

# Answers to Bode Interpretation Examples

This workbook shows the answers to the Bode interpretation/system ID examples in this YouTube video: <https://youtu.be/-fymSkqDUUE>

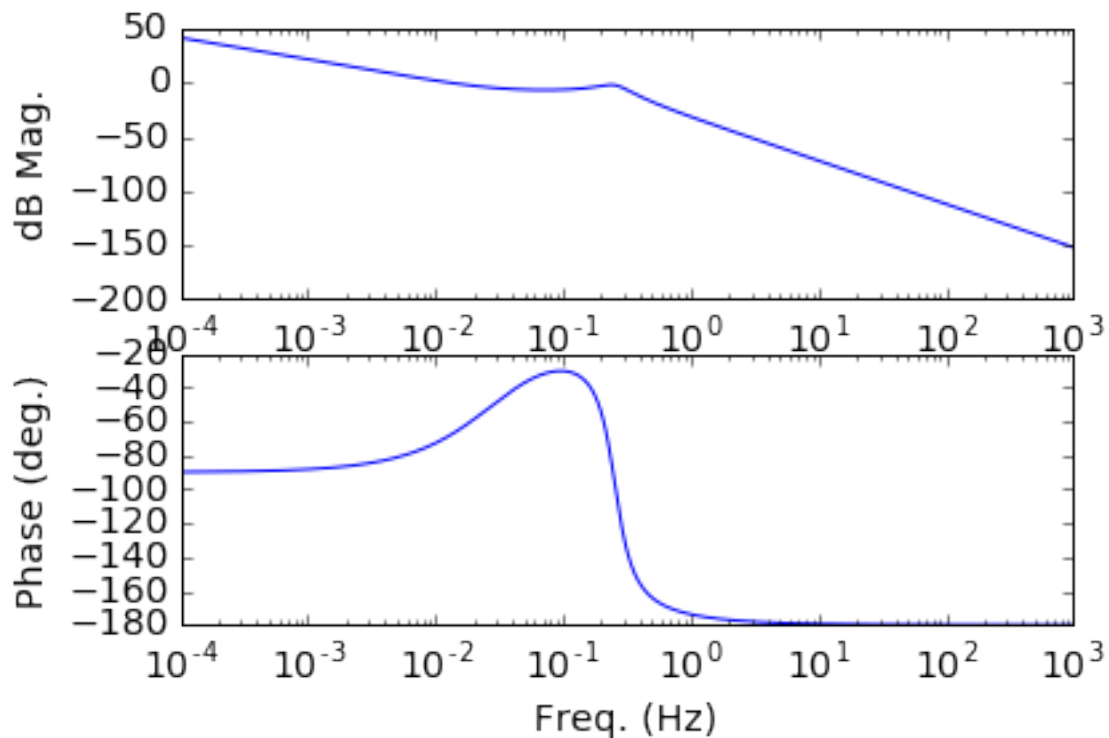
Note that you must save the module `bode_gen_examples_2017.py` in the same folder as this workbook in order for this code to work. If you checked this code out of github, this should be done automatically.

## Import transfer functions

```
from bode_gen_examples_2017 import G1ex, G2ex, G3ex
```

### Example 1

```
plot_bode(G1ex)
```



## Answer

```
def show_answer(G):
    print('G = %s' % G)
    print('poles (rad/sec) = %s' % np.squeeze(G.pole()))
    print('poles (Hz) = %s' % np.squeeze(G.pole()/(2*pi)))
    print('zeros (rad/sec) = %s' % np.squeeze(G.zero()))
    print('zeros (Hz) = %s' % np.squeeze(G.zero()/(2*pi)))

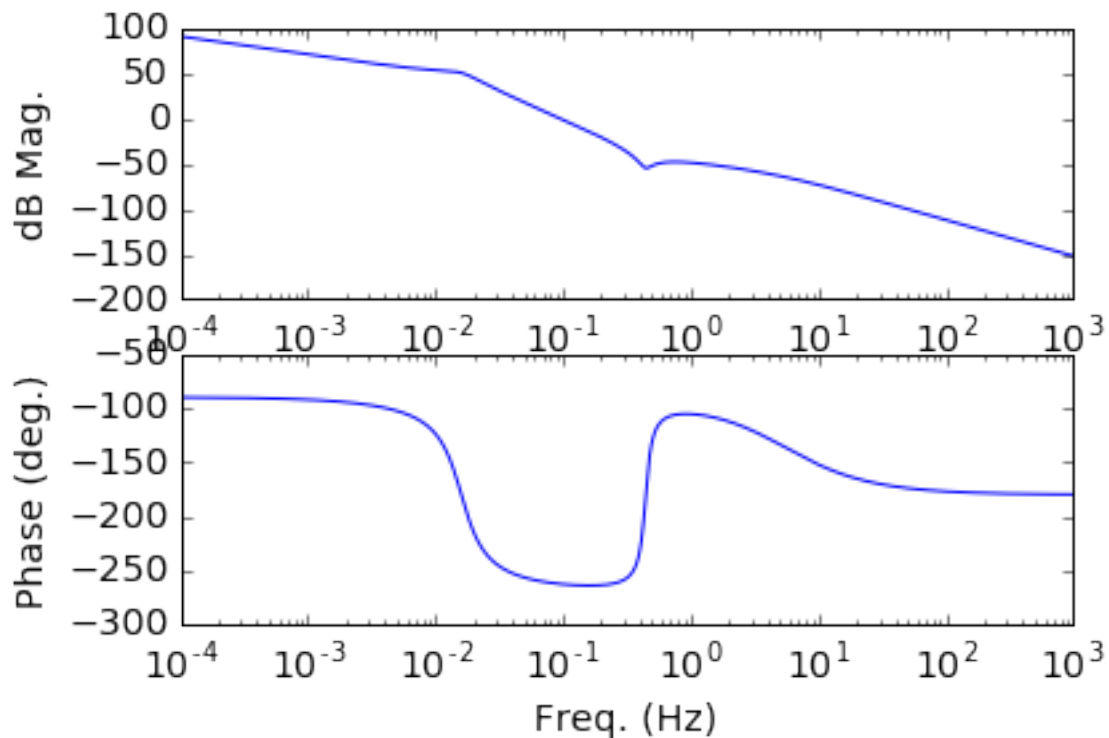
show_answer(Glex)

G =
      s + 0.1895
-----
s^3 + 0.8202 s^2 + 2.56 s

poles (rad/sec) = [-0.41010196+1.54653524j -0.41010196-1.54653524j  0.0]
poles (Hz) = [-0.06526975+0.24613873j -0.06526975-0.24613873j  0.000000]
zeros (rad/sec) = -0.18948775
zeros (Hz) = -0.03015791206786129
```

## Example 2

```
plot_bode(G2ex)
```



## Answer for Example 2

```
show_answer(G2ex)
```

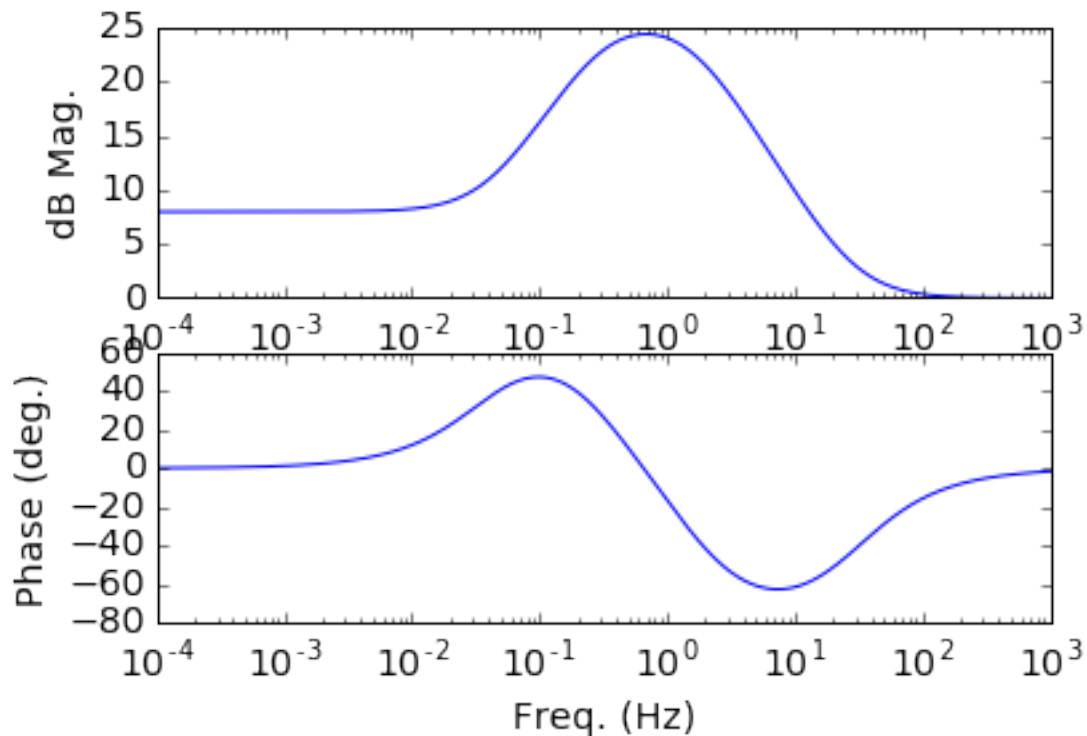
G =

$$\frac{s^2 + 0.497 s + 7.741}{s^4 + 33.79 s^3 + 2.211 s^2 + 0.3396 s}$$

```
poles (rad/sec) = [ -3.37241082e+01+0.j          -3.26272525e-02+0.0948  
                  -3.26272525e-02-0.09489391j    0.00000000e+00+0.j          ]  
poles (Hz) = [ -5.36735852e+00+0.j          -5.19278852e-03+0.01510284j  
              -5.19278852e-03-0.01510284j    0.00000000e+00+0.j          ]  
zeros (rad/sec) = [-0.24850859+2.77117527j -0.24850859-2.77117527j]  
zeros (Hz) = [-0.03955137+0.44104624j -0.03955137-0.44104624j]
```

## Example 3

```
plot_bode(G3ex)
```



### Answer for Example 3

```
show_answer(G3ex)
```

```
G =
```

```
s^2 + 188.7 s + 47.02
```

```
-----
```

```
s^2 + 11.4 s + 18.78
```

```
poles (rad/sec) = [-9.40960868 -1.99537012]
```

```
poles (Hz) = [-1.49758573 -0.31757302]
```

```
zeros (rad/sec) = [-188.42390412 -0.2495499 ]
```

```
zeros (Hz) = [-29.98859574 -0.0397171 ]
```