M3

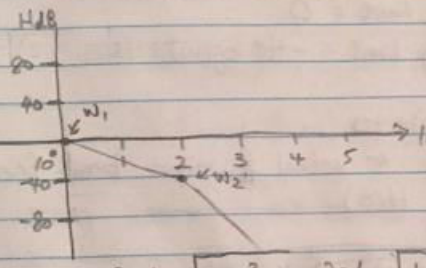
a. $H = \frac{V_{out}}{V_{in}} = \frac{1/Cs}{\frac{1}{Cs}+Ls+R} = \frac{1}{1+LCs^2+RCs}$

b.

1. $H(s) = \frac{1}{0.01s^2+1.01s+1} = \frac{1}{(0.01)(s+1)(s+100)} = \frac{1}{(1+s)(1+\frac{s}{100})}$

break frequency $w = \frac{-1.01 \pm \sqrt{1.01^2-4(0.01)(1)}}{2 \cdot 0.01}$

$w = 1$ rad/s , 100 rad/s ← two break frequencies

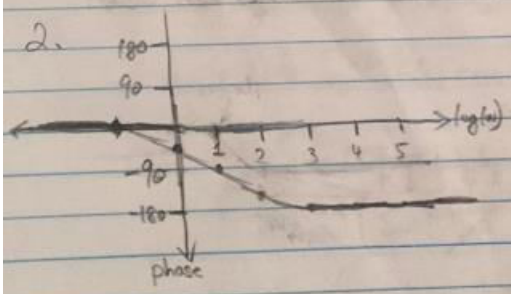


$H_{dB} = 20\log(H(jw))$

$H(jw) = \frac{1}{(1+wj)(1+\frac{w}{100}j)}$

$H_{dB} = -20\log\sqrt{1+w^2} - 20\log\sqrt{1+(\frac{w}{100})^2}$

2.



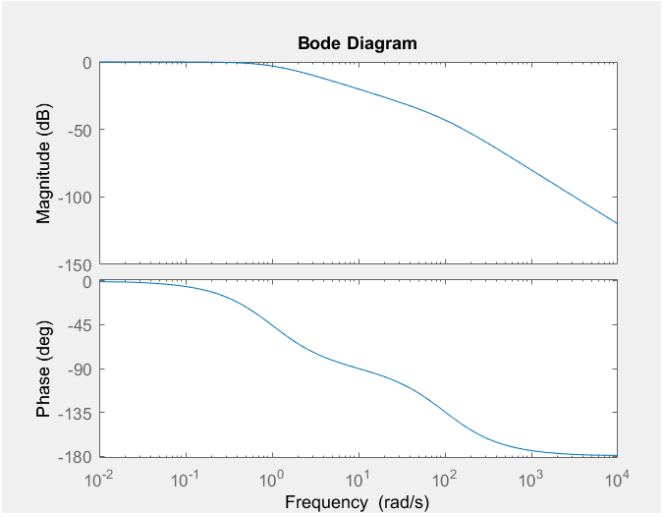
- phase of $(1+jw)$
- phase of $(1+\frac{w}{100}j)$

$w=-1$ phase $\approx 0°$

$w=1$ phase ≈ -45

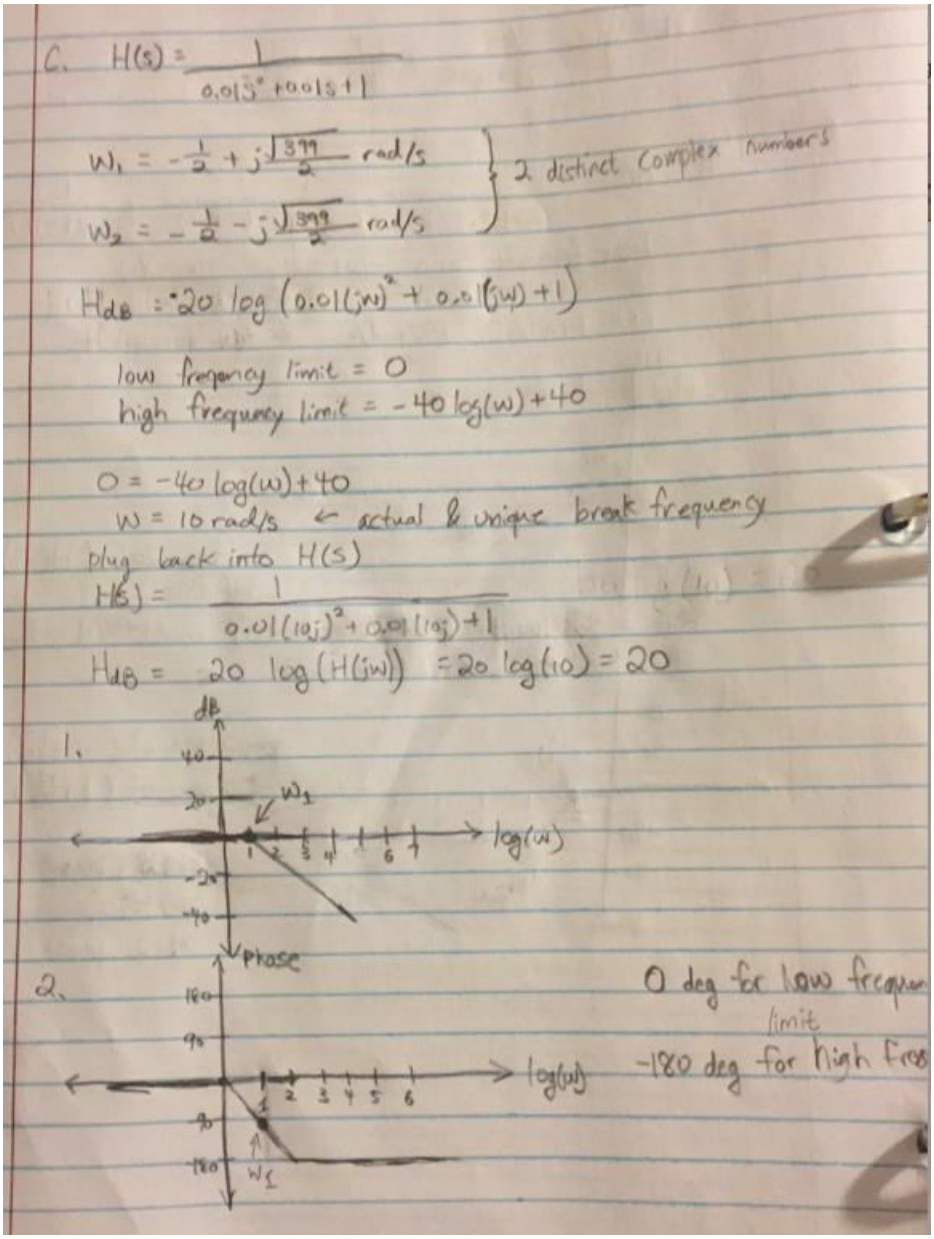
$w=2$ phase ≈ -135

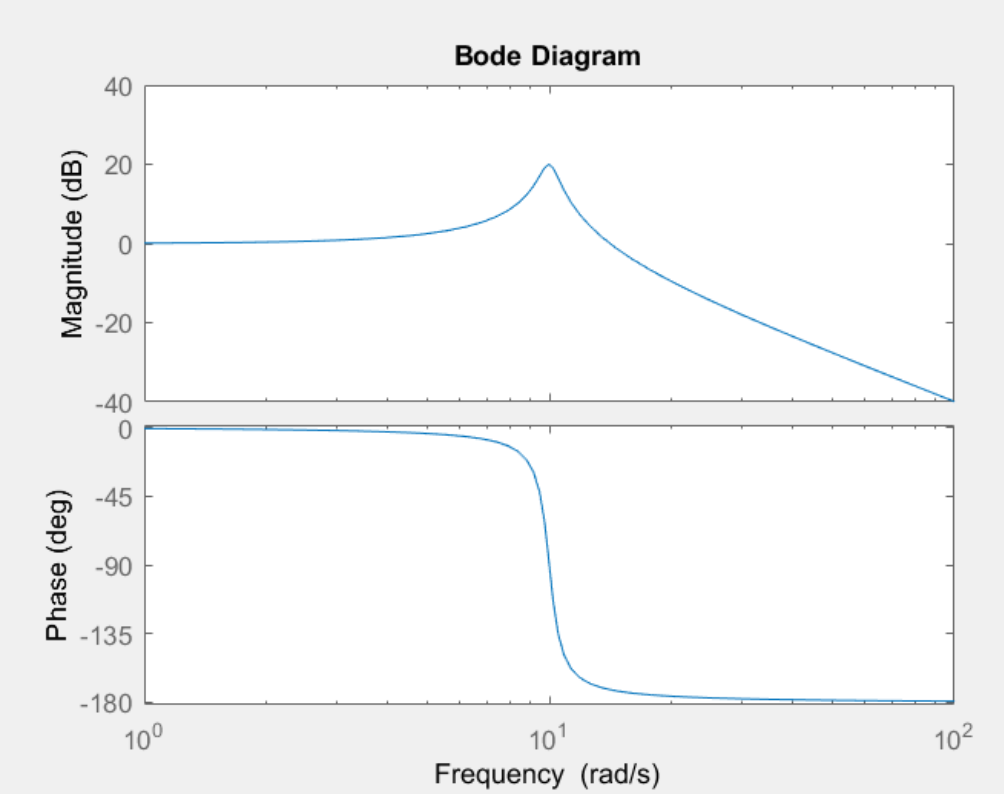
$w=3$ phase ≈ -180



3. The exact magnitude bode diagram are not straight-line segments as it contains more data points. The curve is much smoother. Otherwise, the break frequency and the magnitude seemed matching to the prediction.

4. Just like the magnitude bode diagram, the actual phase diagram has smoother curve since it made with data points instead of straight lines. The actual phase diagram show more changes in phase between two frequencies, but the two break frequencies are on the right position.





3. The location of the break frequency is correct, Since the prediction uses straight lines, its different with the exact bode diagram around the break frequency.

4.

The estimated diagram for phase are very close to the actual one, exception the actual one has more exact data points so it is smooth curve instead of straight line approximations.

```
%Xi Kun Zou M3
% part b 3,4
R=10.1;
L=0.1;
C=0.1;
H=tf([1],[L*C R*C 1])
bode(H)

%part c , 3, 4
R=0.1;
L=0.1;
C=0.1;
H=tf([1],[L*C R*C 1])
bode(H)
```