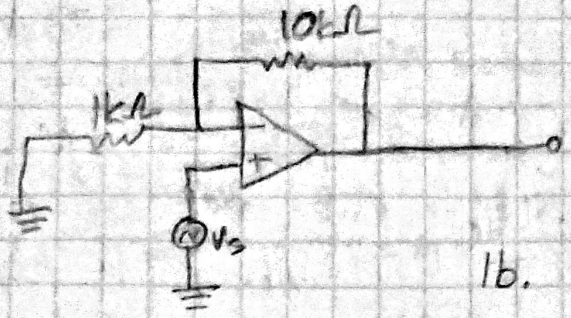
LAB 5: OP AMP Circuits

1a.

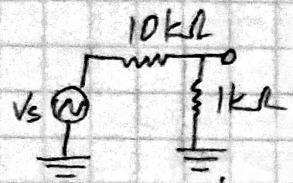


$V_o = \left(\frac{R_2}{R_1} + 1\right) \cdot V_s$

$\frac{V_o}{V_s} = \frac{10k}{1k} + 1 = 11$

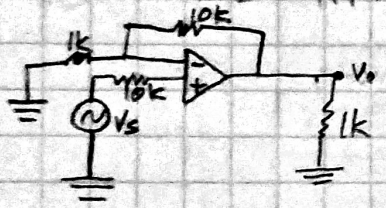
1b. Measured voltage is 4.96v

1c.



Hand calc current without load $\frac{V_s(1k)}{11k} = \frac{V_s}{11}$

Measured voltage is 4.1v at 1k resistor with load



current would be $\frac{4.1}{1k\Omega} = 4.1mA$

$V_n = V_p = 5v$

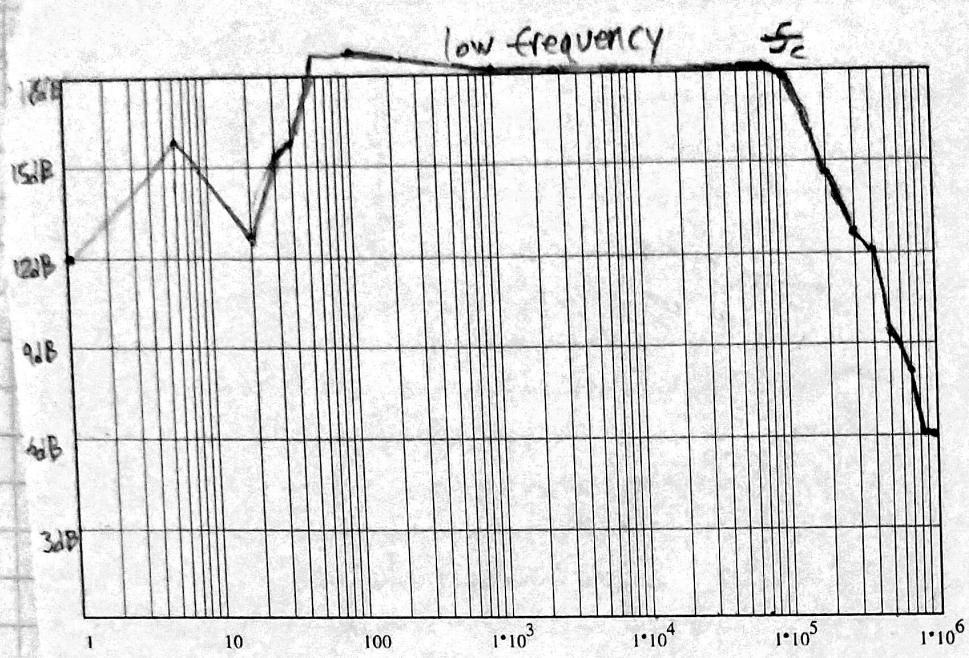
1d) The extra current comes from the op-amp and 2 resistors.

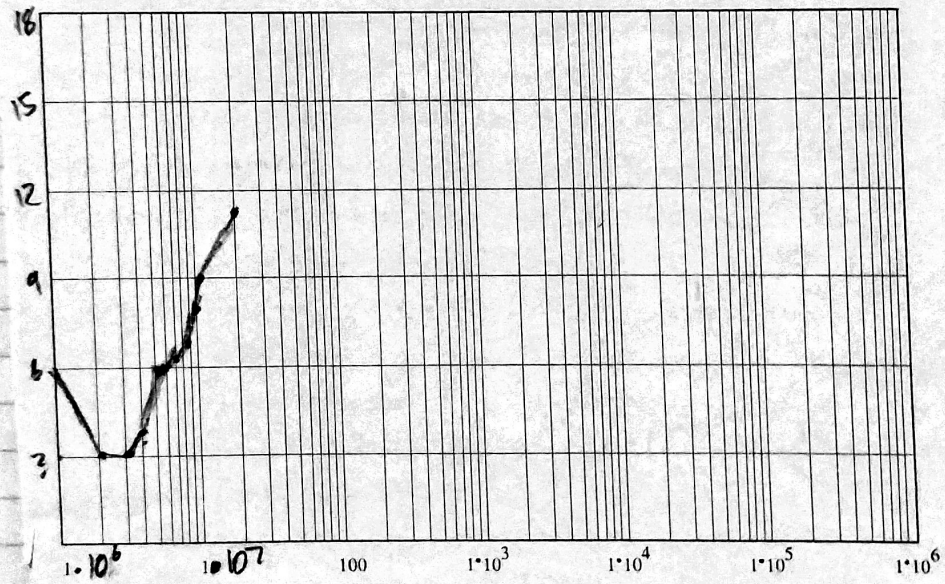
2a)

f (Hz)	Vin (Vpp)	Vout (Vpp)	Vo/Vin (dB)
1 Hz	5mV	20mV	12.04
5 Hz	6mV	40mV	16.48
10 Hz	9.5mV	45mV	13.5
20 Hz	15mV	92mV	15.7
30 Hz	19mV	120mV	16
40 Hz	22mV	210mV	19.6

f (Hz)	Vin (Vpp)	Vo (Vpp)	Vo/Vin (dB)
50 Hz	23.5mV	230mV	19.81
100Hz	23.6mV	230mV	19.81
"	"	"	
"	"	"	
"	"	"	
75k	"	217mV	19.3
100k	"	209mV	18.98
200k	"	129mV	14.79
300k	"	109mV	13.33
400k		96mV	12.22
500k		80mV	10.64
600k		68mV	9.22
700k		60mV	8.14
800k		52mV	6.9
900k		48mV	6.2
1M	20.5mV	44mV	6.63
2M	18.5mV	28mV	3.6
3M	16mV	24mV	3.52
4M	15mV	24mV	4.08
5M	12mV	24mV	6.02
6M	12mV	24mV	6.02
7M	11mV	24mV	6.77
8M	10mV	24mV	7.6
9M	9MV	24mV	8.51
10M	8.5mV	24mV	9.01
11M	8mV	24mV	9.54
	↓ decrease to max multimeter can put out (20M)		
20M	6.5mV	24mV	11.3

2b)



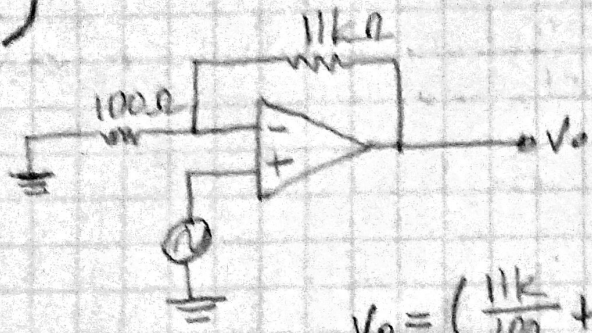


2c)

At about 1-20k Hz and 2.7-4MHz, At around 2MHz it started rising again so it operates at a low frequency of 20-100k Hz and 2.7-4MHz

Experiment 2

1a)



$$V_o = \left(\frac{11k}{100} + 1\right) V_{in}$$

$$\frac{V_o}{V_{in}} = 111$$

1c)

Gain was about right so I have to play with frequencies and amplitude and see what happens

It doesnt seem to go up any farther than 3.3v which is 30 gain. If I turn the voltage powering the op-amp up, I do get a gain of 101. So the DC voltage is causing Gain in AC.

1d)

$$20\log\frac{X}{100mV} = -3dB$$

$$X = .086$$

1c) At about 34 kHz I get -3dB

$$f_c = \frac{4MHz}{111} = 36.036\ kHz$$

They are fairly close together.

From Experiment 1

3. $f_c = \frac{4MHz}{11} = 363,036$ ← value from datasheet

Fairly close, measured was roughly around 100k.

4. Picked frequency 3M and it was close to being the same. about 5mV apart.

1f)

$$20\log\left(\frac{2.3}{.1}\right) = 27.23dB \quad (5kHz)$$

$$20\log\left(\frac{1.6}{.1}\right) = 24.082dB \quad (25kHz)$$

$$27.23 - 24.082 = 3.148$$

$$\frac{-3.148}{25k} = -126$$

1g)

$5f_c = 180.18k = \frac{700mV}{100mV} = 7$

$10f_c = 360.36k = \frac{3.80mV}{100mV} = 38$

It was close to a factor of 2.

2.

At about 17 volts it starts clipping, which is about the same as the data sheets 18V.