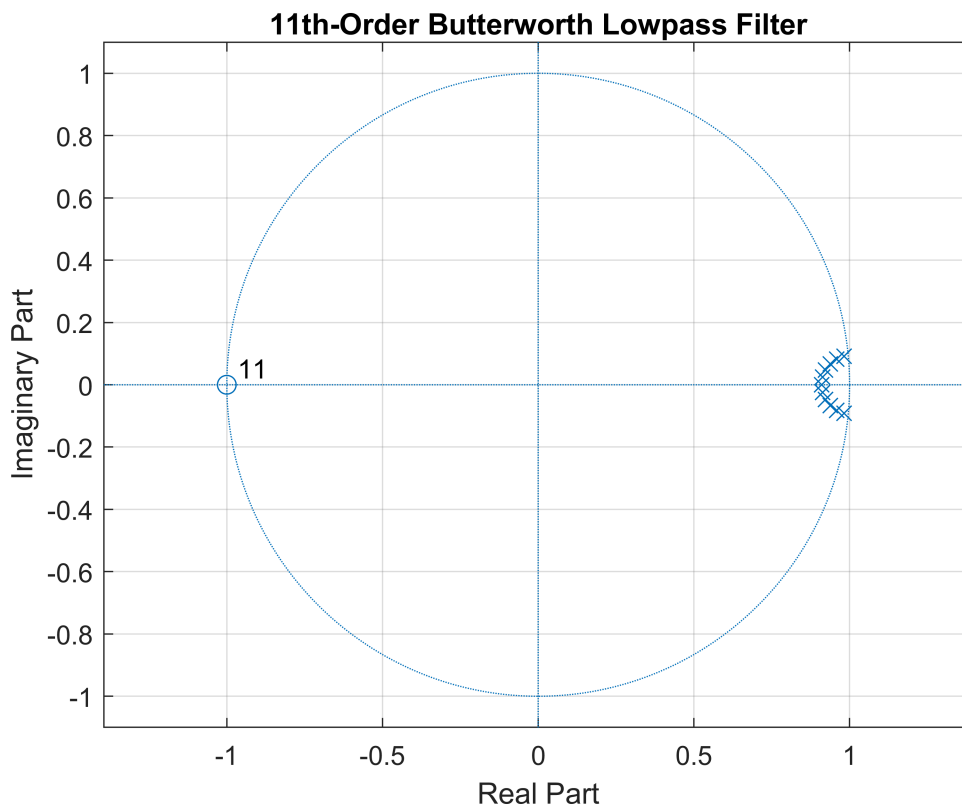


1. Consider an 11th -order analog Butterworth lowpass filter () with 3 dB cutoff frequency of 15 Hz.

```
n = 11;  
fc = 15;  
fs = 1000;
```

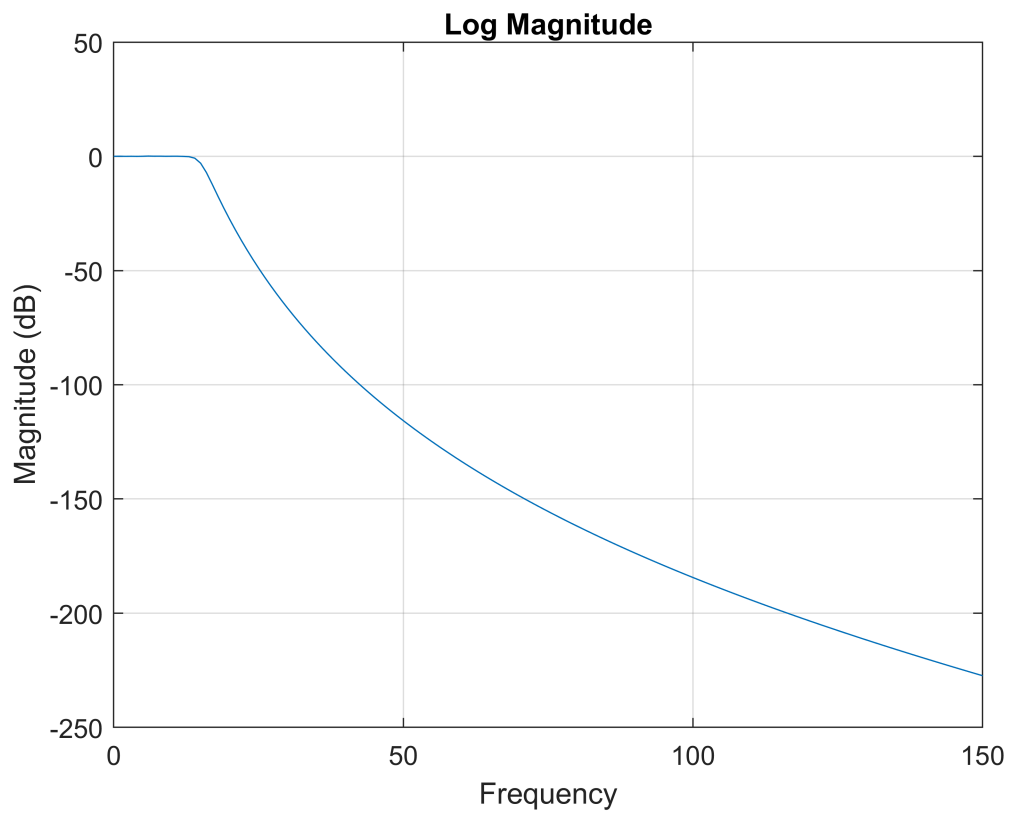
a. Determine and graph the pole locations of ().

```
[z,p,k] = butter(n,fc/(fs/2));  
figure(1);  
zplane(z,p)  
grid  
title('11th-Order Butterworth Lowpass Filter')
```

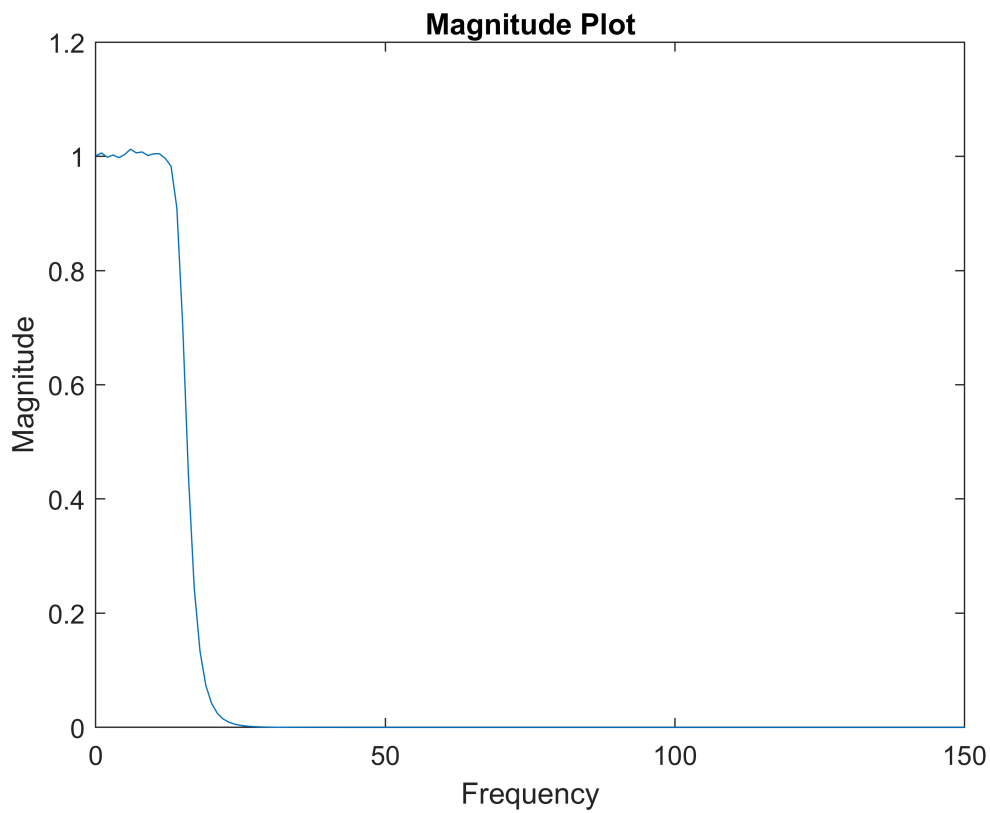


b. Plot the magnitude and log-magnitude responses over [0, 150] Hz range.

```
[b,a] = butter(n,fc/(fs/2));  
[h,w] = freqz(b,a,[0:1:150],fs);  
figure(2);  
plot(w,20*log10(abs(h)))  
title("Log Magnitude")  
ylabel('Magnitude (dB)')  
xlabel('Frequency')  
grid on;
```



```
figure(3);  
plot(w,abs(h));  
ylabel('Magnitude')  
xlabel('Frequency')  
title('Magnitude Plot')
```



c. Determine frequencies at which the attenuation is 20 dB and 50 dB.

```
load("q8_1_c.mat")
cursor_info1
```

```
cursor_info1 = 1x4 struct
```

Fields	Target	Position	DataIndex
1	1x1 Line	[25,-48....	26
2	1x1 Line	[26,-52....	27
3	1x1 Line	[18,-17....	19
4	1x1 Line	[19,-22....	20

From Graph we can see at frequencies are 18Hz and 25Hz respectively