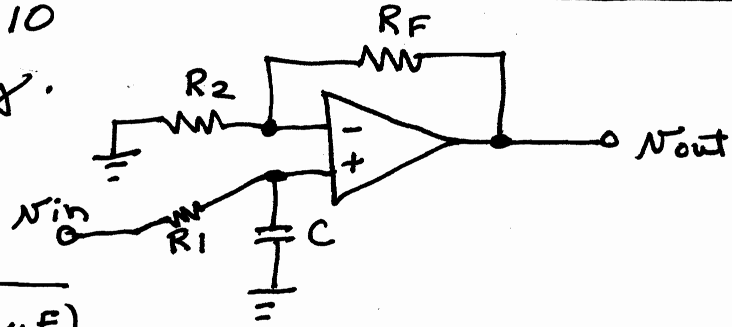
$$\text{in dB} = 20\log 10 = 20 \times 1 = 20\,dB$$

ECET 15700
CH 31 – 27, 29 & 30

27) $C = 0.01\,\mu F$

Want LPF w/ $A_v = 10$
and $f_c = 10K\,Hz$.



$$f_c = \frac{1}{2\pi R_1 C}$$

$$\Rightarrow 10K = \frac{1}{2\pi R_1 (0.01\,\mu F)}$$

$$\Rightarrow R_1 = \frac{1}{2\pi (10K)(0.01\,\mu F)} = \boxed{1.6\,K\Omega}$$

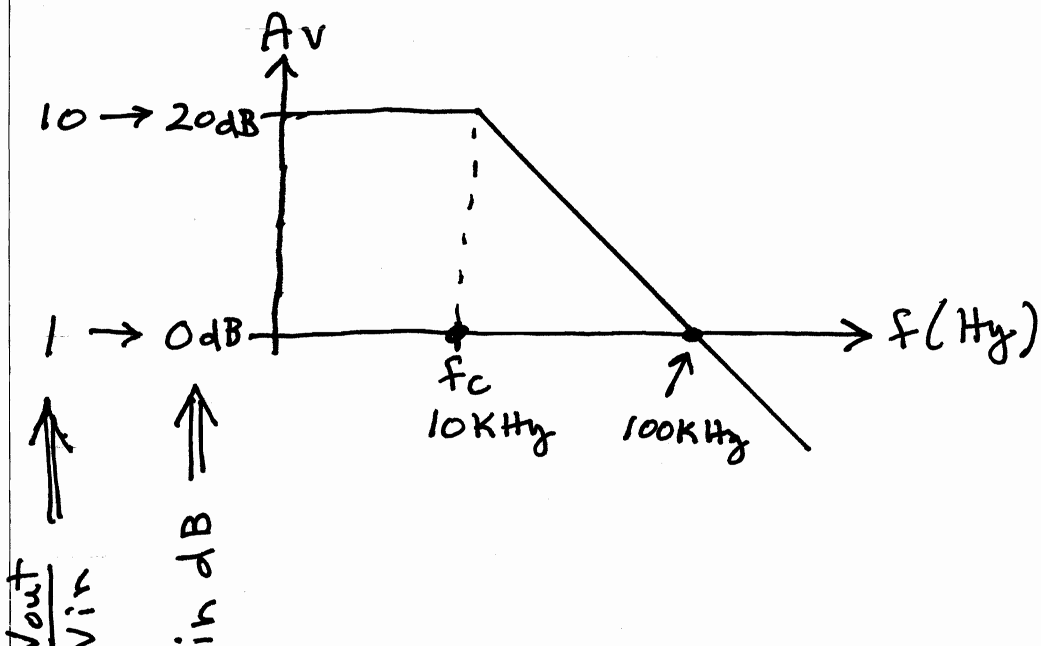
$$A_v = 1 + \frac{R_F}{R_2} \Rightarrow 10 = 1 + \frac{R_F}{R_2} \Rightarrow \frac{R_F}{R_2} = 9$$

Must pick R_2, then $R_F = 9R_2$

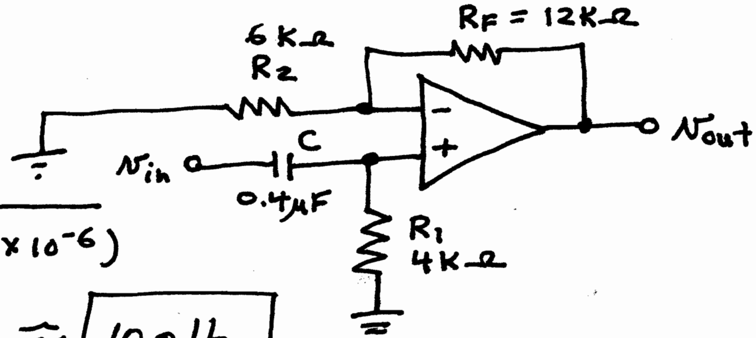
Let's pick $\boxed{R_2 = 1K\Omega}$

then $\boxed{R_F = 9K\Omega}$

Freq response of gain (A_v):



(29) $f_c = \dfrac{1}{2\pi R_1 C}$



$$= \frac{1}{2\pi(4K)(0.4\times10^{-6})}$$

$$= \boxed{99.5\ Hz} \approx \boxed{100\ Hz}$$

This is a HPF, so f_c is the low-freq cut-off.

$$A_V = 1 + \frac{R_F}{R_2} = 1 + \frac{12K}{6K} = 1 + 2 = \boxed{3}$$

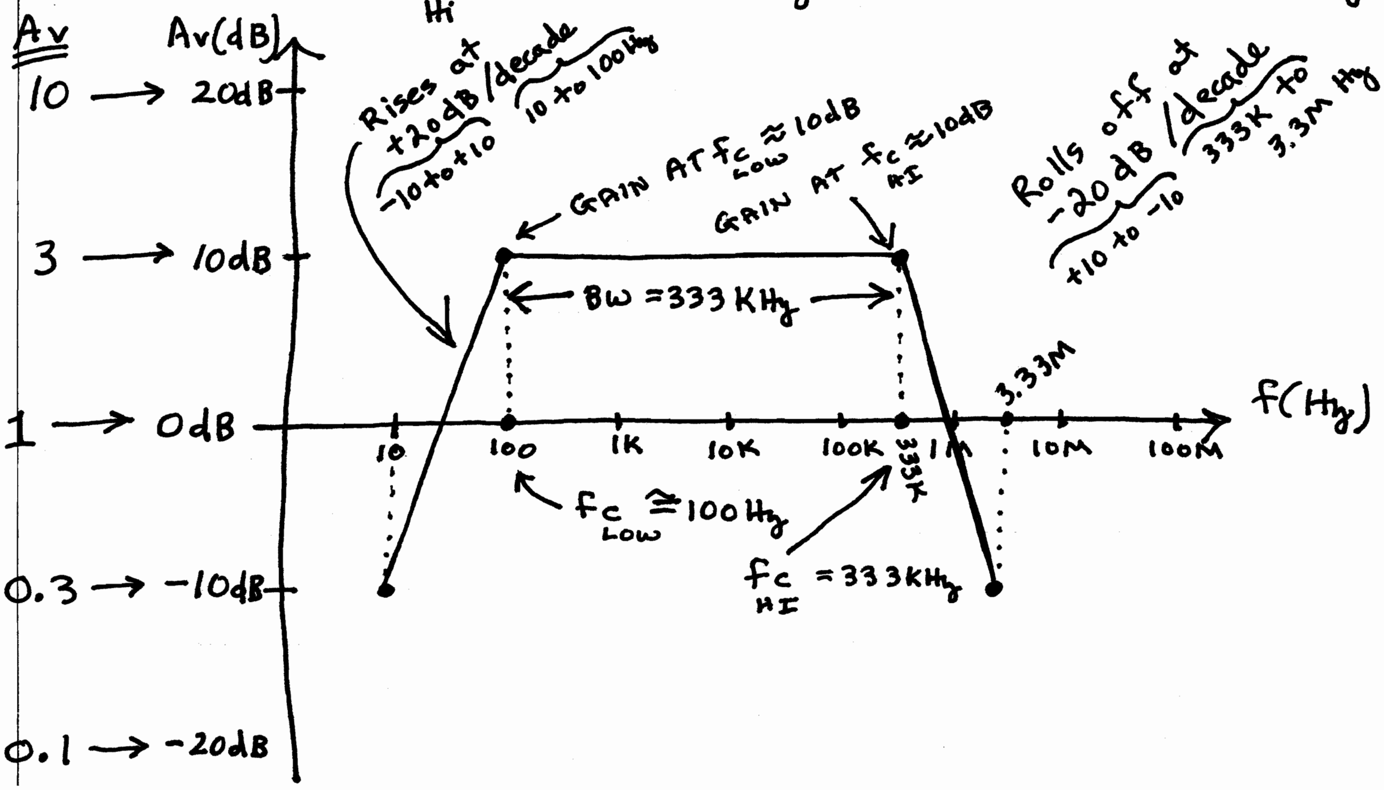
$$A_V(dB) = 20\log(3) = \boxed{9.54\,dB} \approx \boxed{10\,dB}$$

Hi-freq cut-off: Gain-BW Product $= 10^6$

$$\Rightarrow A_V \times BW = 10^6$$

$$\Rightarrow BW = \frac{10^6}{A_V} = \frac{10^6}{3} = 333K\ Hz$$

$$\Rightarrow f_{c_{Hi}} = 333K\ Hz + 99.5\ Hz \approx 333K\ Hz$$



(30) Same ckt as (29).

Keep $C = 0.4\mu F$, but change R_1 so $f_c = 250 Hz$.

$$f_c = \frac{1}{2\pi R_1 C}$$

$$\Rightarrow 250 = \frac{1}{2\pi R_1 (0.4\mu F)}$$

$$\Rightarrow R_1 = \frac{1}{2\pi (250)(0.4\mu F)} = 1591 = \boxed{1.6K\Omega}$$

Want $A_v = 10 \Rightarrow A_v = 1 + \frac{R_F}{R_2}$

Let's pick $R_2 = \boxed{1K\Omega}$

Then $R_F = \boxed{9K\Omega}$

Calculate BW: $\text{Gain} * BW = 10^6$

$$\Rightarrow BW = \frac{10^6}{\text{Gain}} = \frac{10^6}{A_v} = \frac{10^6}{10} = \boxed{100KHz}$$

So, $f_{c_{HI}} = f_{c_{Low}} + BW \Rightarrow f_{c_{HI}} = 250 + 100K Hz \approx 100KHz$