

Q. 3.25

find V_1

10 times area

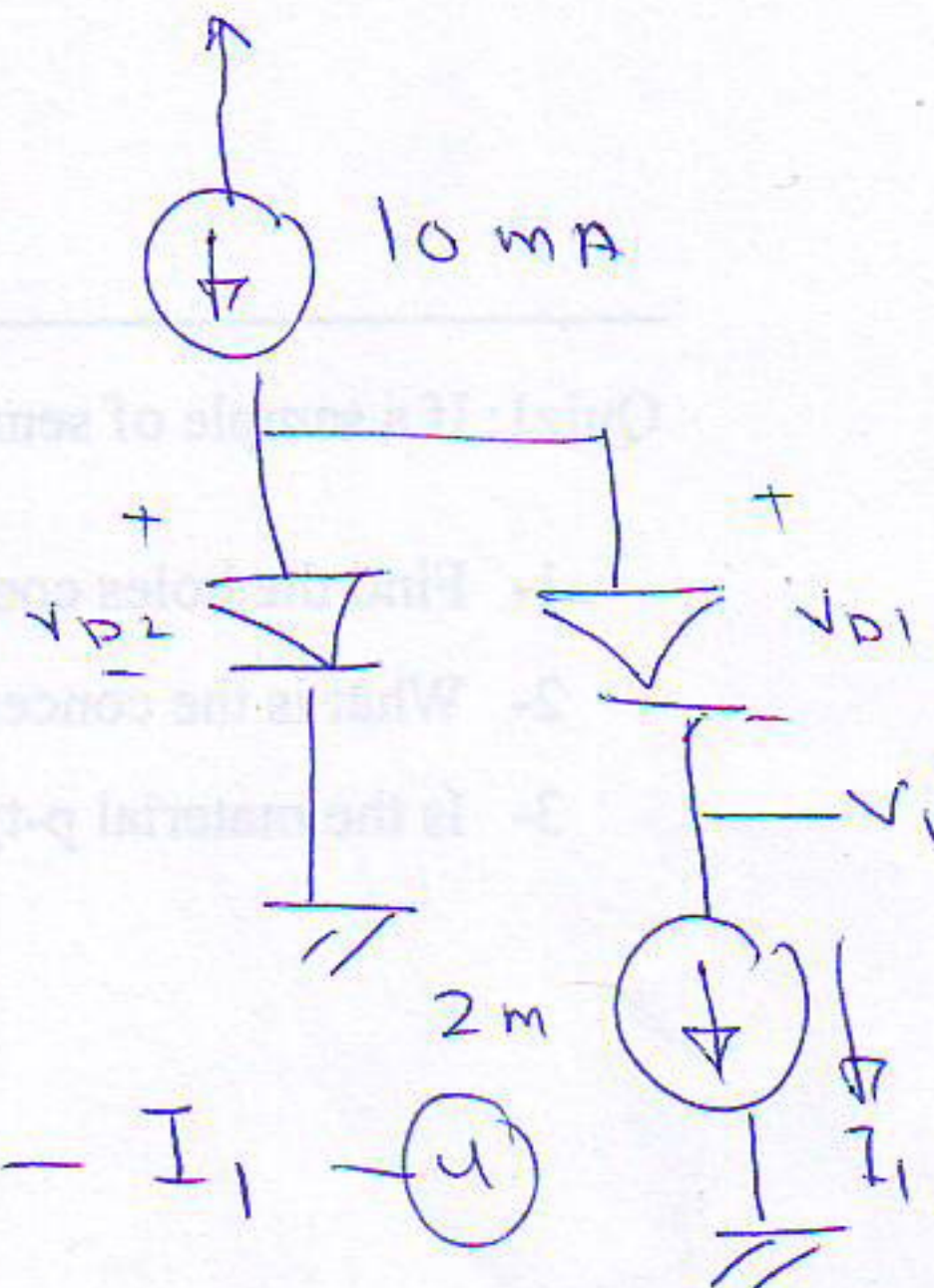
V_{D1}/V_T

$$D_1 \Rightarrow I_1 = 10 \times I_s e^{\frac{V_{D1}}{V_T}} \quad (1)$$

$$D_2 \Rightarrow I_2 = I_s e^{\frac{V_{D2}}{V_T}} \quad (2)$$

$$V_{D2} = V_{D1} + V_1 \quad (3)$$

$$I_1 + I_2 = 10 \text{ m} \Rightarrow I_2 = 0.01 - I_1 \quad (4)$$



* (3) in (2)

$$\frac{V_{D1} + V_1}{V_T}$$

$$I_2 = I_s e^{\frac{V_{D1} + V_1}{V_T}} \quad (5)$$

* (4) in (5)

$$(0.01 - I_1) = I_s e^{\frac{V_{D1} + V_1}{V_T}} \quad (6)$$

* divide (6) by (1)

$$\frac{0.01 - I_1}{I_1} = \frac{I_s}{10 I_s} e^{\frac{V_{D1} + V_1}{V_T} - \frac{V_{D1}}{V_T}}$$

$$\Rightarrow \frac{0.01 - I_1}{I_1} = 0.1 e^{\frac{V_1}{V_T}}$$

a) $I_1 = 2 \text{ mA} \rightarrow \text{find } V_1$

$$\frac{0.01 - I_1}{2 \text{ m}} = 0.1 \times e^{\frac{V_1}{V_t}} \quad \frac{V_1}{V_t} = 0.025 \text{ V}$$

$$40 = e^{\frac{V_1}{0.025}}$$

$$V_1 = 0.025 \ln(40)$$

$$= 0.0922 \text{ V}$$

b) $I_1 = ?$ if $V = 50 \text{ mV}$

$$\frac{0.01 - I_1}{I_1} = 0.1 e^{\frac{50 \text{ mV}}{25 \text{ m}}}$$

$$0.01 - I_1 = 0.1 (7.38) I_1$$

$$(1.738) I_1 = 0.01 \Rightarrow I_1 = 5.8 \text{ mA}$$