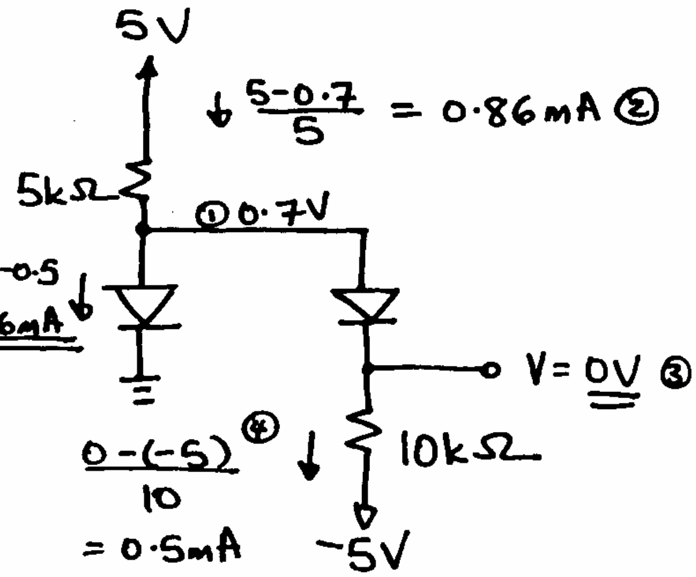
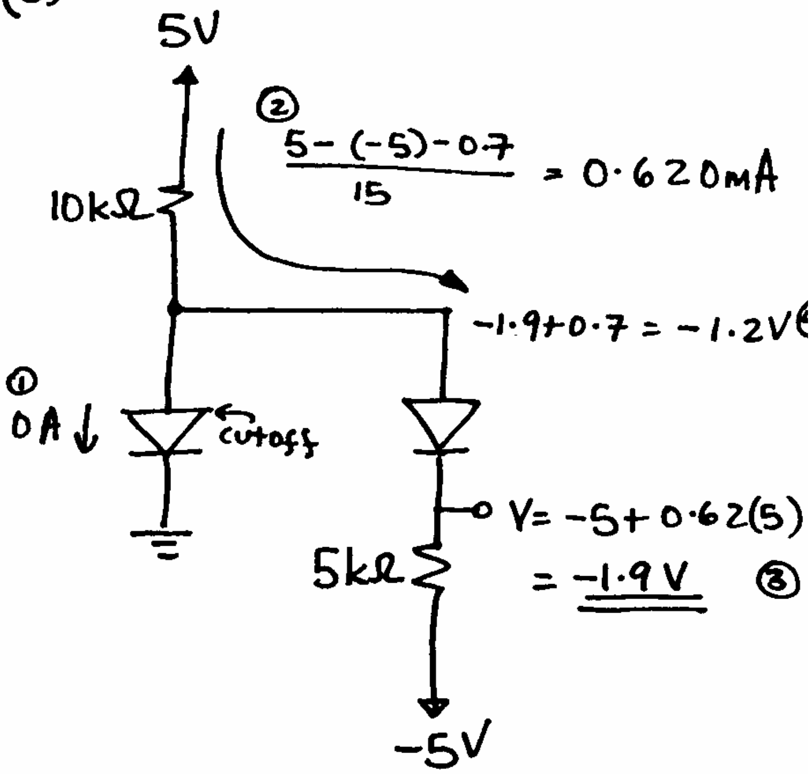
3.48

(a)



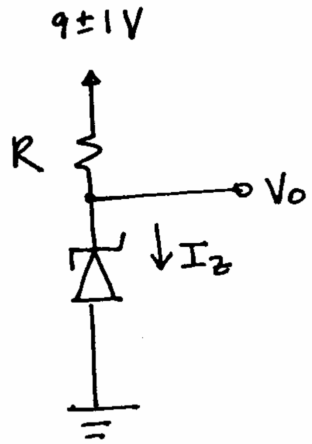
5V
$\frac{5-0.7}{5} = 0.86\text{mA}$ ②
5kΩ
① 0.7V
⑤
0.86-0.5
=0.36mA
V= 0V ③
$\frac{0-(-5)}{10}$ ④
= 0.5mA
10kΩ
-5V

(b)



5V
②
$\frac{5-(-5)-0.7}{15} = 0.620\text{mA}$
10kΩ
-1.9+0.7 = -1.2V
①
0A
cutoff
V= -5+0.62(5)
= -1.9V ③
5kΩ
-5V

3.69



GIVEN PARAMETERS

$V_Z = 6.8V$, $r_Z = 5\Omega$, $I_Z = 20mA$

By knee

$I_{ZK} = 0.25mA$

$r_Z = 750\Omega$

FIRST DESIGN - 9V supply can easily supply cu

Let $I_Z = 20mA$ ~ well above knee

$$\therefore R = \frac{9 - 0.68}{20} = \underline{\underline{110\Omega}}$$

$$\text{Line Regulation} = \frac{\Delta V_O}{\Delta V_S} = \frac{r_Z}{r_Z + R}$$

$$= \frac{5}{5 + 110}$$

$$= \underline{\underline{43.5 \frac{mV}{V}}}$$

SECOND DESIGN ~ limited current from 9V suppl

$I_Z = 0.25mA$

$V_Z = V_{ZK} \simeq V_{Z0}$ - calculate V_{Z0} from

$$V_Z = V_{Z0} + r_Z I_{ZT}$$

$$6.8 = V_{Z0} + 5 \times 0.02$$

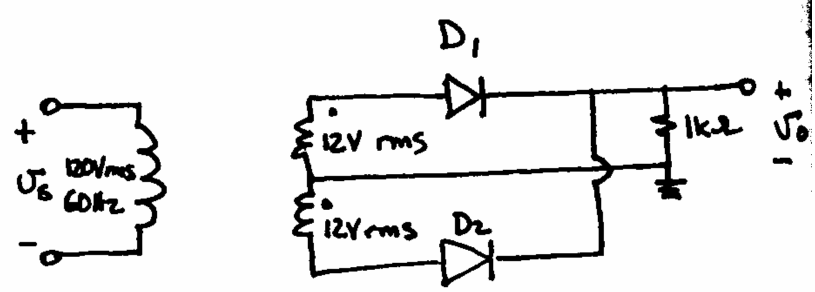
$$V_{Z0} = 6.7V$$

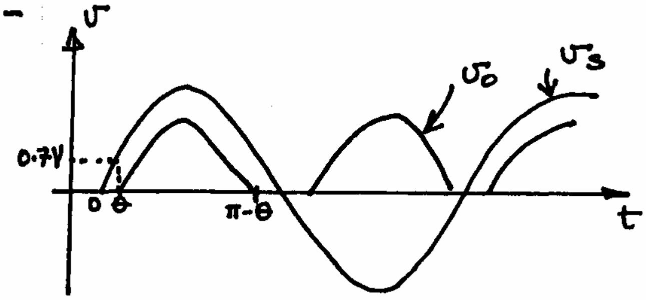
$$\therefore R = \frac{9 - 6.7}{0.25} = \underline{\underline{9.2k\Omega}}$$

$$\text{LINE REGULATION} = \frac{\Delta V_O}{\Delta V_S} = \frac{750}{750 + 9200}$$

$$= \underline{\underline{75.4 \frac{mV}{V}}}$$

3.77





$\hat{v}_O = 12\sqrt{2} - V_{DO} = \underline{16.27V}$

Conduction starts at $\theta = \sin^{-1}\frac{0.7}{12\sqrt{2}}$
$= 0.0412$ rad

and ends at $\pi - \theta$. Conduction angle $= \pi - 2\theta = 3.06$ rad in each half cycle. Thus the fraction of a cycle for which one of the two diodes conduct $= \frac{2(3.06)}{2\pi} \times 100$

$= \underline{97.4\%}$

Note that during 97.4% of the cycle there will be conduction. However each of the two diodes conducts for only half the time, i.e. for 48.7% of the cycle.

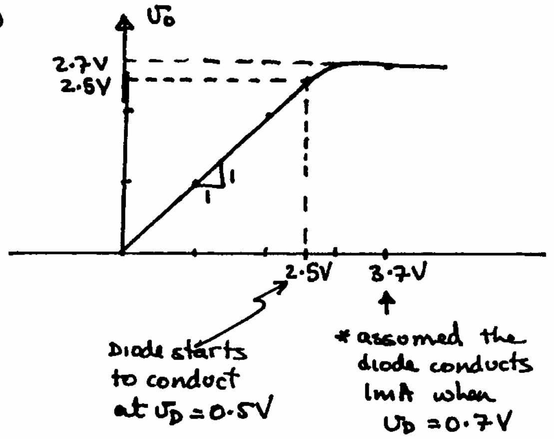
$$v_{O,avg} = \frac{1}{\pi}\int_{\theta}^{\pi-\theta} 12\sqrt{2}\sin\phi - 0.7 \; d\phi$$

$= \underline{10.12V}$

$i_{D,avg} = \frac{10.12}{1k\Omega} = \underline{10.12mA}$

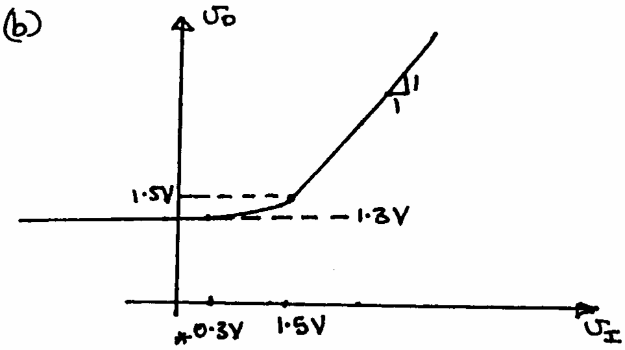
3.93

(a)



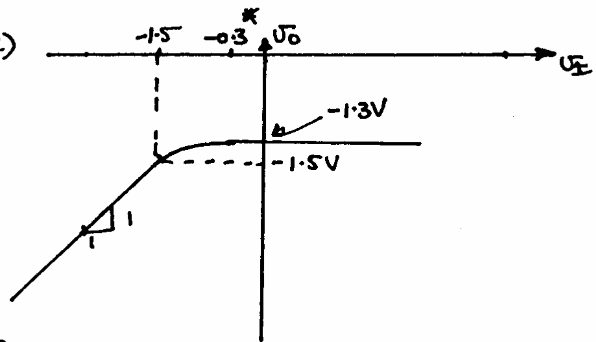
v_O
2.7V
2.5V
1
1
2.5V
3.7V
Diode starts to conduct at $v_D = 0.5V$
* assumed the diode conducts 1mA when $v_D = 0.7V$

(b)



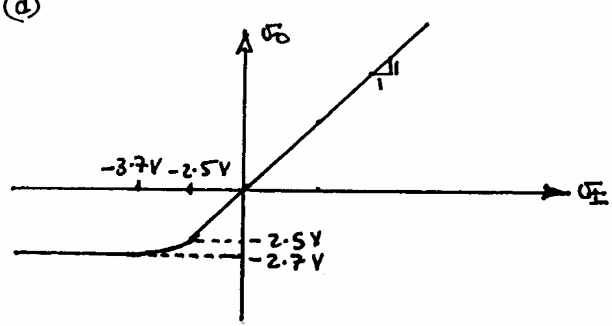
v_O
1.5V
1.3V
1
1
*0.3V
1.5V
v_I

(c)



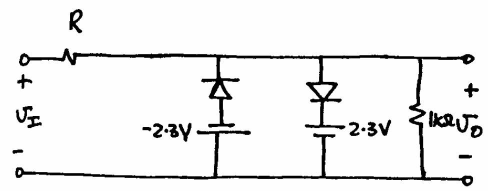
-1.5
-0.3
*
v_O
v_I
-1.3V
-1.5V
1
1

(d)



v_O
1
1
-3.7V
-2.5V
v_I
-2.5V
-2.7V

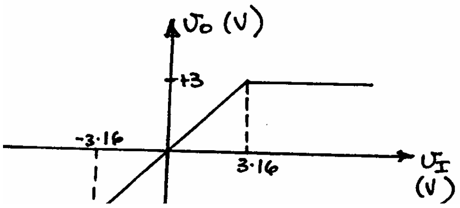
3.100



In the limiting region

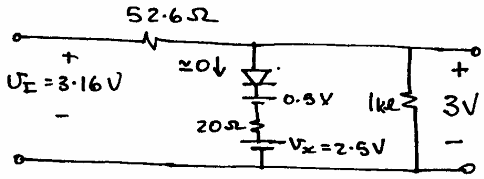
$$\frac{v_O}{v_I} = \frac{1000}{1000+R} \geq 0.95$$

$R \leq$ 52.6 Ω



$$\frac{0.2}{10\times10^{-3}} = 20\Omega \sim$$

At the verge of limiting in the positive direction we have :-



For v_I = 10V

$v_O \cong 3 + 0.28(10 - 3.16)$

= 4.9V

For v_I = -10V

v_O = -4.9V