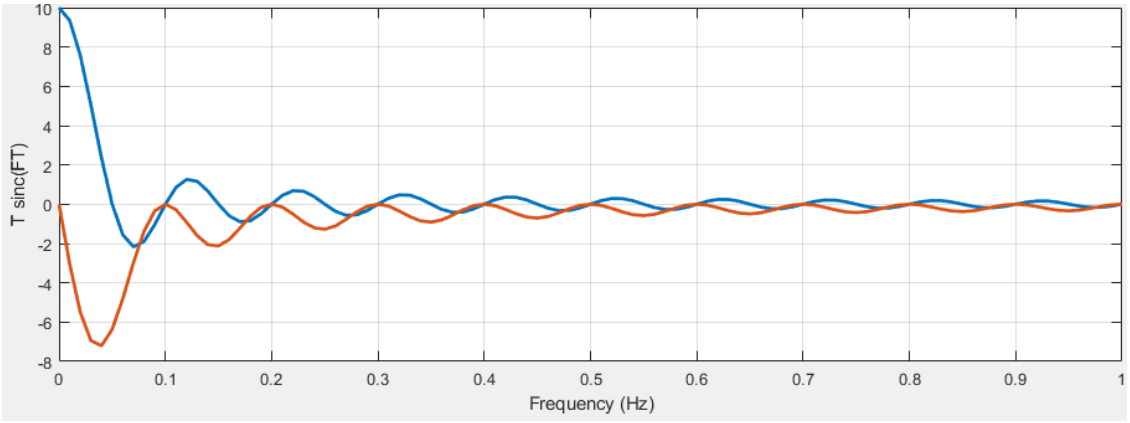


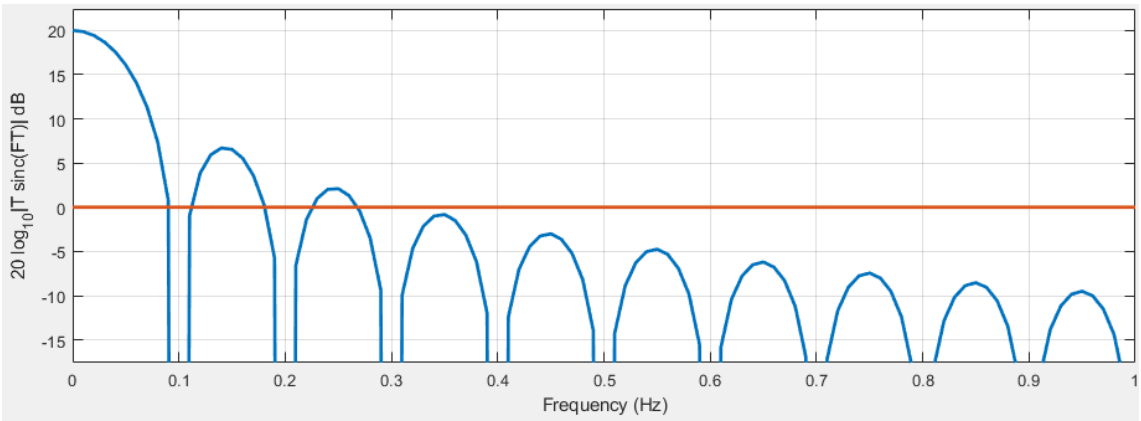
2. $S = [0, 10]$ (plot real and imaginary parts on same axis using Matlab's `hold on` and `hold off` commands)

$$\int_0^{10} e^{-j2\pi Ft}\,dt = \frac{e^{-j2\pi F10} - 1}{-j2\pi F} = \frac{e^{-j2\pi F10} - e^{-j2\pi F\cdot 0}}{-j2\pi F}$$

$$\frac{-e^{-j\pi Ft} + e^{j\pi Ft}}{+j2\pi F} e^{-j\pi FT}$$

$$\boxed{\frac{\sin(10\pi F)}{\pi F} e^{-j\pi F\cdot 10}} \Rightarrow 10\left[\frac{\sin(10\pi F)}{10\pi F}\right] e^{-j\pi F\cdot 10}$$





3. $S = [-10, -5] \cup [5, 10]$ (hint: union of two intervals)

$$\int_{-10}^{-5} e^{-j2\pi Ft}\,dt = \frac{e^{-j2\pi F(-5)} - e^{-j2\pi F(-10)}}{-j2\pi F}$$

$$\frac{e^{-j2\pi F(-5)} - e^{-j2\pi F(-10)}}{-j2\pi F} \cdot e^{-j2\pi F\left(\frac{-15}{2}\right)}$$

$$\frac{-5 - -10}{2} = \frac{5}{2}$$

$$\frac{-e^{-j2\pi F\left(\frac{5}{2}\right)} + e^{j2\pi F\left(\frac{5}{2}\right)}}{+j2\pi F} e^{-j2\pi F\left(-\frac{15}{2}\right)}$$

$$\frac{\sin(5\pi F)}{\pi F} e^{15j\pi F}$$

$$\int_{5}^{10} e^{-j2\pi Ft}\,dt = \frac{e^{-j2\pi F10} - e^{-j2\pi F5}}{-j2\pi F}$$

$$\frac{-e^{-j2\pi F\left(\frac{5}{2}\right)} + e^{j2\pi F\left(\frac{5}{2}\right)}}{+j2\pi F} e^{-j2\pi F\left(\frac{15}{2}\right)}$$

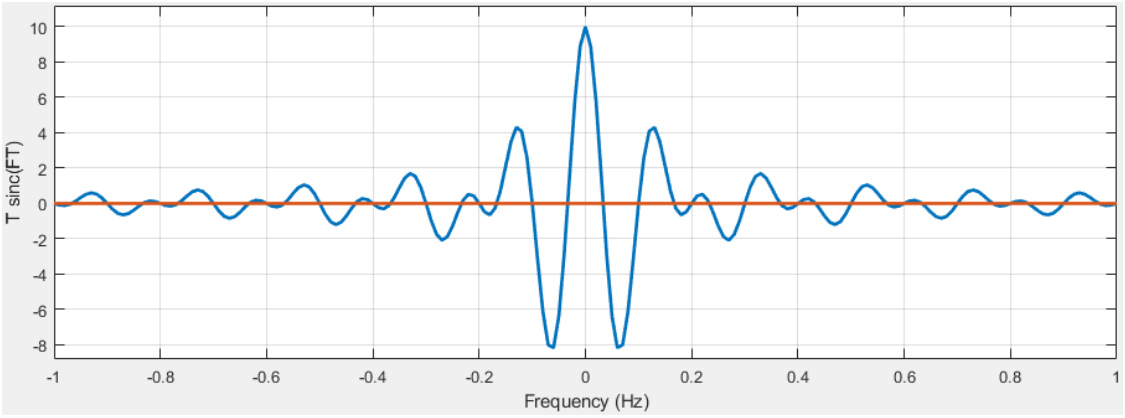
$$= \frac{e^{5j\pi F} - e^{-5j\pi F}}{j2\pi F} e^{-15j\pi F}$$

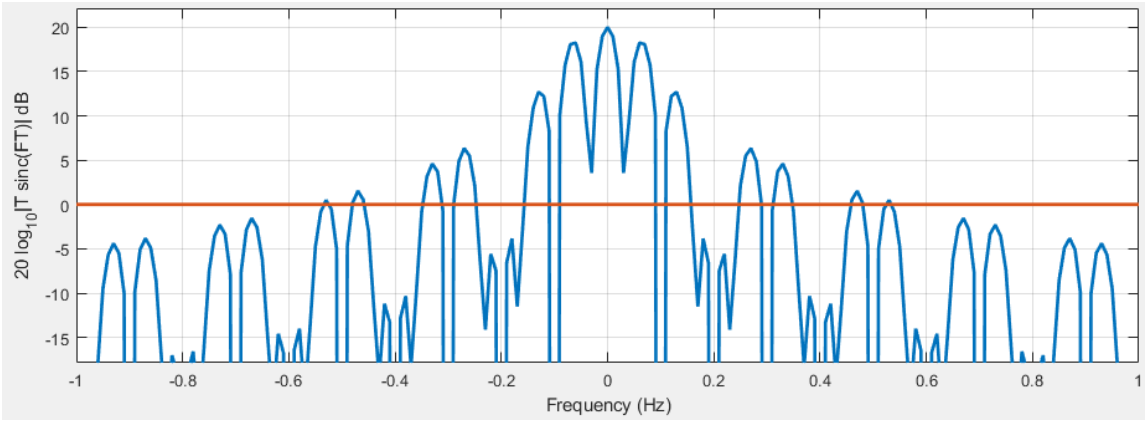
$$= \frac{\sin(5\pi F)}{\pi F} e^{-15j\pi F}$$

$$\frac{\sin(5\pi F)}{\pi F} e^{15j\pi F} + \frac{\sin(5\pi F)}{\pi F} e^{-15j\pi F}$$

$$= \boxed{\frac{\sin(5\pi F)}{\pi F}\left[e^{15j\pi F} + e^{-15j\pi F}\right]}$$

$$\Rightarrow 5\left[\frac{\sin(5\pi F)}{5\pi F}\right]\left[e^{15j\pi F} + e^{-15j\pi F}\right]$$





```
% HW1 question 1
T = 10;
F = [-2:0.01:2];
S = T*sinc(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 question 2
T = 10;
F = [0:0.01:1];
S = T*sinc(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 question 3
T = 5;
F = [-1:0.01:1];
S = T*sinc(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;
```