### 3.2

\[ G_{dB} = 60 \text{dB} \]
\[ V_i = 3 \text{mV} = 3 \times 10^{-3} \text{volts} \]
\[ G_{dB} = 60 \text{dB} = 20 \log_{10} G \]

\[ 3 \text{dB} = \log_{10} G \]

\[ \Rightarrow G = 10^3 \]

\[ \Rightarrow G = \frac{V_o}{V_i} \]

\[ V_o = G \times V_i = 10^3 (3 \times 10^{-3}) \]

\[ = 3 \text{ volts} \]

### 3.6

a) From Eq. 3.14,  
\[ G = 1 + \frac{R_2}{R_1} \]

\[ 100 = 1 + \frac{R_2}{R_1} \]

\[ 99 = \frac{R_2}{R_1} \]

Since \( R_1 \) and \( R_2 \) typically range from 1kΩ to 1MΩ, we arbitrarily choose:

\[ R_2 = 99 \text{kΩ} \]

\[ \Rightarrow R_1 = 1 \text{kΩ} \]

b) \( f = 10 \text{ kHz} = 10^4 \text{ Hz} \)

\[ \text{GBP} = 10^6 \text{ Hz for 741} \]

\[ G = 100 \]

From Eq. 3.15,  
\[ f_c = \frac{\text{GBP}}{G} = \frac{10^6 \text{ Hz}}{100} = 10^4 \text{ Hz} \]

This is the corner frequency so signal is -3dB from dc gain.

dc gain = 100 = 40dB. Gain at 10^4 Hz is then 37 dB.

From Eq. 3.16,  
\[ \phi = -\tan^{-1}\left(\frac{f}{f_c}\right) = -\tan^{-1}\left(\frac{10^4}{10^4}\right) = -\frac{\pi}{4} = -45^\circ \]

### 3.8

\[ G = 1000 = 1 + \frac{R_2}{R_1} \]

\[ 999 = \frac{R_2}{R_1} \]

Selecting \( R_2 = 999 \text{kΩ} \), \( R_1 \) can be evaluated as 1 kΩ.

Since GBP = 1MHz for the μA741C op-amp and \( G = 1000 \) at low frequencies,

\[ \text{GBP} = 1 \text{MHz} = 1000(\text{Bandwidth}) \]

\[ \Rightarrow \text{Bandwidth} = 1 \text{ kHz} = f_c \]

If \( f = 10 \text{ kHz} \) and \( f_c = 1 \text{ kHz} \), we must calculate the number of times \( f_c \) doubles before reaching \( f \).
\[ f_c \times 2^x = f \]
\[ 1000 \times 2^x = 10000 \]
\[ \therefore x = 3.32 \]

Now the gain can be calculated knowing that for each doubling the gain decreases by 6dB (i.e. per octave)

\[
\text{Gain(dB)} = 20\log_{10} \frac{1000}{3.32} (6\text{dB})
\]
\[ = 40\text{dB} \]

From Eq. 3.16,

\[
\phi = -\tan^{-1}\left(\frac{f}{f_c}\right)
\]
\[ = -\tan^{-1}\left(\frac{10000}{1000}\right) \]
\[ = -84.3^\circ \]