1

model | Param | cond

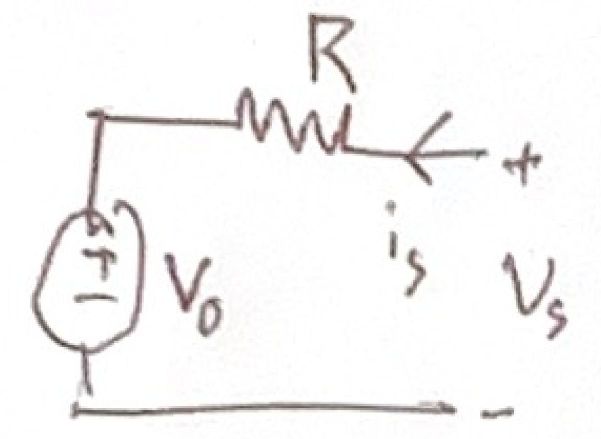
(1) (a) Seg 1:

O.C.

no param

$V_s \le 2V$

Seg 2:



$V_0 = x\text{-intercept}$
$= 2V$

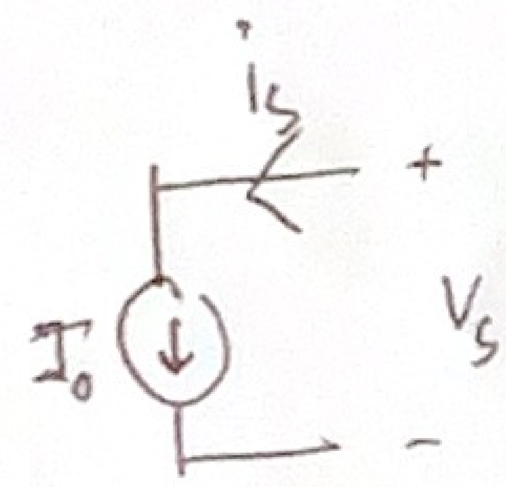
$R = \frac{1}{\text{Slope}} = 0.8K\Omega$

$y = 1.25(x-2)$

$\underline{\underline{i_s = 1.25(V_s - 2)}}$

$V_s < 2 \le 5V$

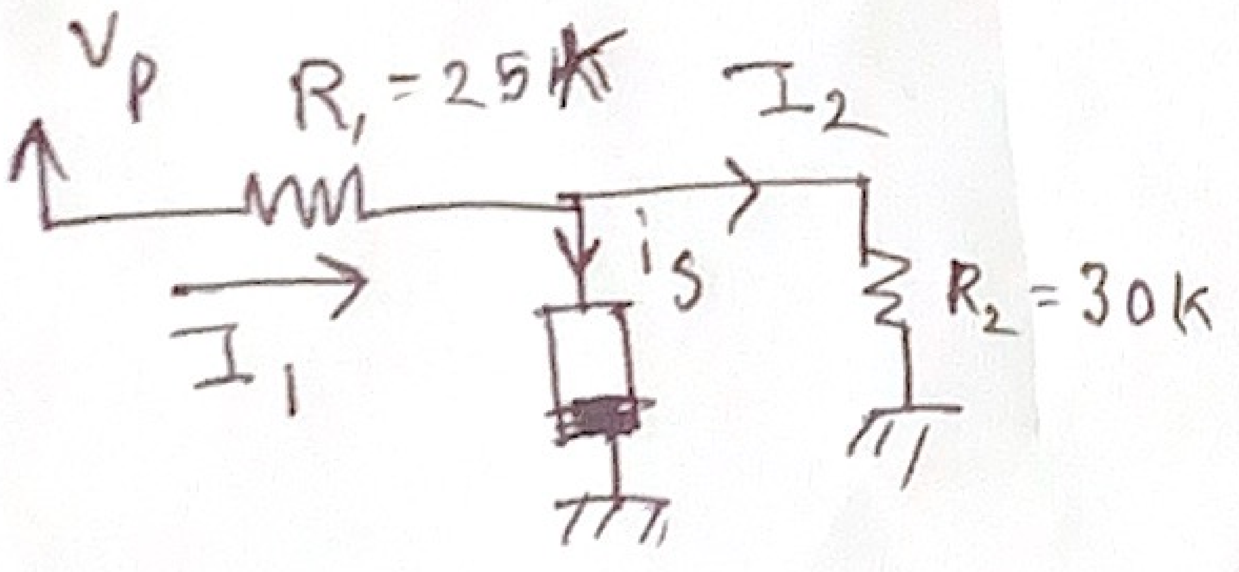
Seg 3:



$I_0 = 1.25(5-2)$
$= 3.75mA$

$V_s > 5V$

(b)



(c) From graph, when $V_s = 3V \Rightarrow$ segment 2.

Hense, $i_s = 1.25(V_s - 2) = \underline{1.25mA}$

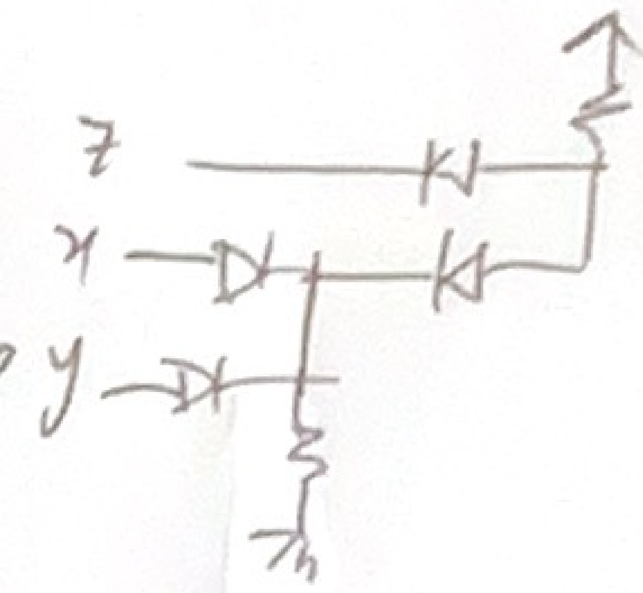
(d) KCL $\Rightarrow I_1 = i_s + I_2$ | Ohm's law $\rightarrow I_2 = \frac{V_s}{R_2} = \frac{3V}{30k} = 0.1mA$

$= 1.25 + 0.1 = \boxed{1.35mA}$

KVL $\Rightarrow V_p = I_1 R_1 + V_s = 1.35 \times 25k + 3 = 36.75V$

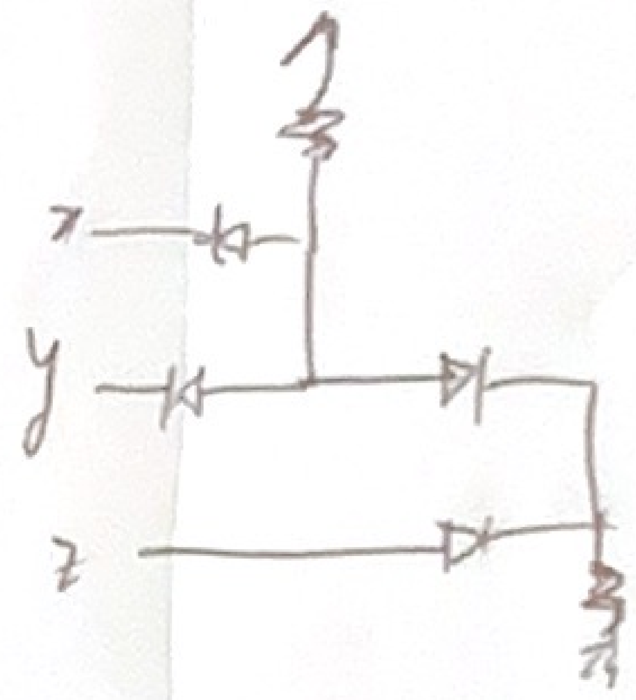
Q2

(a) Either $f=(x+y)z$



OPT-1

or $f = x.y+z$



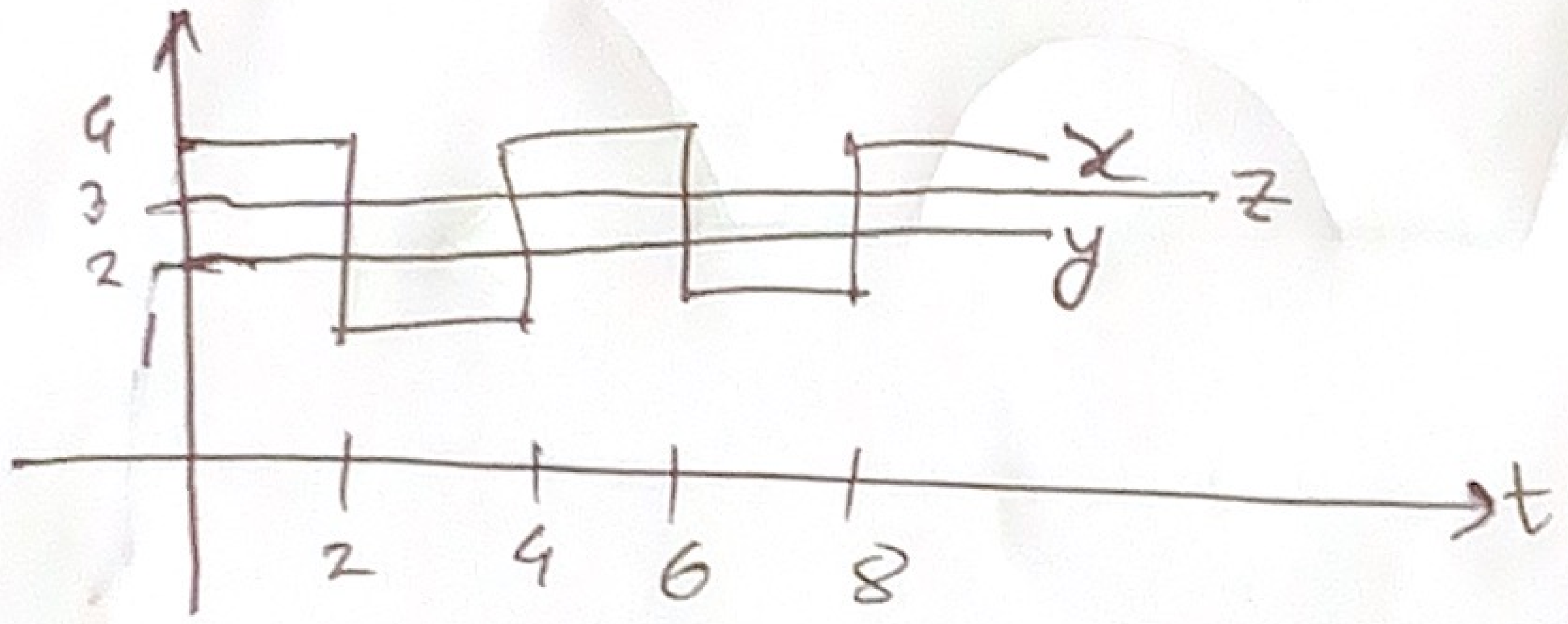
OPT-2

(b) for OPT-1:

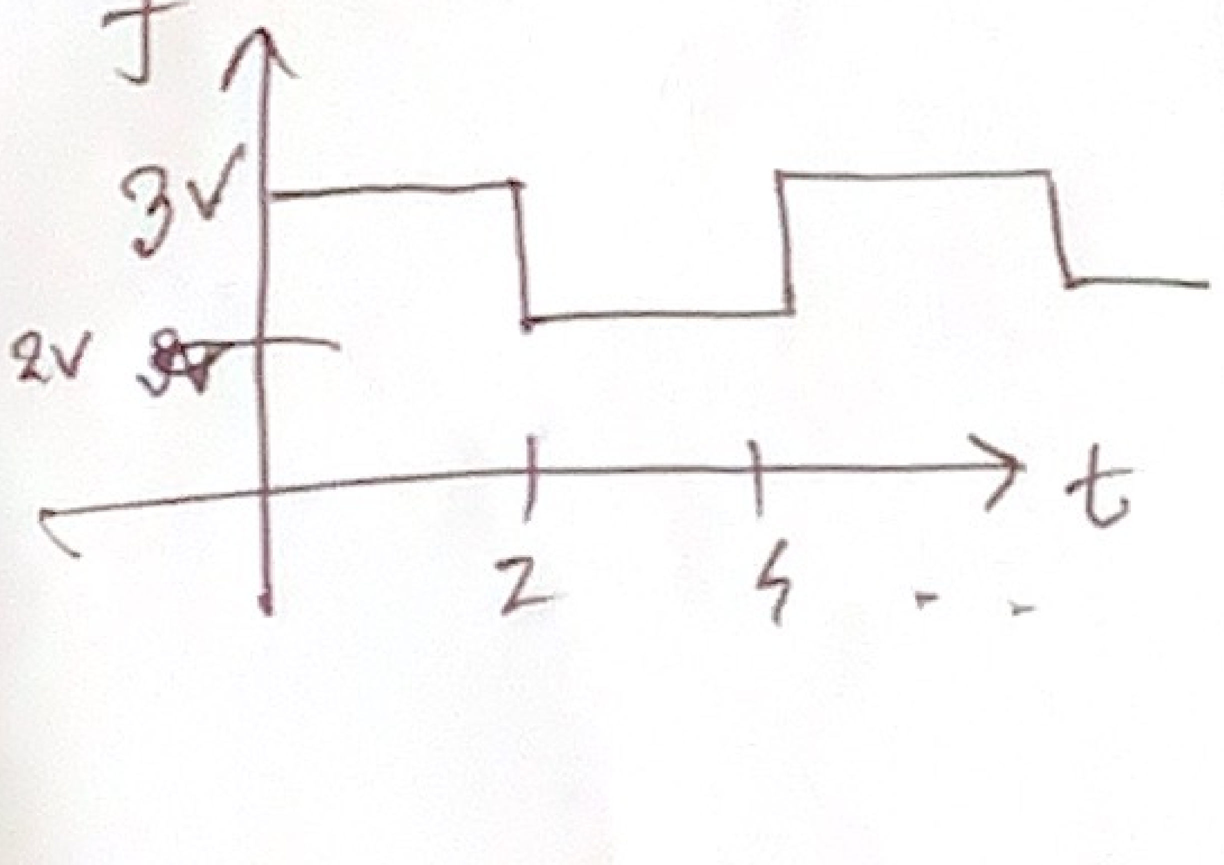
$f=\min(\max(x,y),z)$

for OPT-2:

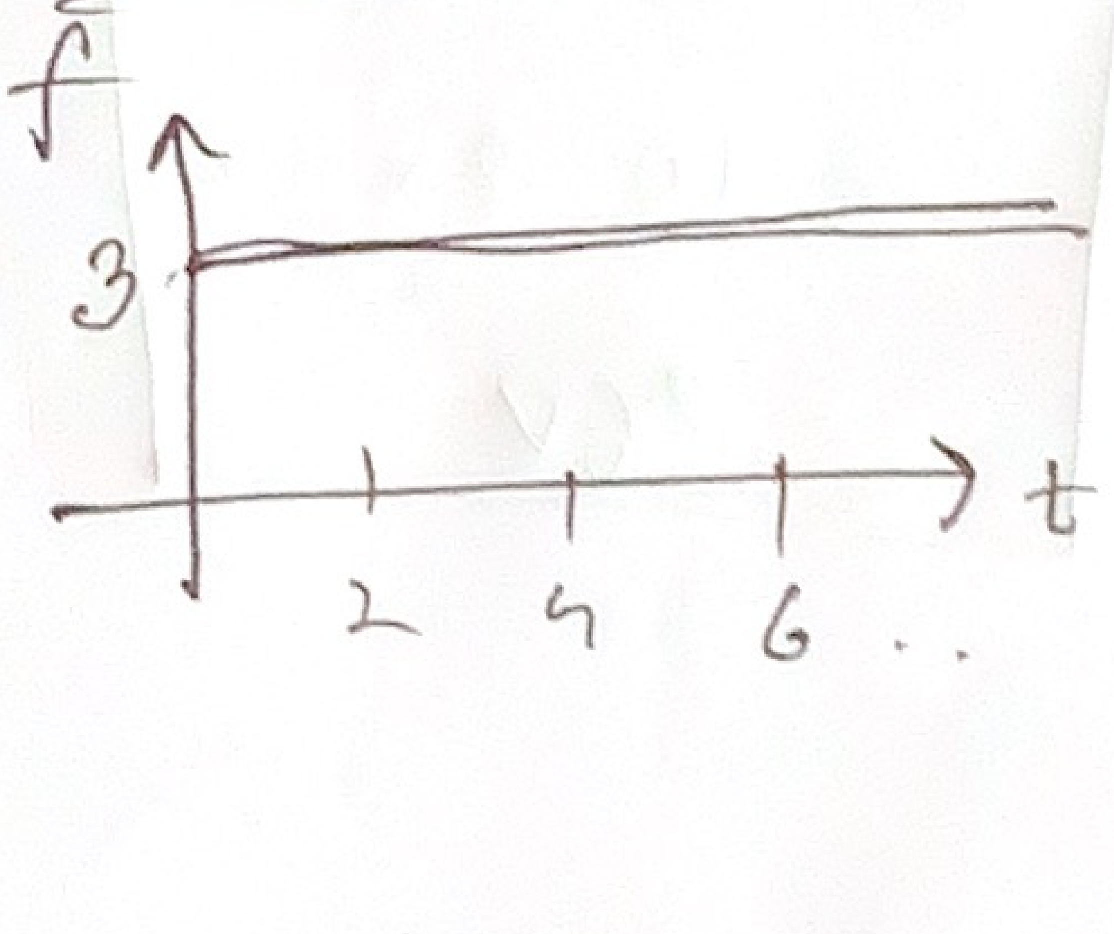
$f=\max(\min(x,y),z)$



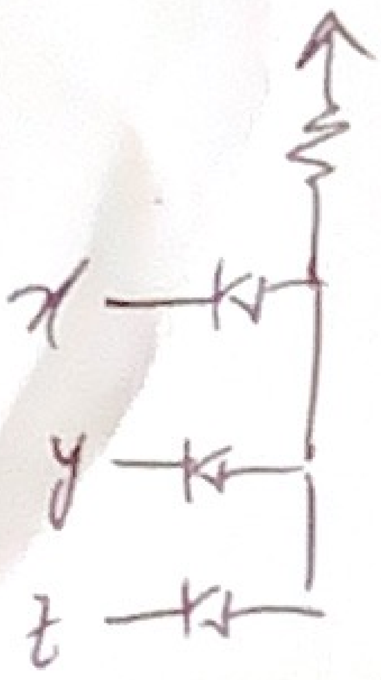
for OPT-1



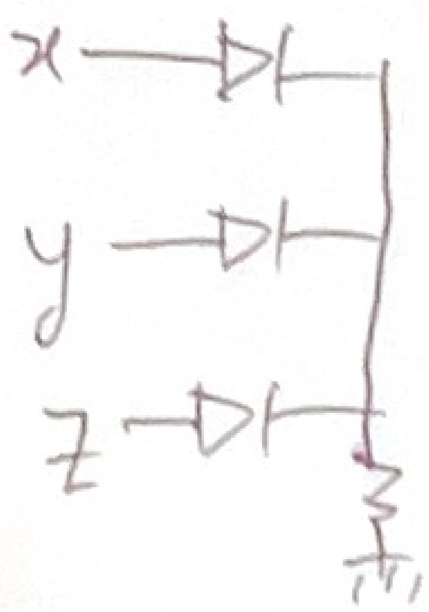
for OPT-2



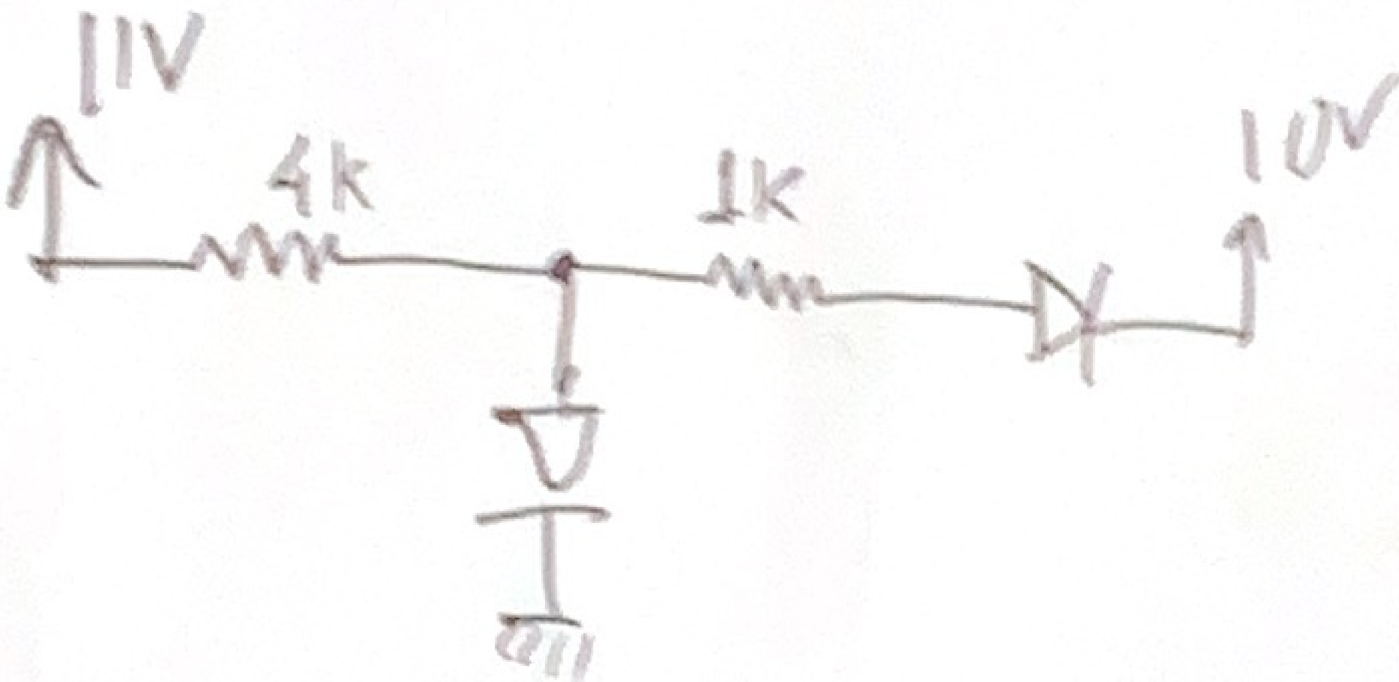
(c) $f=x.y.z$



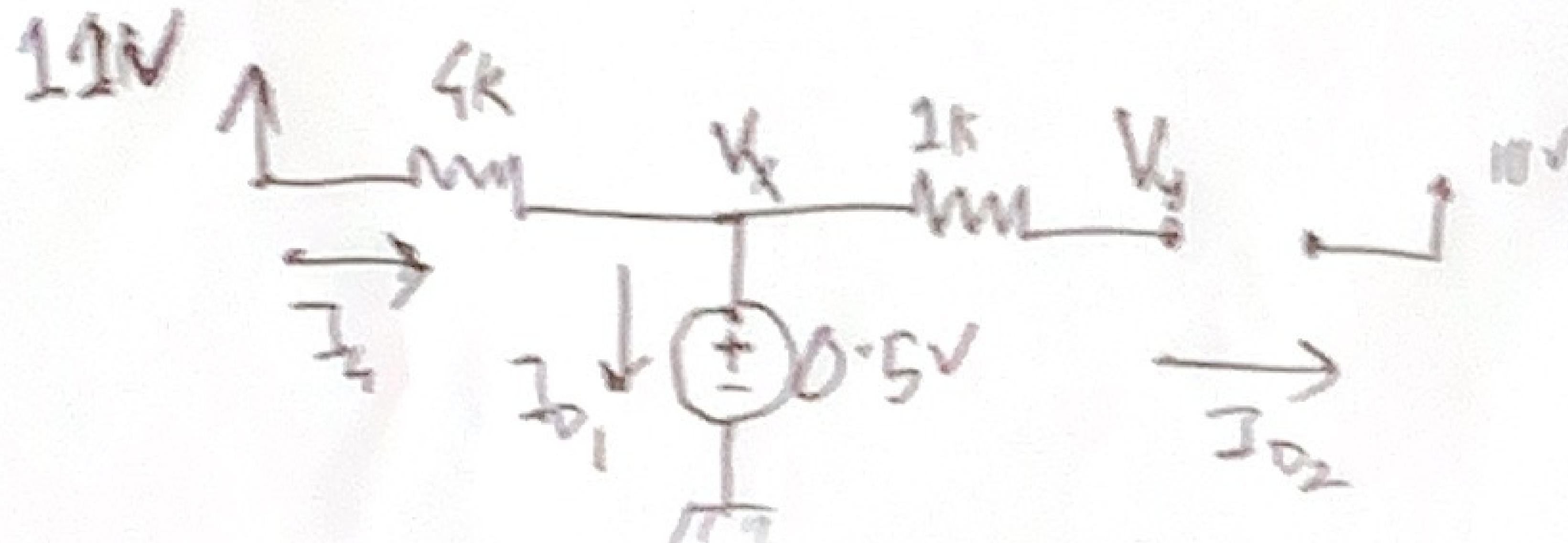
$f=x+y+z$



Q③



ⓐ $D_1 = ON, \quad D_2 = OFF$



$V_x = V_y = 0.5V$

$$I_4 = I_{D_1} = \frac{11 - 0.5}{4} = 2.625 \text{ mA}$$

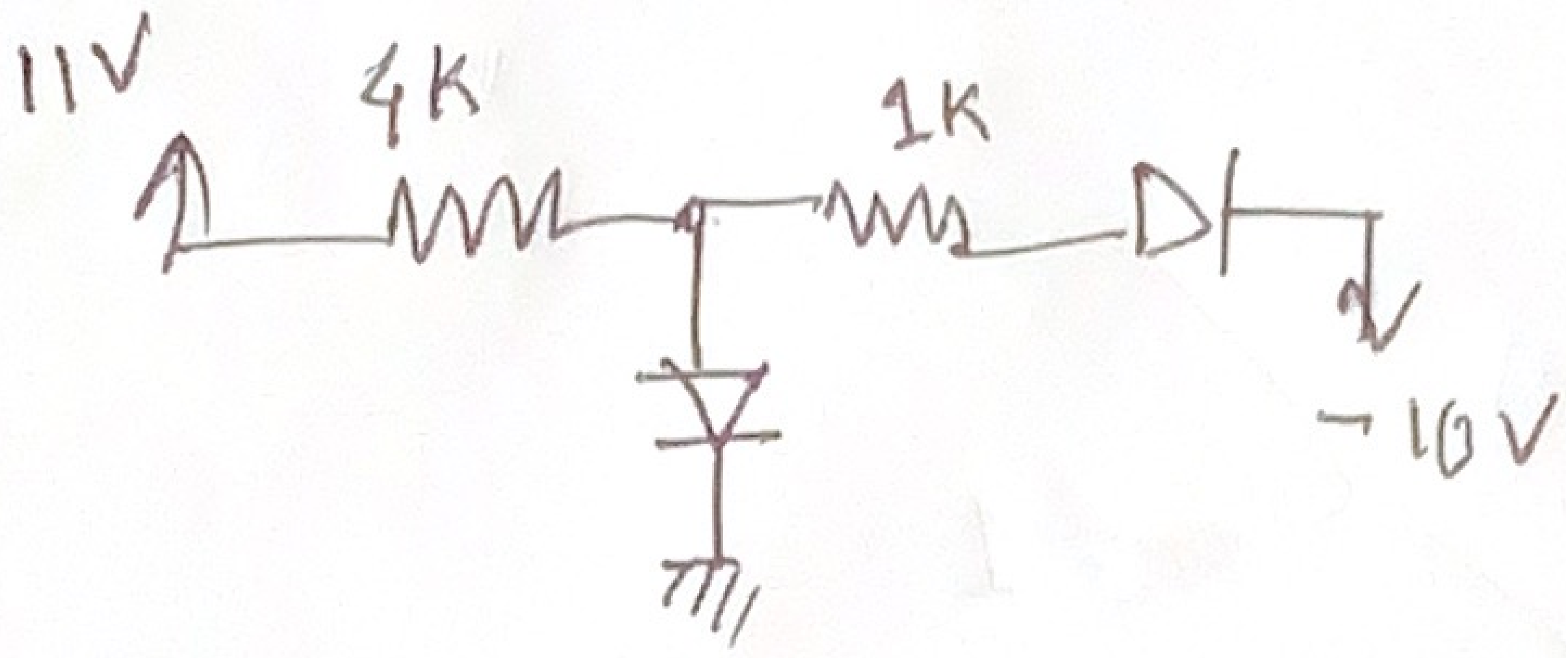
$I_{D2} = 0$

ⓑ $D_1(ON) \Rightarrow I_{D_1} > 0 \Rightarrow$ TRUE

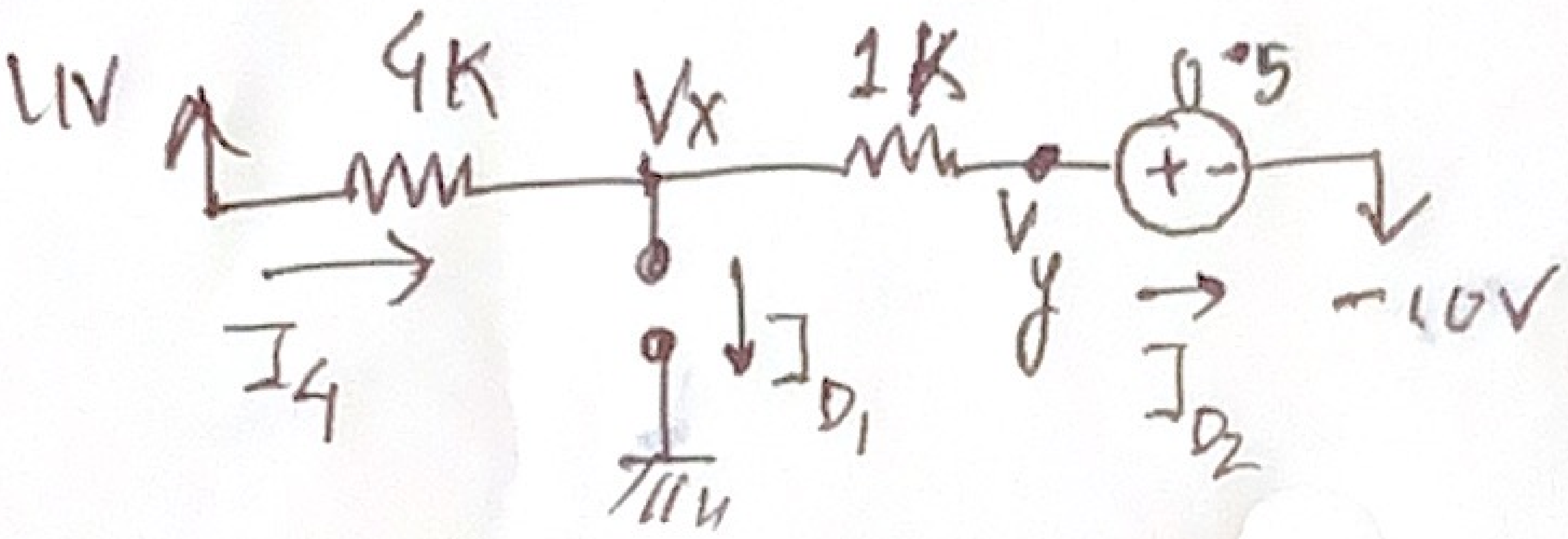
$D_2(OFF) \Rightarrow V_{D_2} = V_y - 10V = -9.5V$

$\therefore V_{D2} < V_{D0} \Rightarrow$ TRUE

Therefore, assumption correct!



ⓐ $D_1 = OFF, \quad D_2 = ON$



$$\boxed{V_y = -10 + 0.5 = -9.5V}$$

$$I_{D_1} = 0$$

$$I_4 = I_{D_1} + I_{D_2} \Rightarrow \boxed{I_4 = I_{D_2}}$$

$$\boxed{I_4 = I_{D2} = \frac{11 - (-9.5)}{4+1} = 4.1\,mA}$$

$$I_4 = \frac{11 - V_x}{4} \Rightarrow V_x = 11 - I_4 \times 4$$

$$\Rightarrow \boxed{V_x = -5.4V}$$

ⓑ $D_1(OFF)$: $V_{D_1} = V_x - 0 = -5.4$

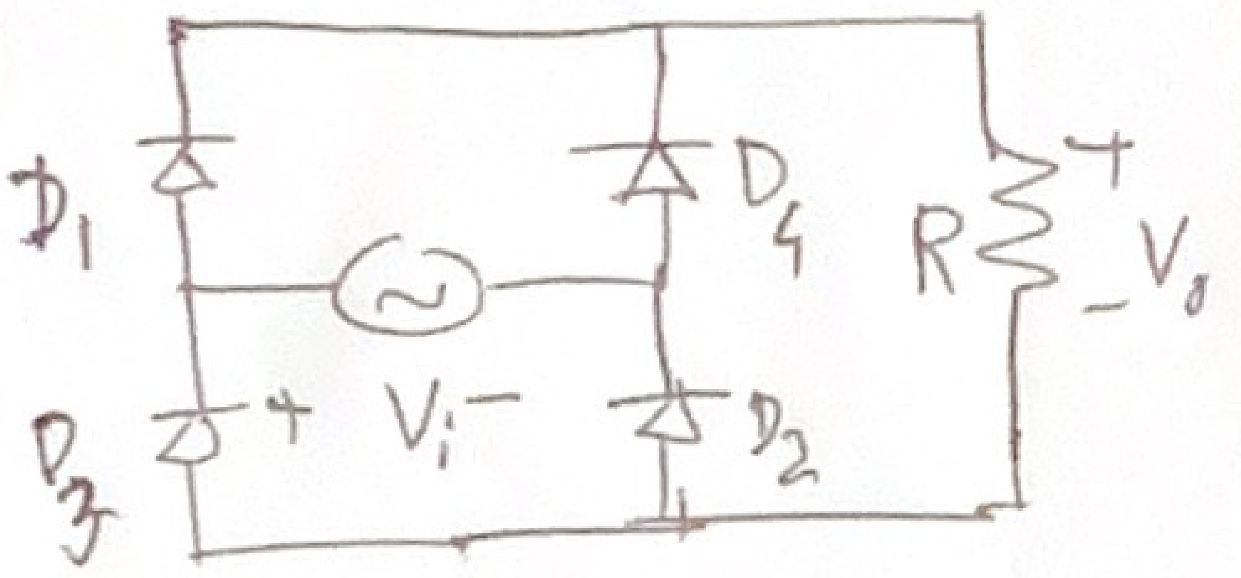
Therefore, $V_{D_1} < V_{D0} \Rightarrow$ TRUE

$D_1(ON)$: $I_{D2} > 0 \Rightarrow$ TRUE

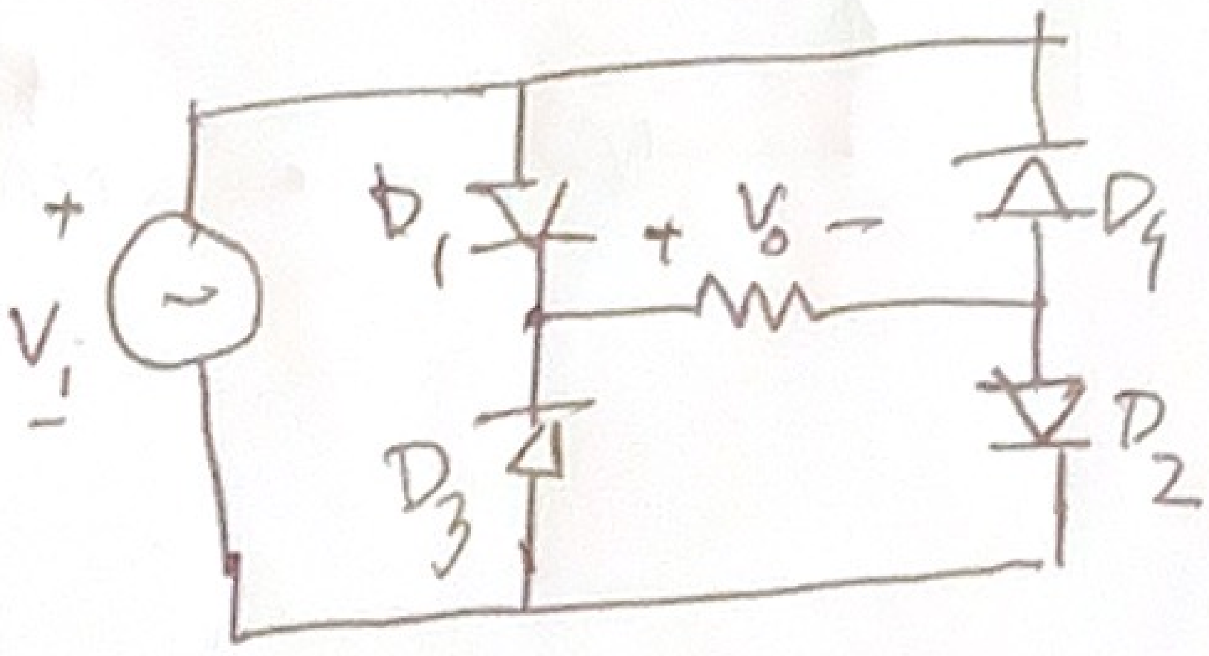
} Therefore, Assumption Correct!

Q4

(a)



OR



(b) $V_M = 10\,V$

Hence, $V_{Avg} = V_{DC} = \frac{2}{\pi} V_M - 2V_{DO}$

$= \frac{2}{3.14} \times 10 - 2\times 0.7$

$\cancel{5.37\,V} = 4.97\,V$

(c) $V_p = V_M - 2V_{DO} = 8.6\,V$

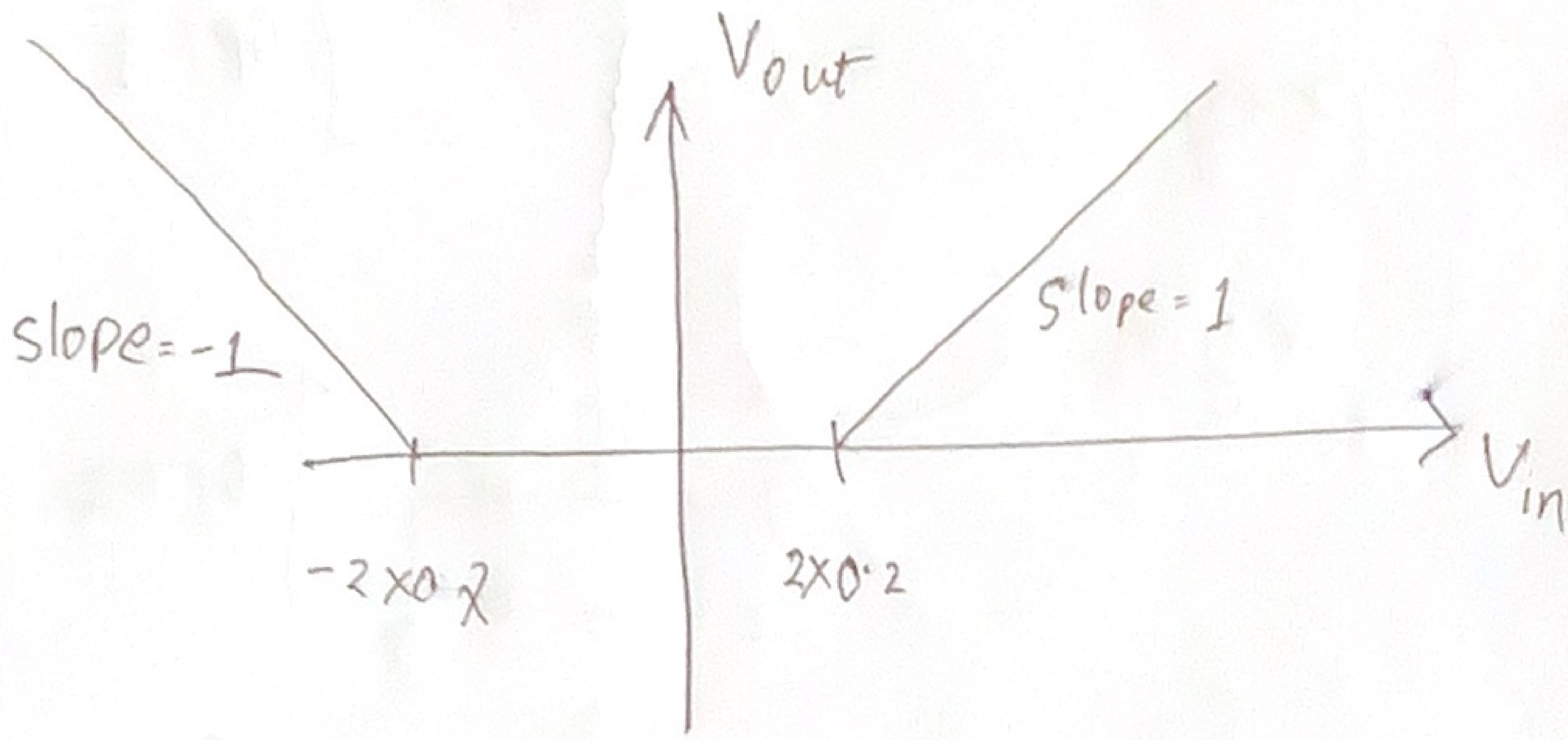
$f_R = 2f_i = \frac{2\times\omega}{2\pi} = \frac{2\times 100\pi}{2\pi} = 100\,Hz$

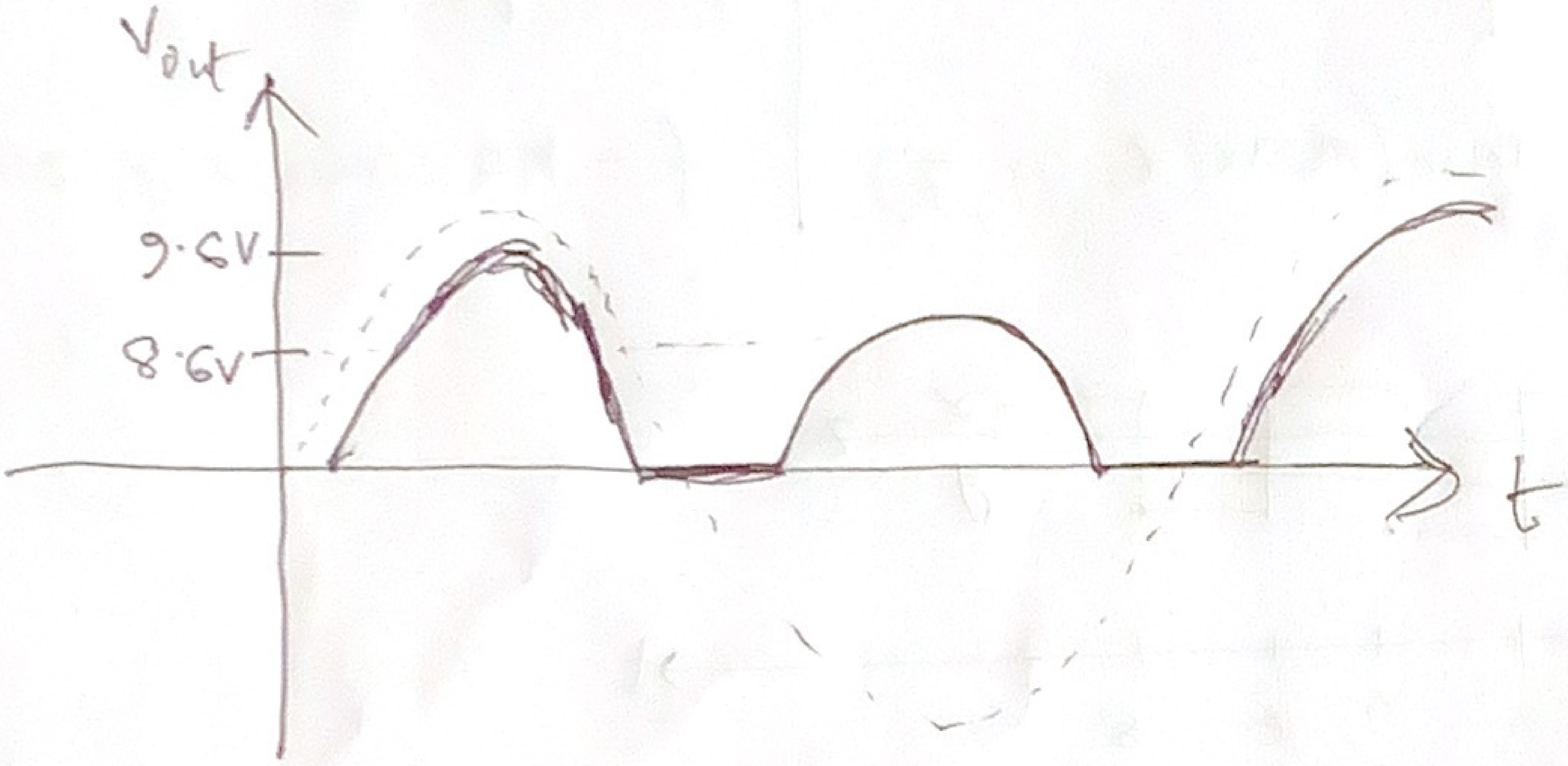
$V_r = \frac{V_p}{f_R RC} = \frac{8.6}{100\times 50\times 10^3\times 5\times 10^{-6}} = 0.344$

$\therefore V_{DC} = V_p - \frac{V_r}{2} = 8.6 - \frac{0.344}{2} = 8.428\,V$

(d) D_1 and D_2.

(e)





$$\boxed{\begin{aligned} V_p' &= V_M - 2V_{D_0}' \\ &= 10 - 2\times 0.2 \\ &= 9.6V \end{aligned}}$$