Find the transfer function of the systems whose
Bode plot is given.

1. Starting Slope $\sqrt{\text{dB/dec}} = 0$ dB/dec
   Also Starting Phase $= 0^\circ$
   
   $\therefore$ We don't have a pole or zero at $s = 0$

   Starting Mag $= 20$ dB $= K_{\text{dB}}$
   
   $\therefore 20 \log K = K_{\text{dB}} = 20$
   $\therefore K = 10$

   Corner frequency $= 2, 3 \text{ rad/sec}$

   $H(s) = \frac{K}{(1 + \frac{1}{2}s)(1 + \frac{1}{3}s)}$ due to pole
   
   $= \frac{60}{(s+2)(s+3)}$
2. Starting slope of magnitude = -20 dB/dec
   Also, the starting phase = -90°
   We have a pole at s = 0
   Starting Magnitude = 34 dB
                      = K dB + 20
   \[ K dB = 14 \]
   \[ 20 \log K = K dB = 14 \]
   \[ K = 5 \]
   Corner frequencies = \[ \frac{1}{\sqrt{5}} \quad \frac{5}{\sqrt{5}} \]
   \( \text{Due to pole} \)
   \( \text{due to zero} \)
   \( \text{Because the slope changes from} \)
   \( -20 \text{dB/dec to } 0 \text{ dB/dec,} \)
   \( \text{therefore, there is a change} \)
   \( \text{of } +20 \text{ dB/dec} \)

\[ H(s) = \frac{s(1 + \frac{1}{s\sqrt{5}})}{s(1 + \frac{5}{s\sqrt{5}})} \]
\[ = \frac{25(s+1)}{s(s+5)} \]
   Also, starting phase = -90°

   \[ \therefore \text{There is a pole at } S = 0 \]
   Corner frequencies = 10, 100, 1000 and 2000 rad/s

   • Corner frequency 10 is due to a real zero because the slope changes from -20 dB/dec to 0 dB/dec at 10 rad/sec.
     So, there is a change of 20 dB/dec.

   • Corner freq of 100 is due to a pole at S=100 because the slope changes from 0 dB/dec to -20 dB/dec.

   • Corner freq of 1000 is due to a pole at S=1000 because the slope changes from -20 dB/dec to -40 dB/dec.

   • Corner freq of 2000 is due to a pole at S=2000 because the slope changes from -40 dB/dec to -60 dB/dec.

\[ \text{Starting Mag } = 6 \text{ dB } = K_d B + 0 \]

\[ 20 \log K = K_d B = 6 \]

\[ \therefore K = 2 \]

\[ H(s) = \frac{2 (1 + \frac{1}{10 s})}{s (1 + \frac{1}{100 s})(1 + \frac{1}{1000 s})(1 + \frac{1}{2000 s})} \]
Bode Diagram

Gm = 44.696 dB (at 1506.7 rad/sec), Pm = 100.19 deg (at 2.0448 rad/sec)
4. Starting slope of magnitude = 20 dB/dec
   Also, the starting phase = 90°

   There is a zero at s = 0

   Corner frequencies: 1, 2 rad/sec
                      ↓
                      due to a pole

   Starting Mag = -90° + dB = K dB - 20
   \[ K dB = 18.06 \]

   \[ K dB = 20 \log K \]
   \[ K = 8 \]

   \[ H(s) = \frac{8s}{(1 + \frac{1}{1}s)(1 + \frac{1}{2}s)} \]

   \[ = \frac{16s}{(s+1)(s+2)} \]