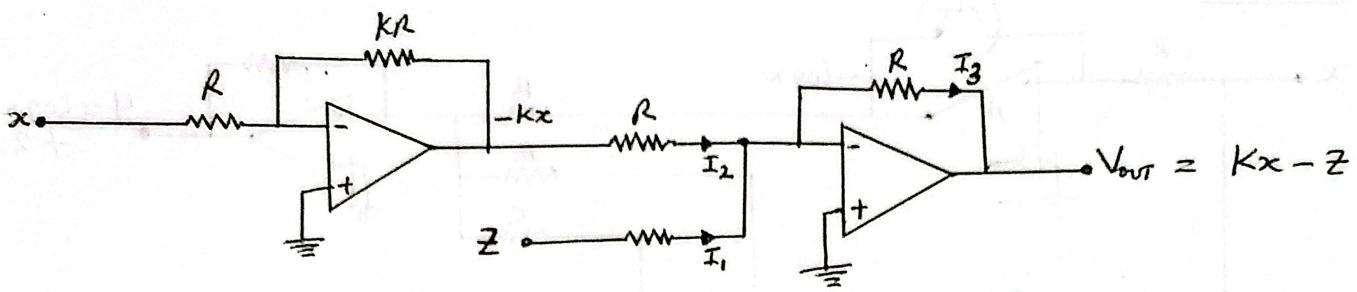


$$(5) \quad y = kx - z$$



RECALL

If all resistors are equal, scale changing does not occur.
Using KCL at "N" node to find if the output is equal
 V_{out} .

SOLUTION

From the diagram, $I_1 + I_2 - I_3 = 0$

$$I_1 = \frac{z}{R}, \quad I_2 = \frac{-Kx}{R}, \quad I_3 = \frac{0 - V_{out}}{R}$$

$$\frac{z}{R} + \left(\frac{-Kx}{R} \right) - \left(\frac{0 - V_{out}}{R} \right) = 0$$

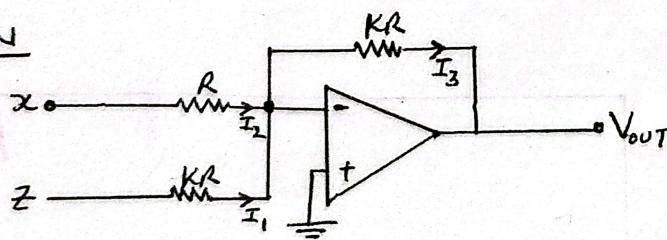
$$\frac{z}{R} + \frac{Kx}{R} + \frac{V_{out}}{R} = 0$$

$$V_{out} = \underline{\underline{Kx - z}}$$

(6)

$$y = -Kx - z$$

SOLUTION



RECALL

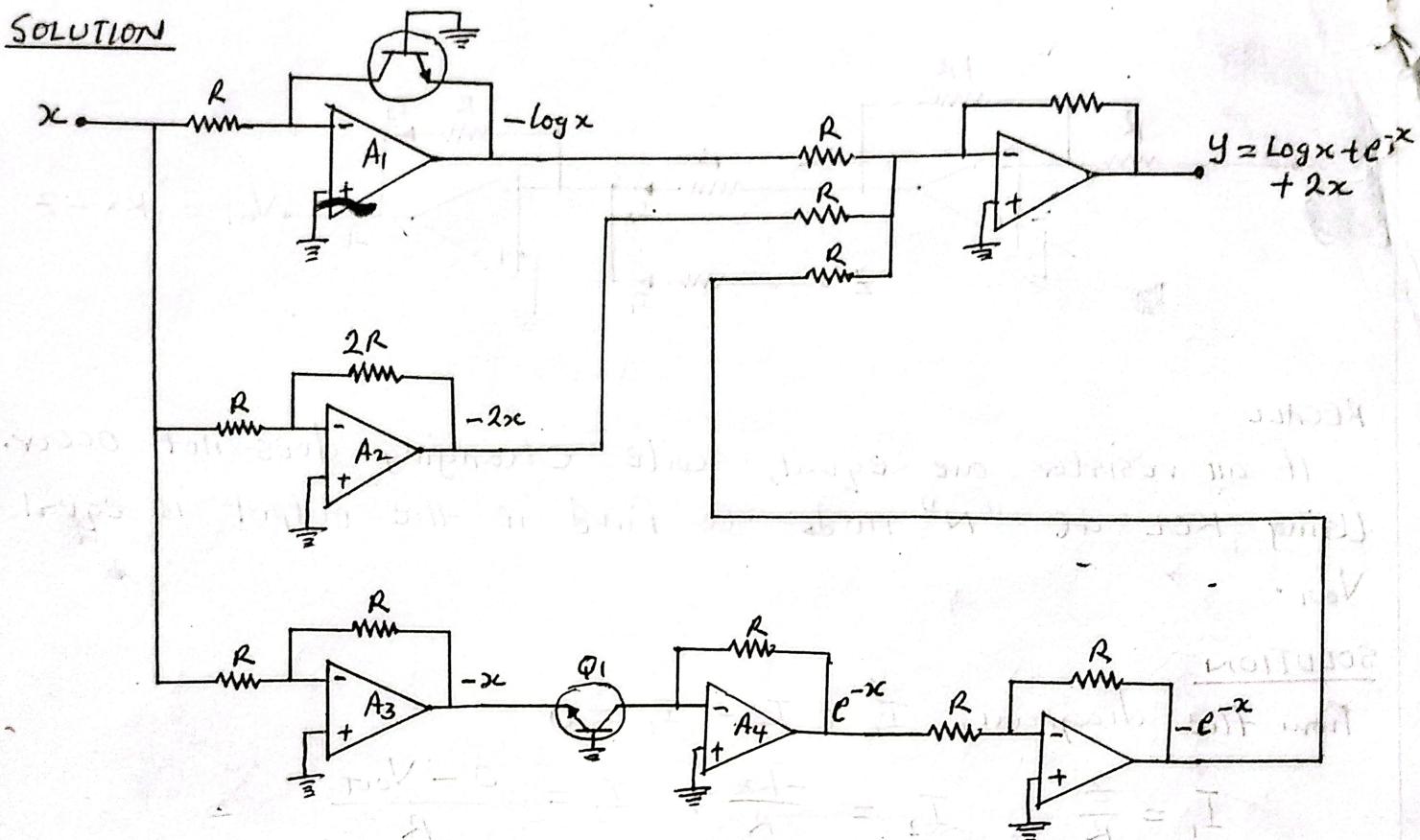
$$I_1 + I_2 - I_3 = 0$$

$$\frac{z}{KR} + \frac{x}{R} - \left(\frac{0 - V_{out}}{KR} \right) = 0, \quad \frac{z}{KR} + \frac{x}{R} + \frac{V_{out}}{KR} = 0$$

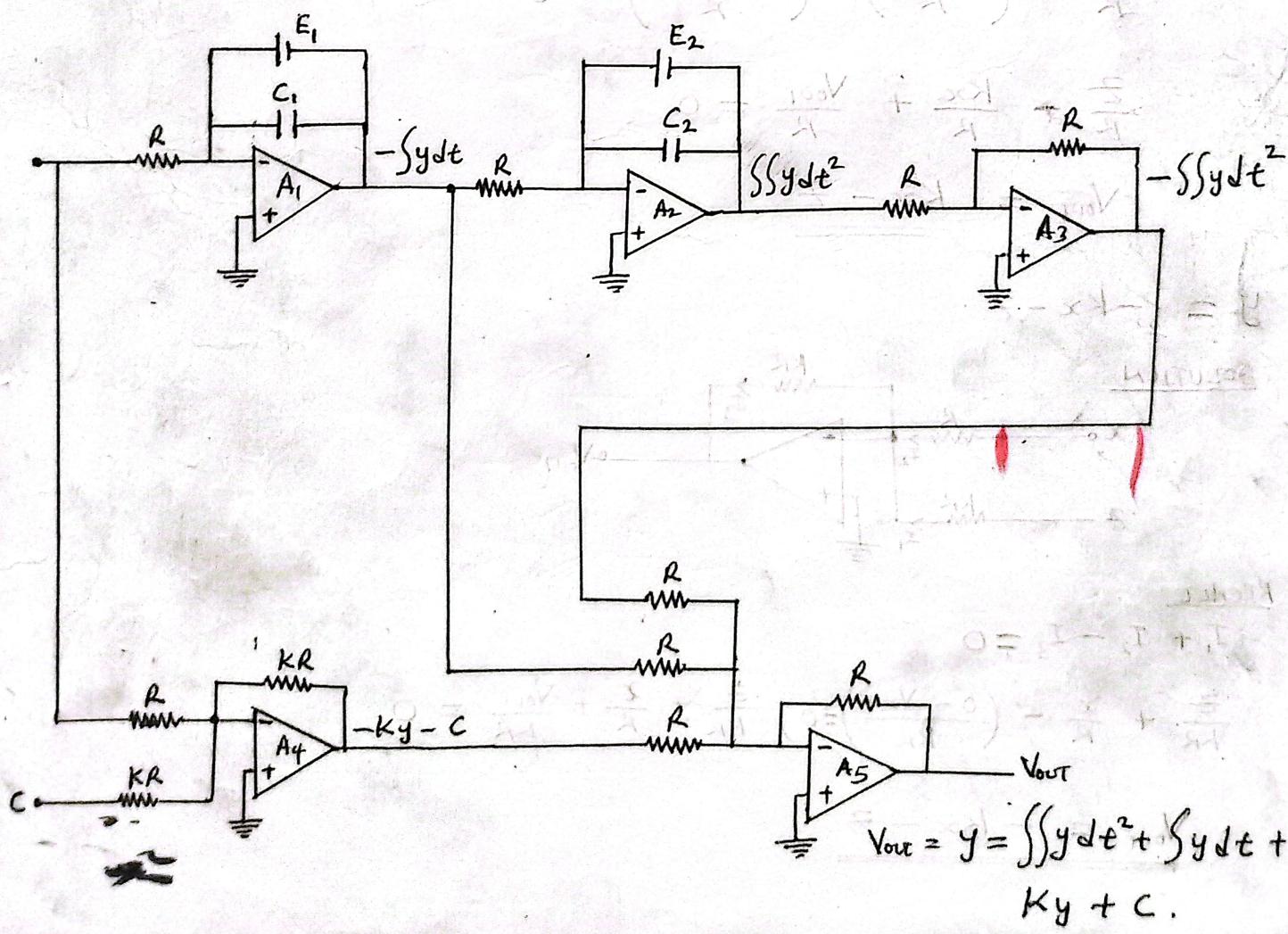
$$V_{out} = \underline{\underline{-Kx - z}}$$

$$y = \ln x + e^{-x} + 2x$$

SOLUTION

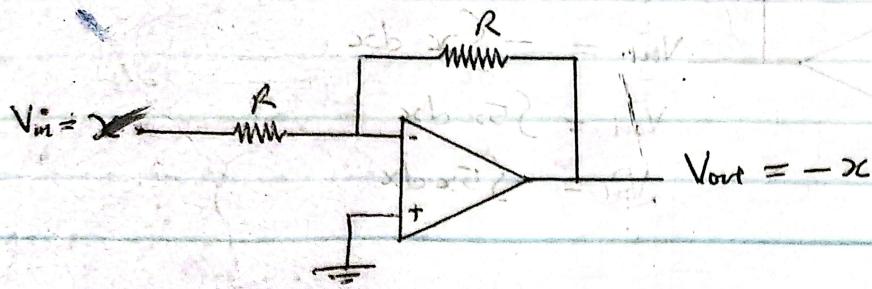


$$⑧ y = \int \int y dt^2 + \int y dt + Ky + C$$



POINTS TO NOTE

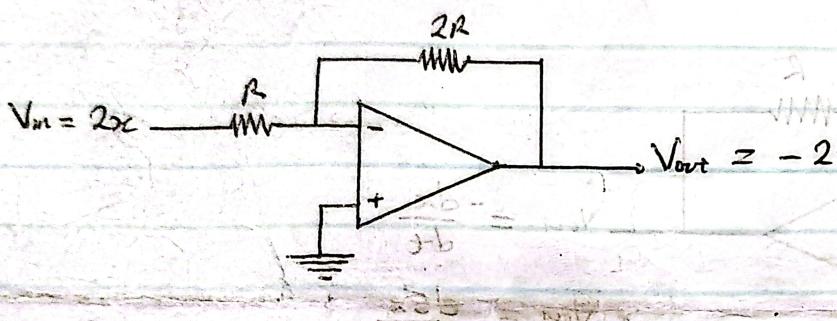
(1) SIGN CHANGER



RECALL

$$V_m = \frac{R_f}{R} (-V_m), \text{ if } R_f = R$$

$V_{out} = -V_m$

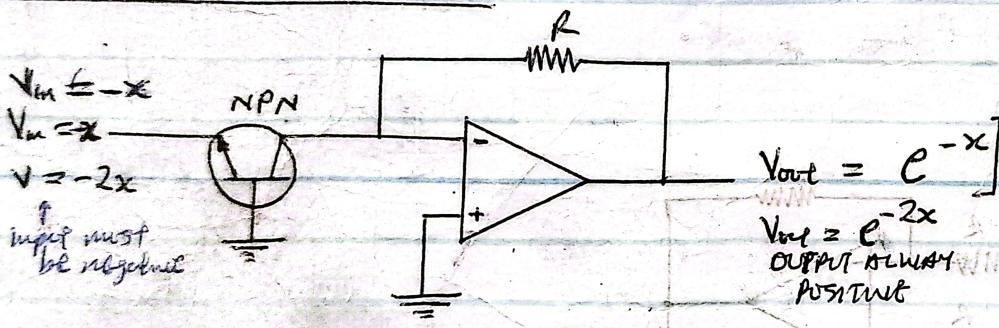


RECALL

$$V_{out} = \frac{R_f}{R} (-V_m), \text{ if } R_f = 2R$$

$V_{out} = -V_m$

(2) EXPONENTIAL AMPLIFIER



RECALL $\frac{-V_m}{V_t}$

$$V_{out} = R_f I_{es} C$$

if $R_f = 1, V_t = 1, I_{es} = 1$

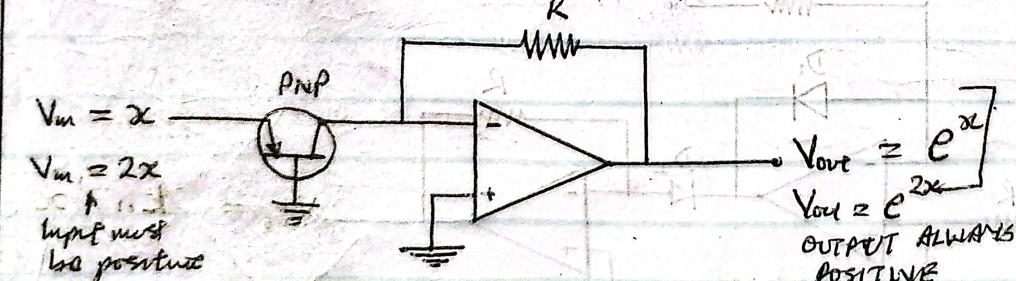
$V_{out} = e^{-V_m}$

RECALL

$$V_{out} = R_f I_{es} C$$

$$\text{if } V_t = R_f = I_{es} = 1$$

$$\underline{\underline{V_{out} = C^{\frac{V_m}{V_t}}}}$$



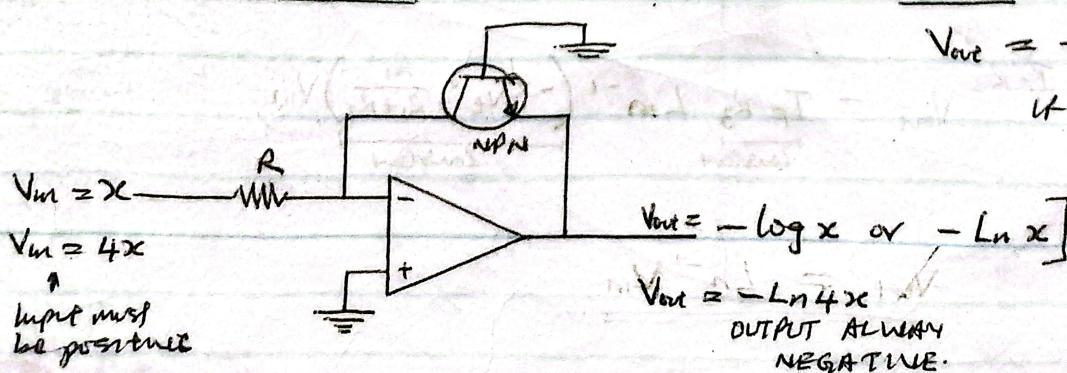
RECALL

$$V_{out} = -V_t \ln \frac{V_m}{R_i I_{es}}$$

$$\text{if } R_i = I_{es} = V_t = 1$$

$$\underline{\underline{V_{out} = -\ln V_m}}$$

(3) LOGARITHM AMPLIFIER



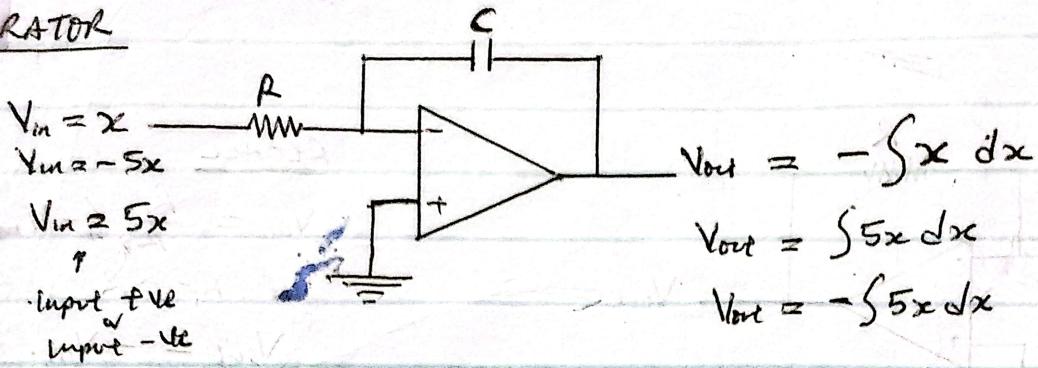
RECALL

$$V_{out} = -V_t \ln \frac{V_m}{R_i I_{es}}$$

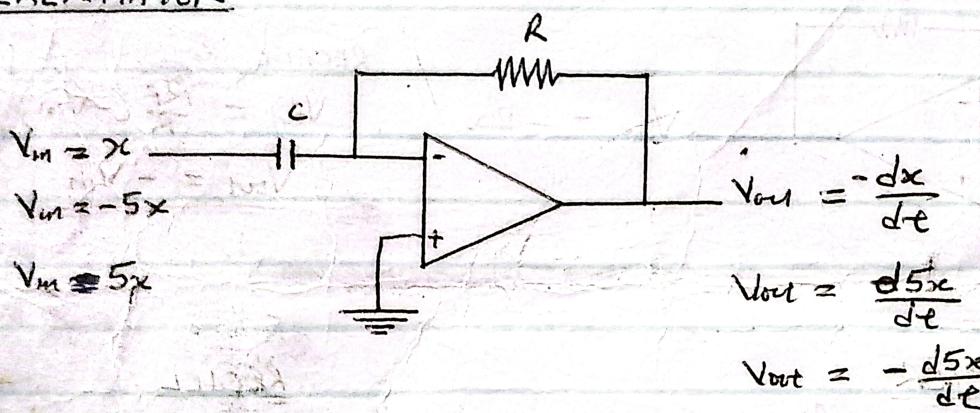
$$\text{if } R_i = I_{es} = V_t = 1$$

$$\underline{\underline{V_{out} = -\ln V_m}}$$

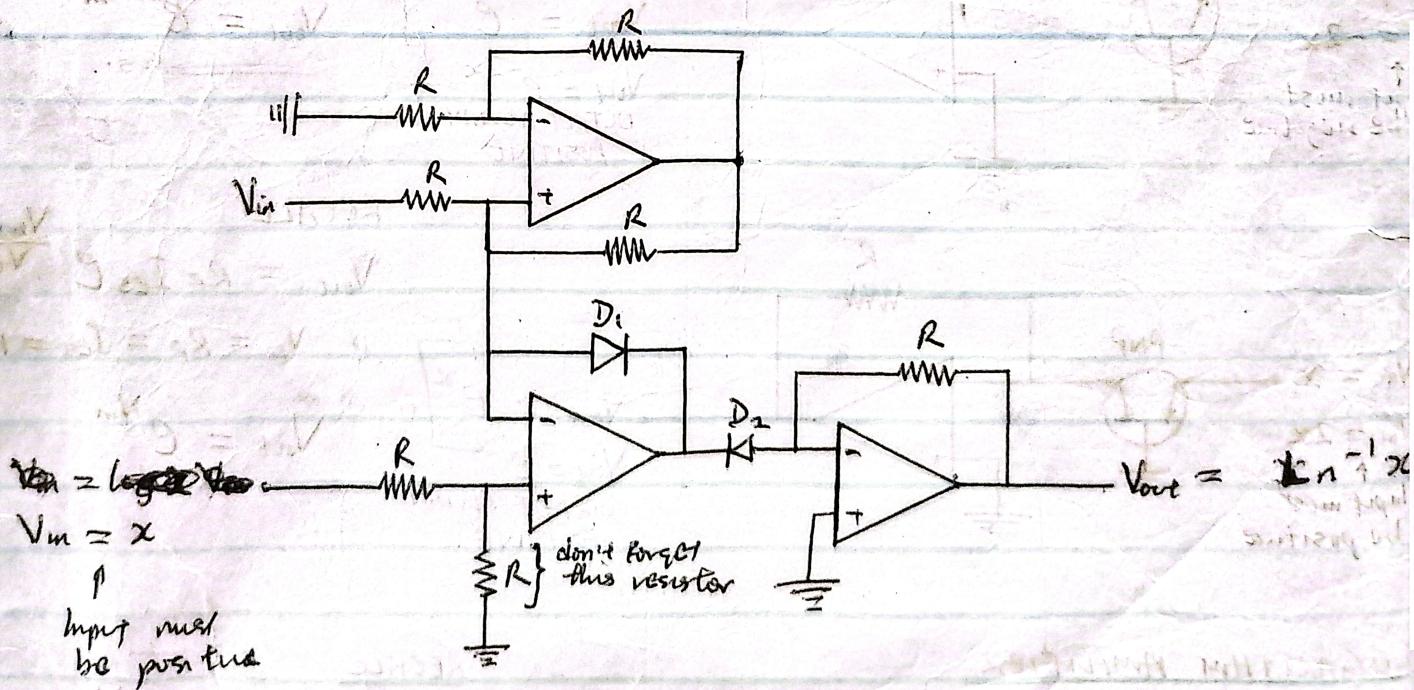
④ INTEGRATOR



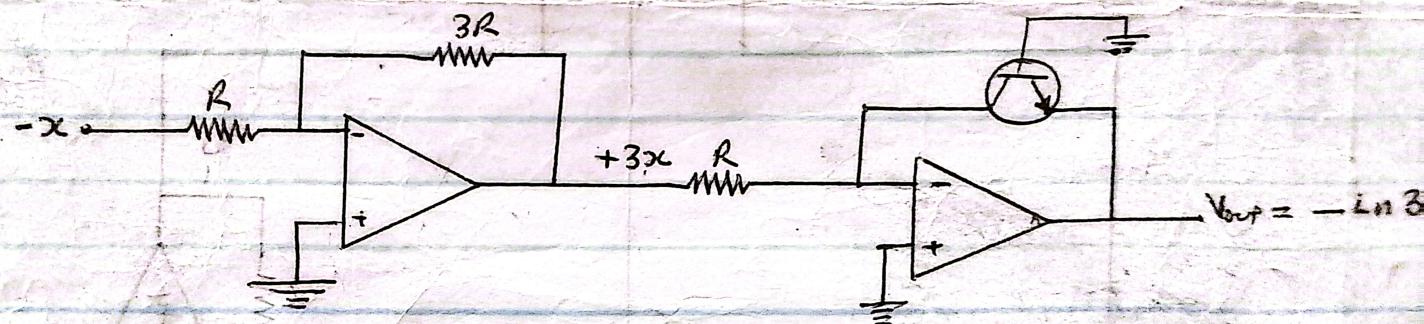
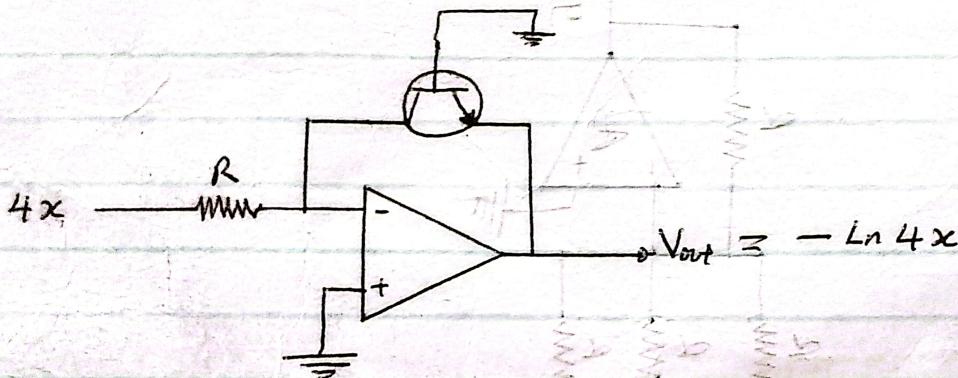
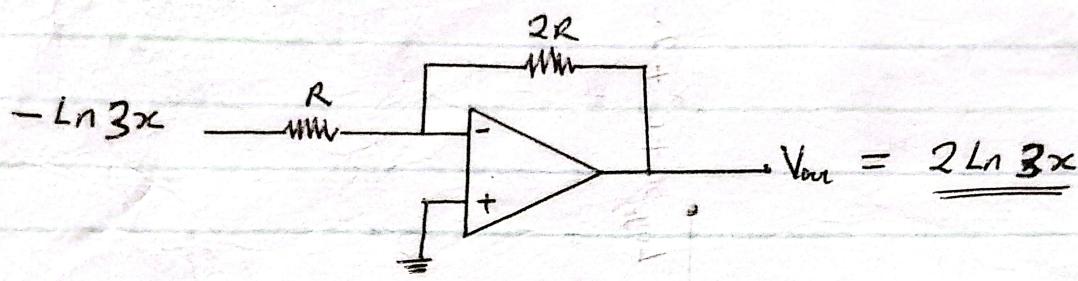
⑤ DIFFERENTIATOR



⑥ ANTILOG AMPLIFIER

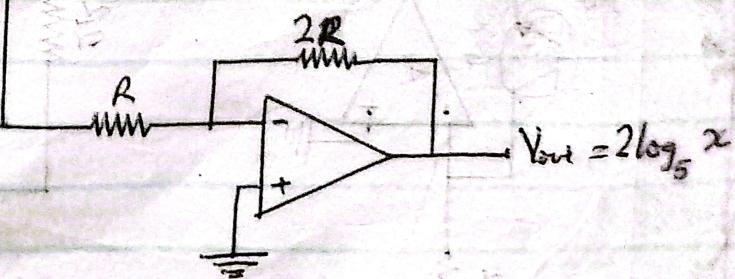
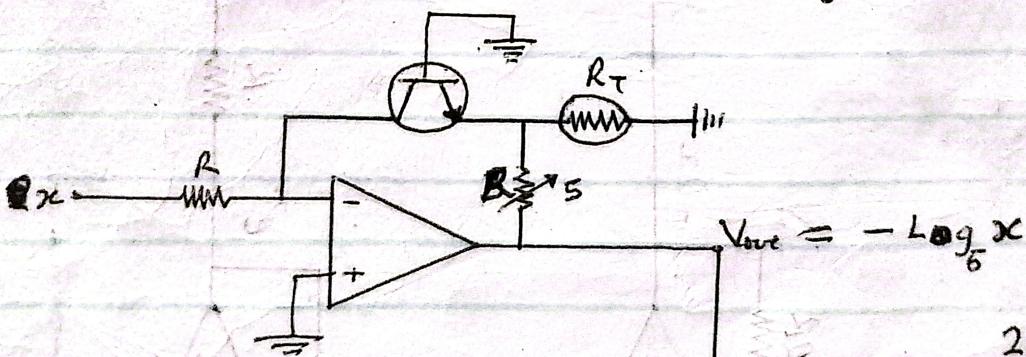


MORE ON LOGARITHM

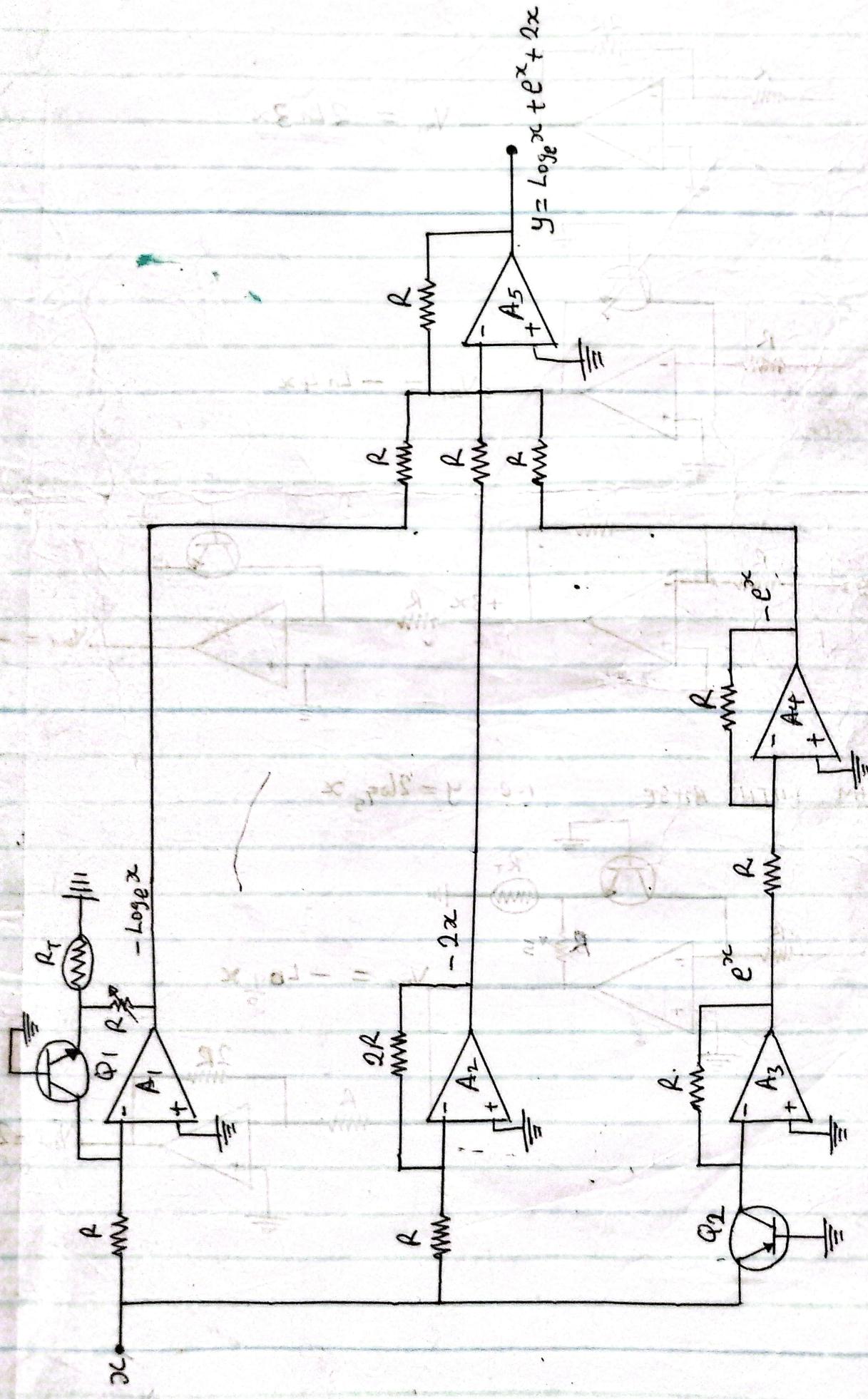


LOGARITHM WITH BASE

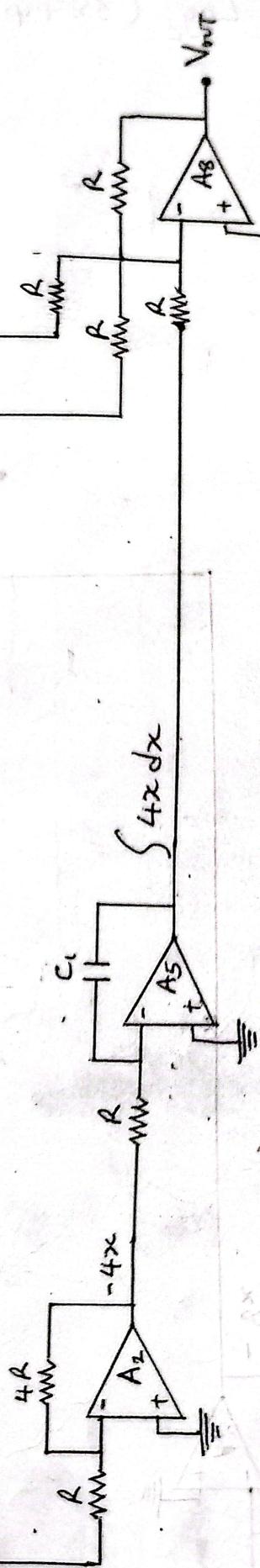
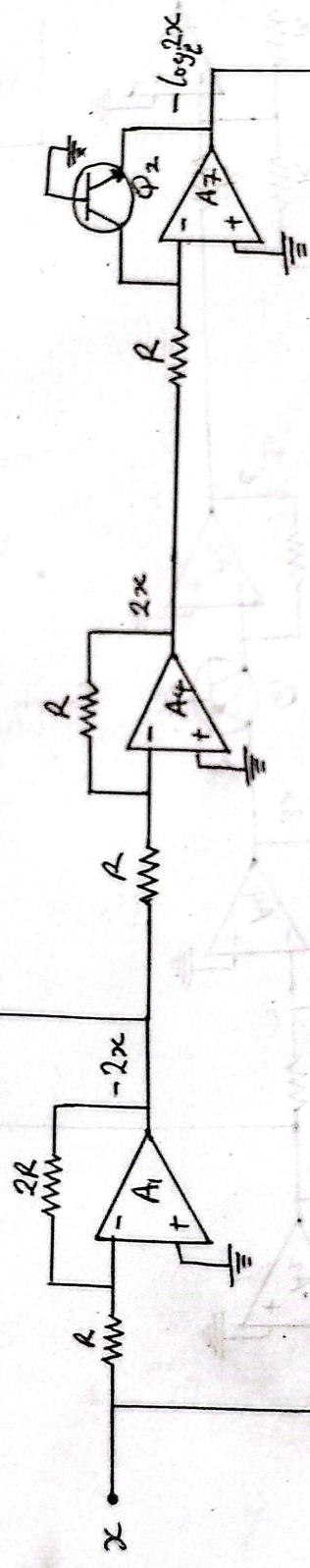
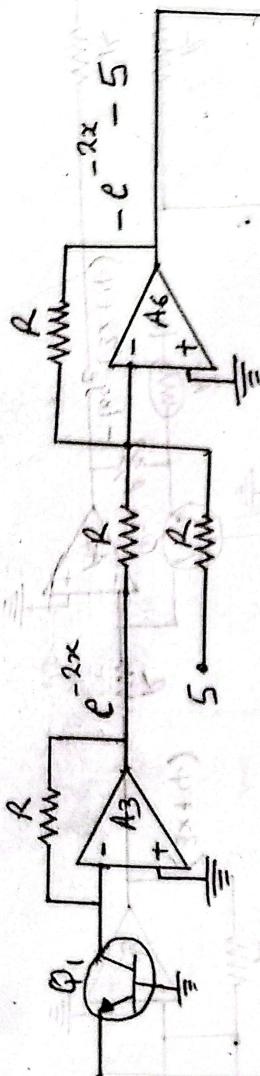
$$1-e^{-y} = 2 \log_5 x$$



$$y = \log_e x + e^x + 2x$$

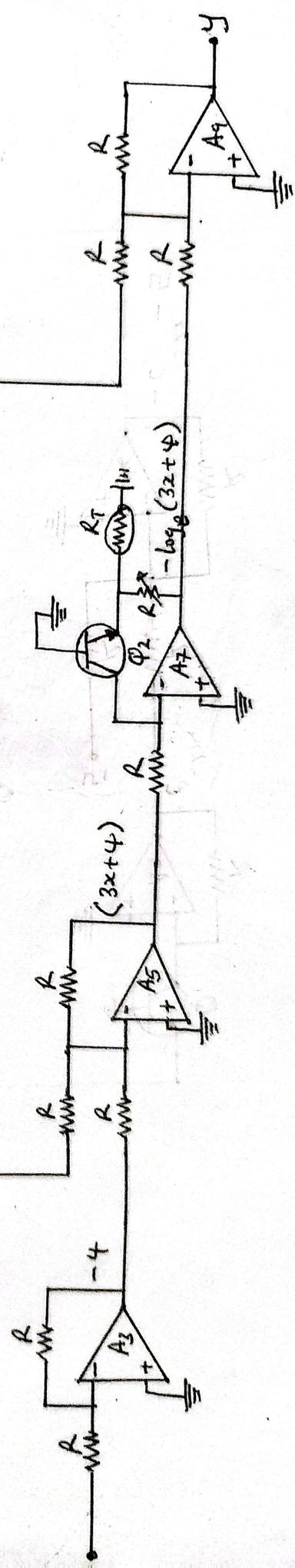
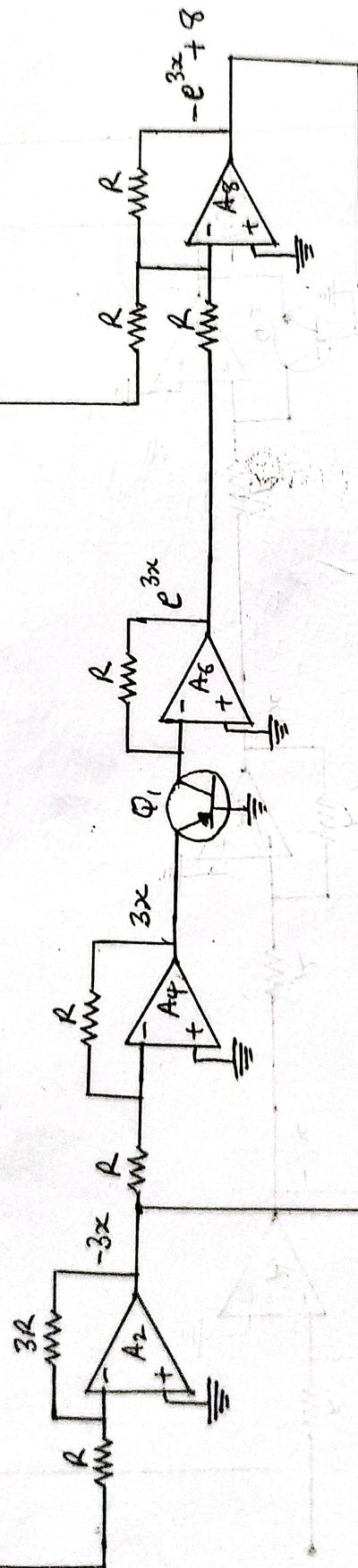
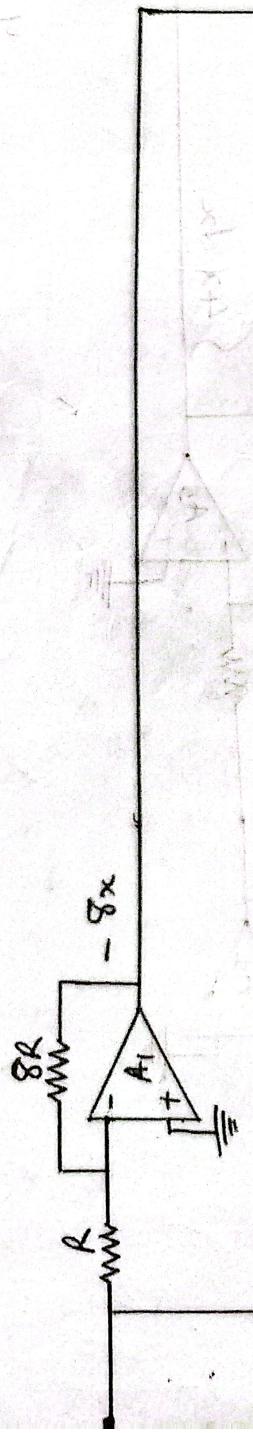


$$y = \log_e 2x - \int 4x dx + e^{-2x} + 5$$



$$y = V_{out} = \log_e 2x - \int 4x dx + e^{-2x} + 5$$

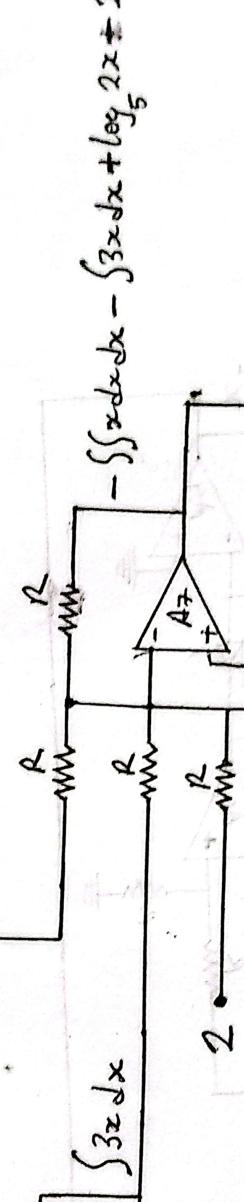
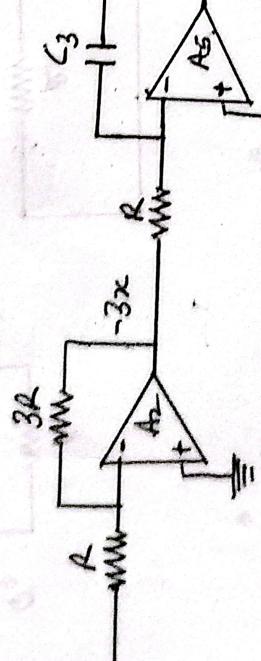
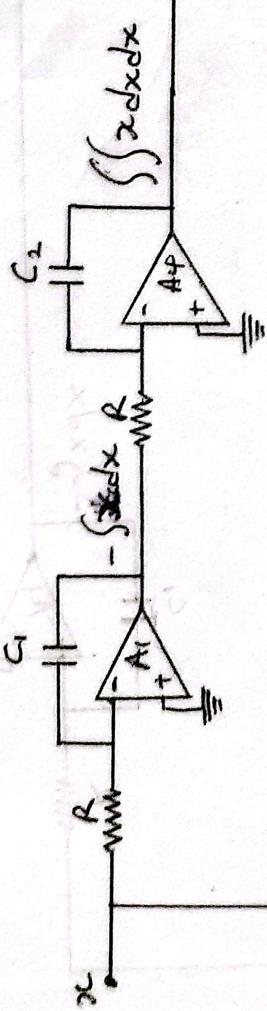
$$y = \log_e(3x+4) + e^{3x} - 8x$$



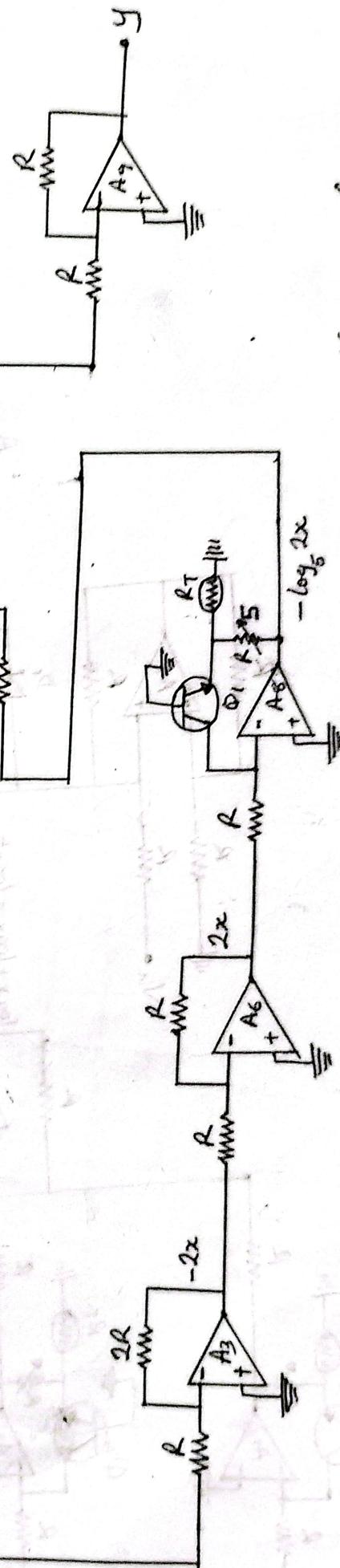
$$y = \log_e(3x+4) + e^{3x} - 8x$$

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$$y = \iint x dx dx + \int 3x dx - \log_5 2x + 2.$$



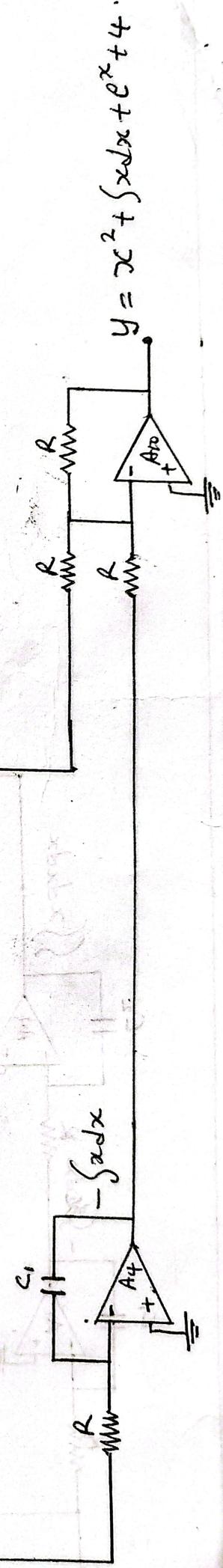
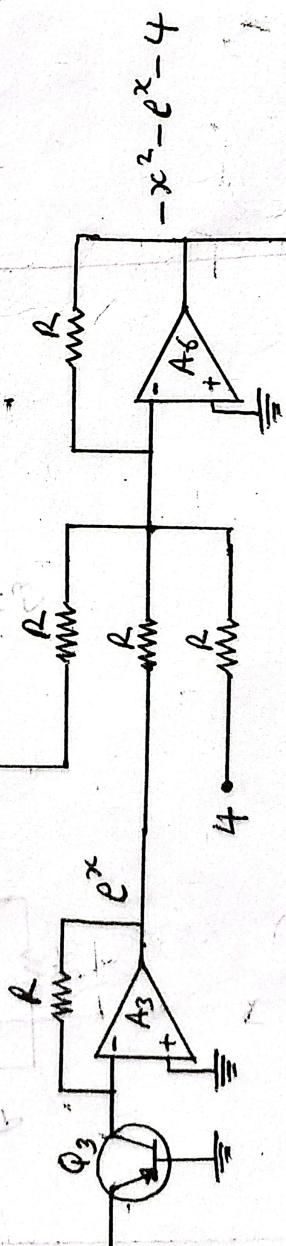
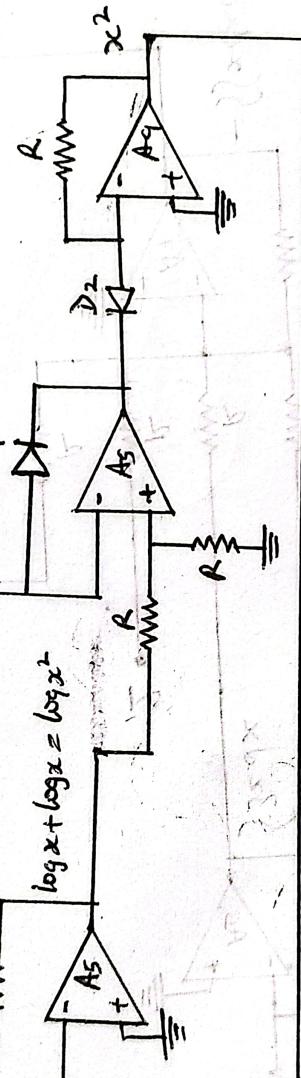
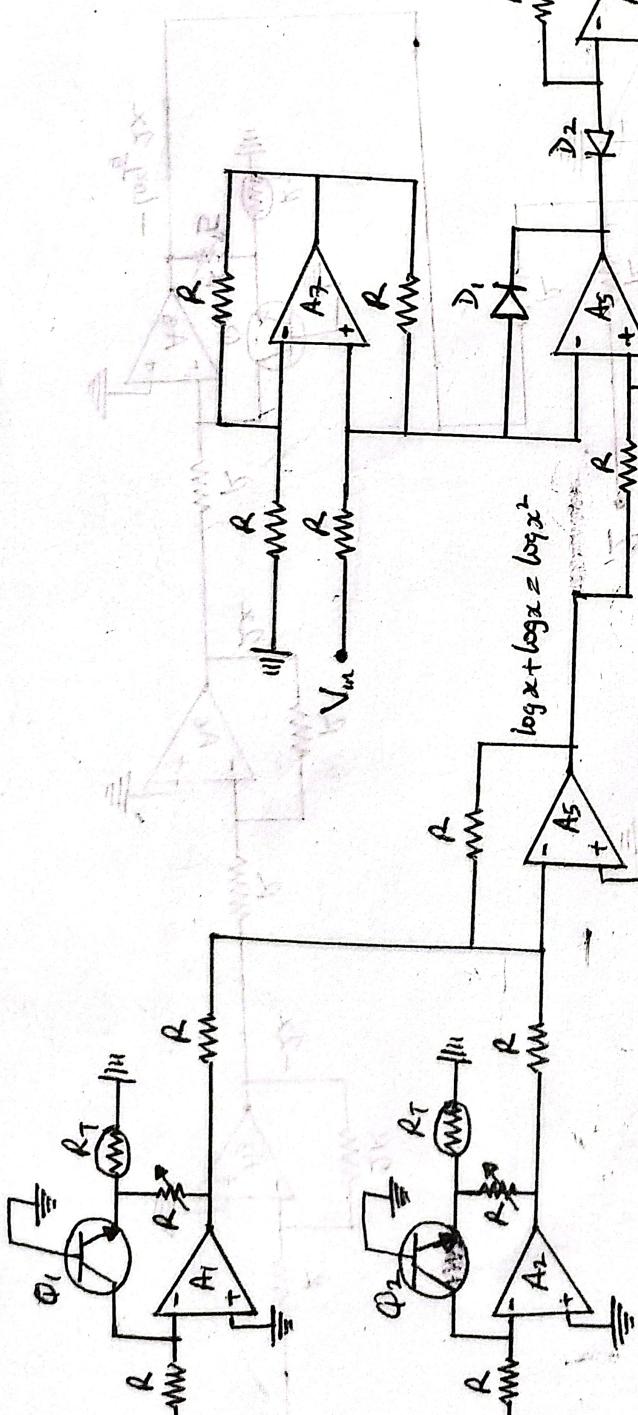
37



$$y = \iint x dx dx + \int 3x dx - \log_5 2x + 2$$

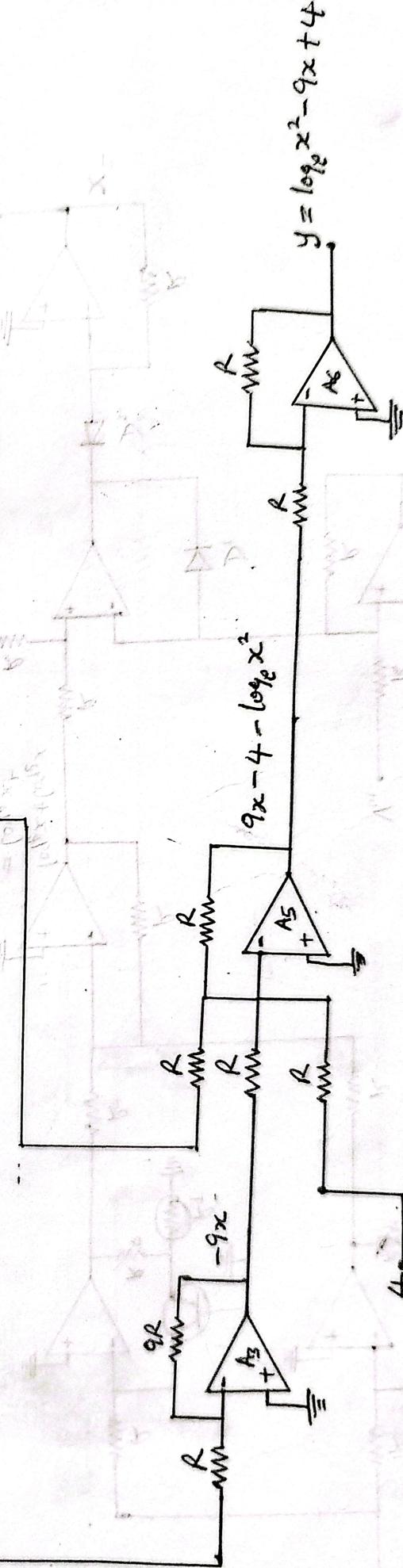
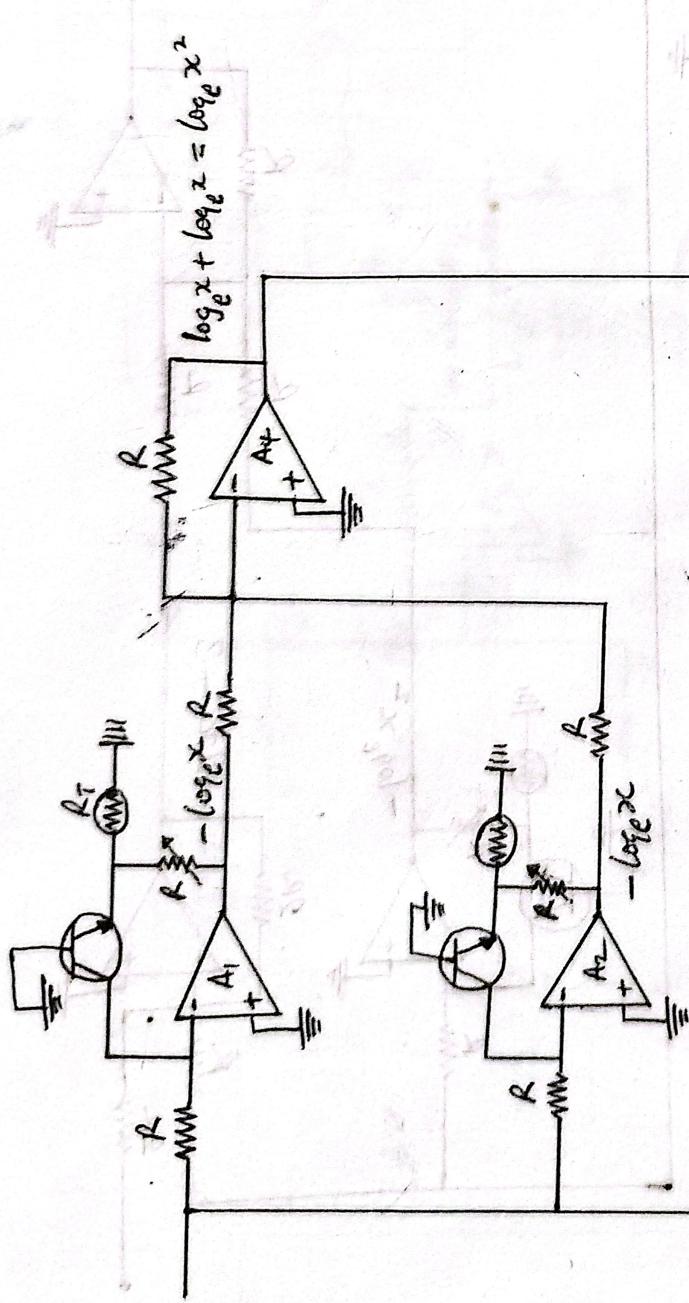
13

$$y = x^2 + \int x dx + e^x + 4$$



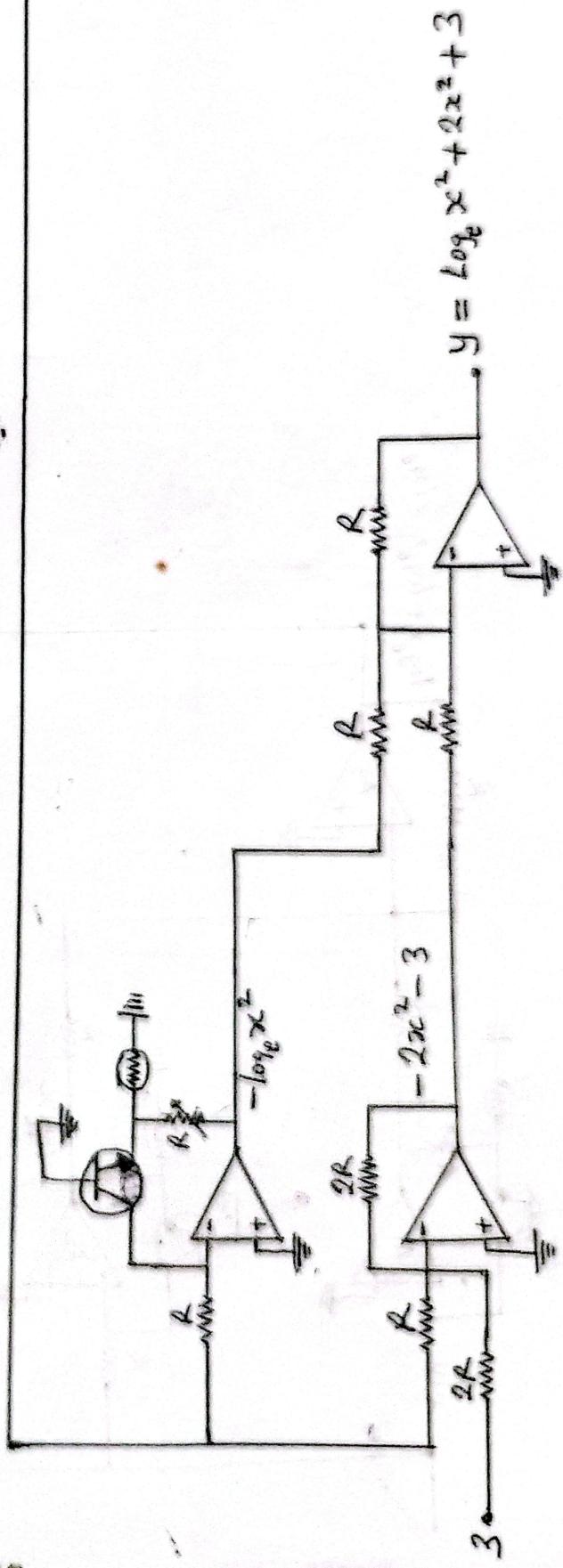
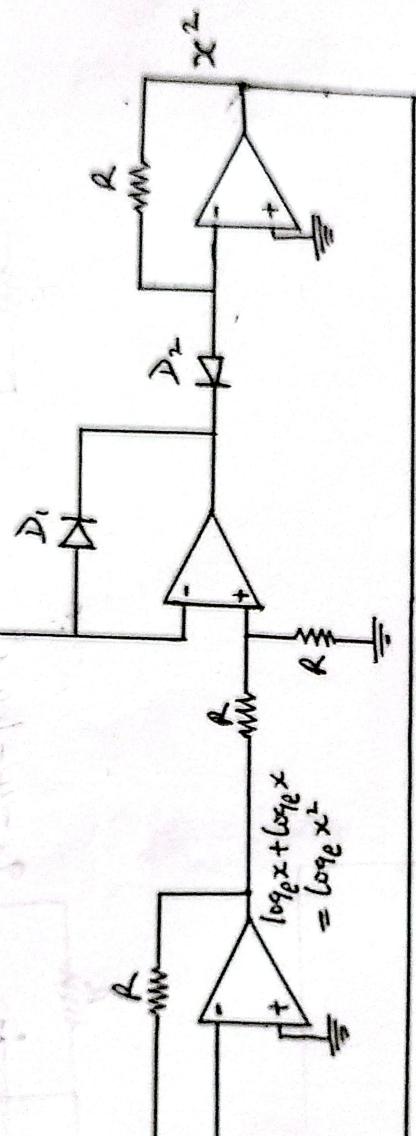
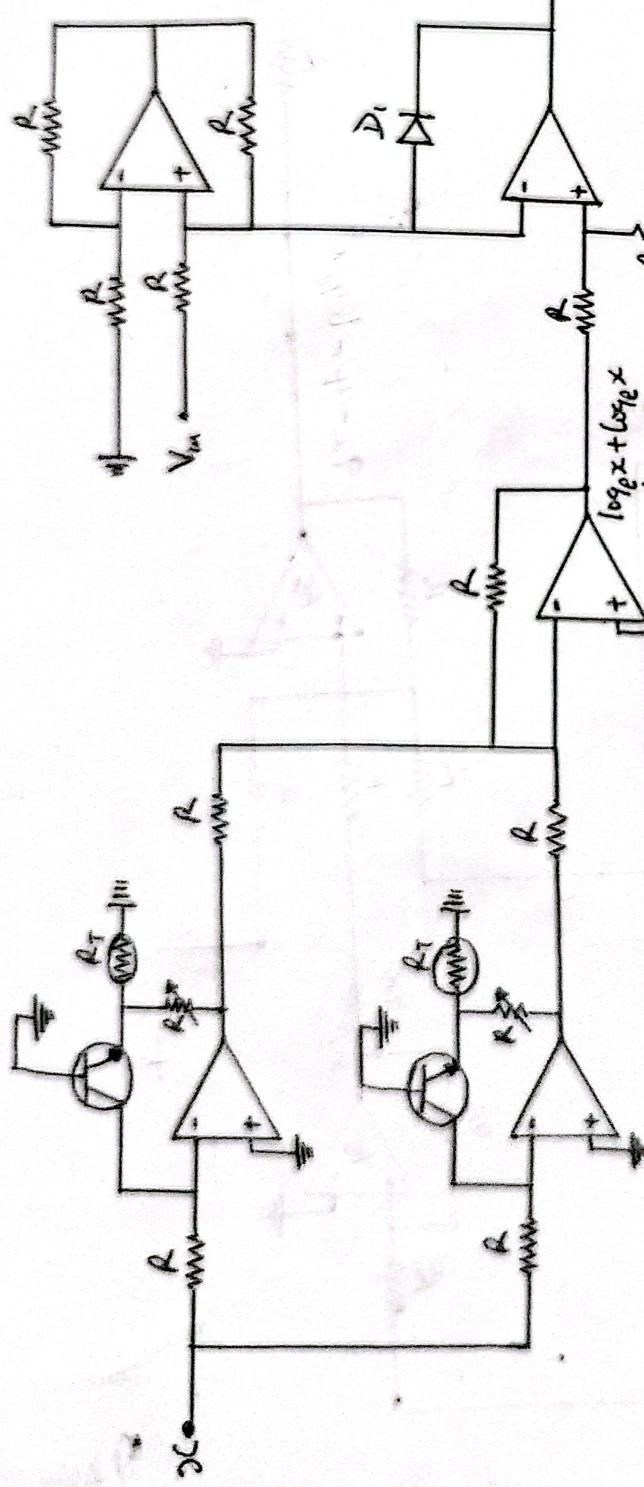
$$y = x^2 + \int x dx + e^x + 4$$

$$Y = \log_e x^2 - 9x + 4$$

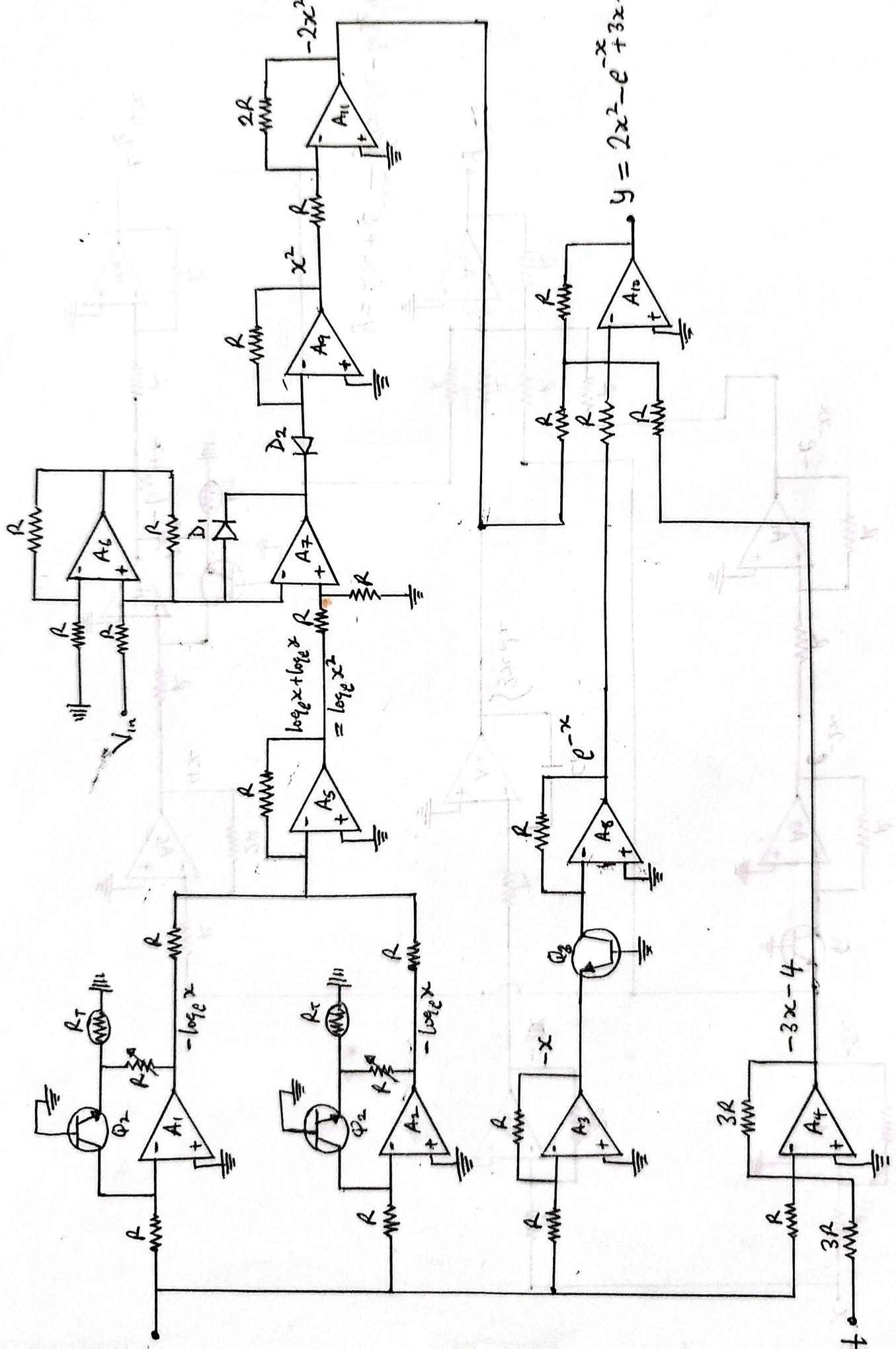


$$y = \log_e x^2 - 9x + 4$$

15 ✓ $\log_e x^2 + 2x^2 + 3$

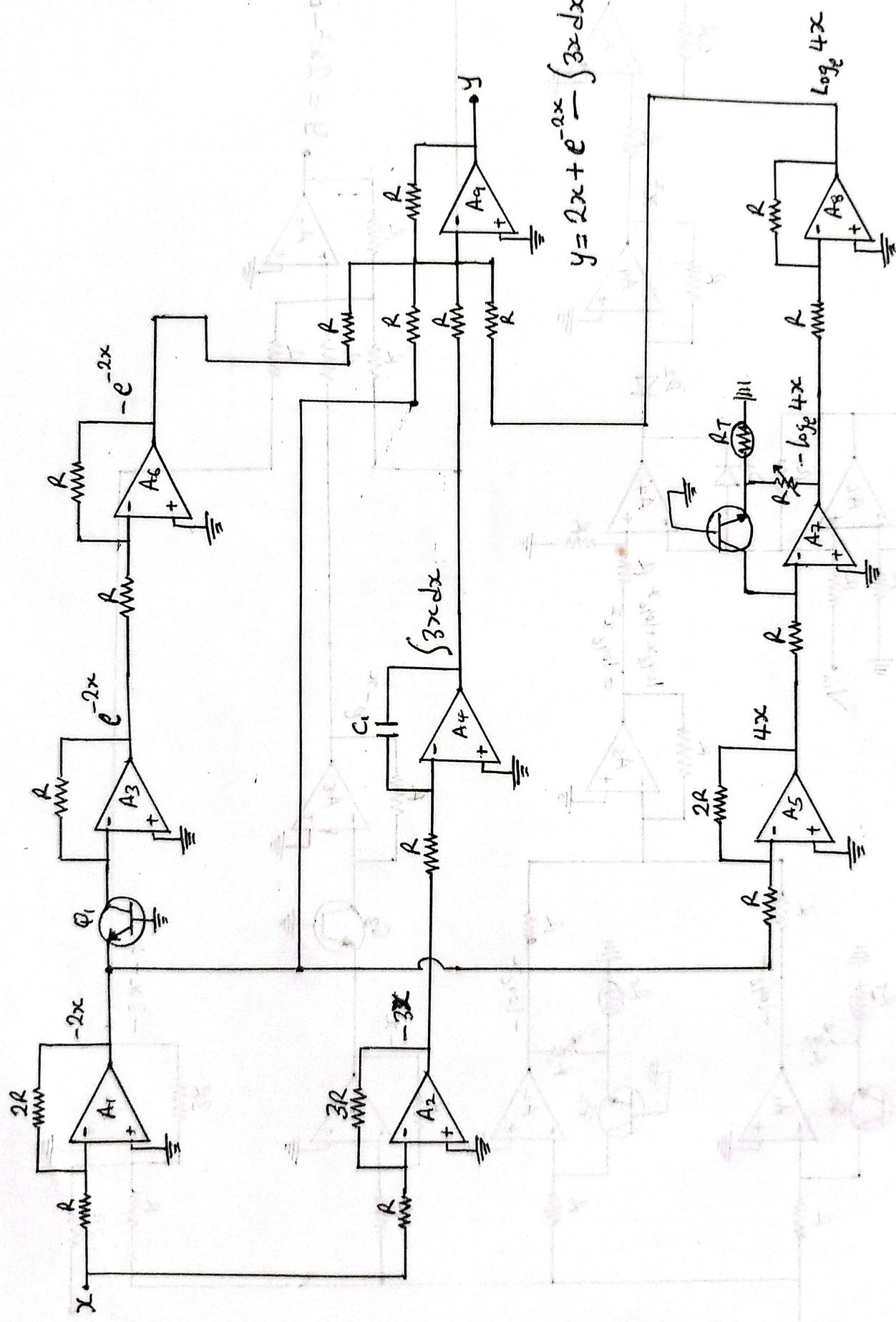


$$L = 2x^2 - e^{-x} + 3x + 4$$

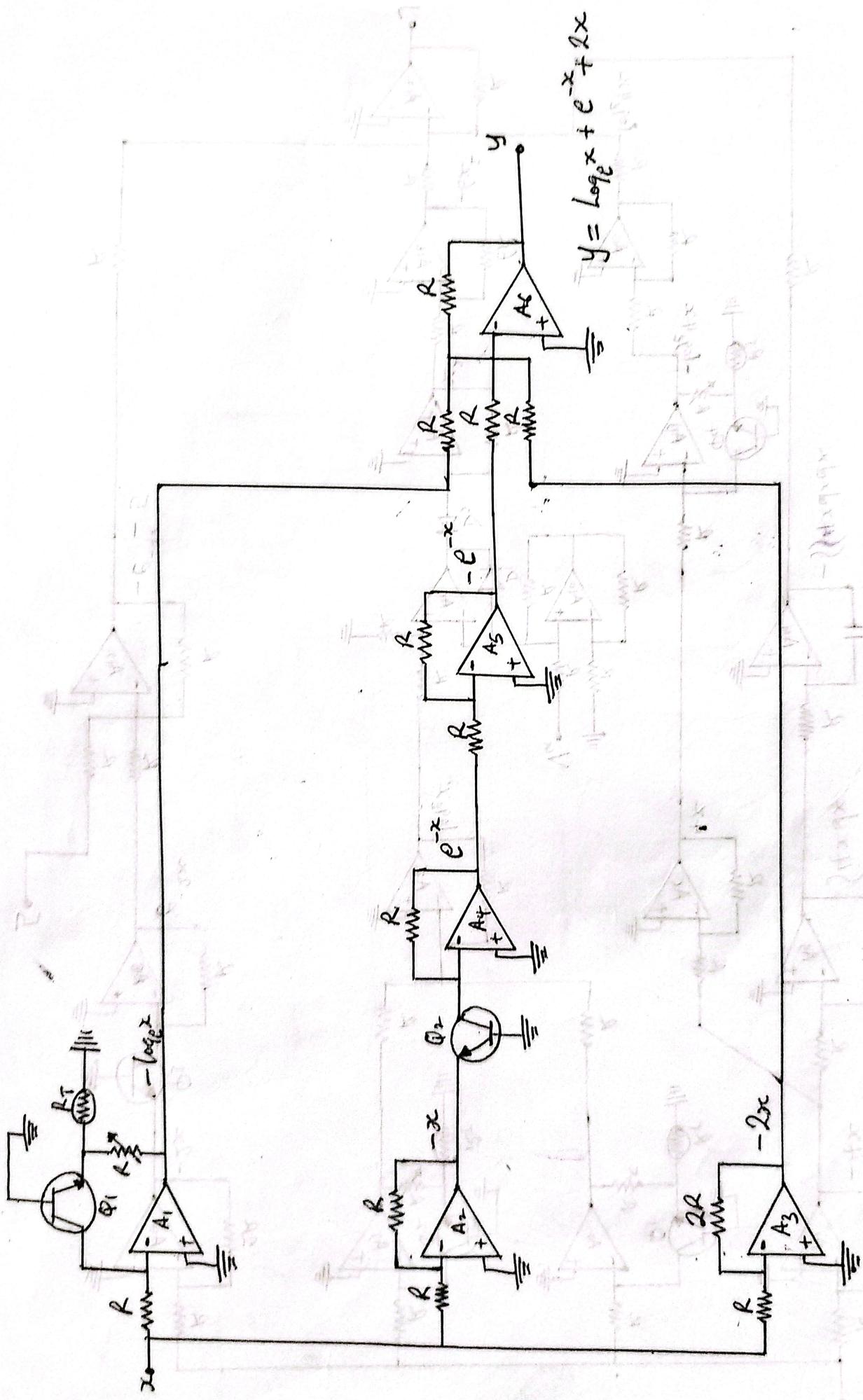


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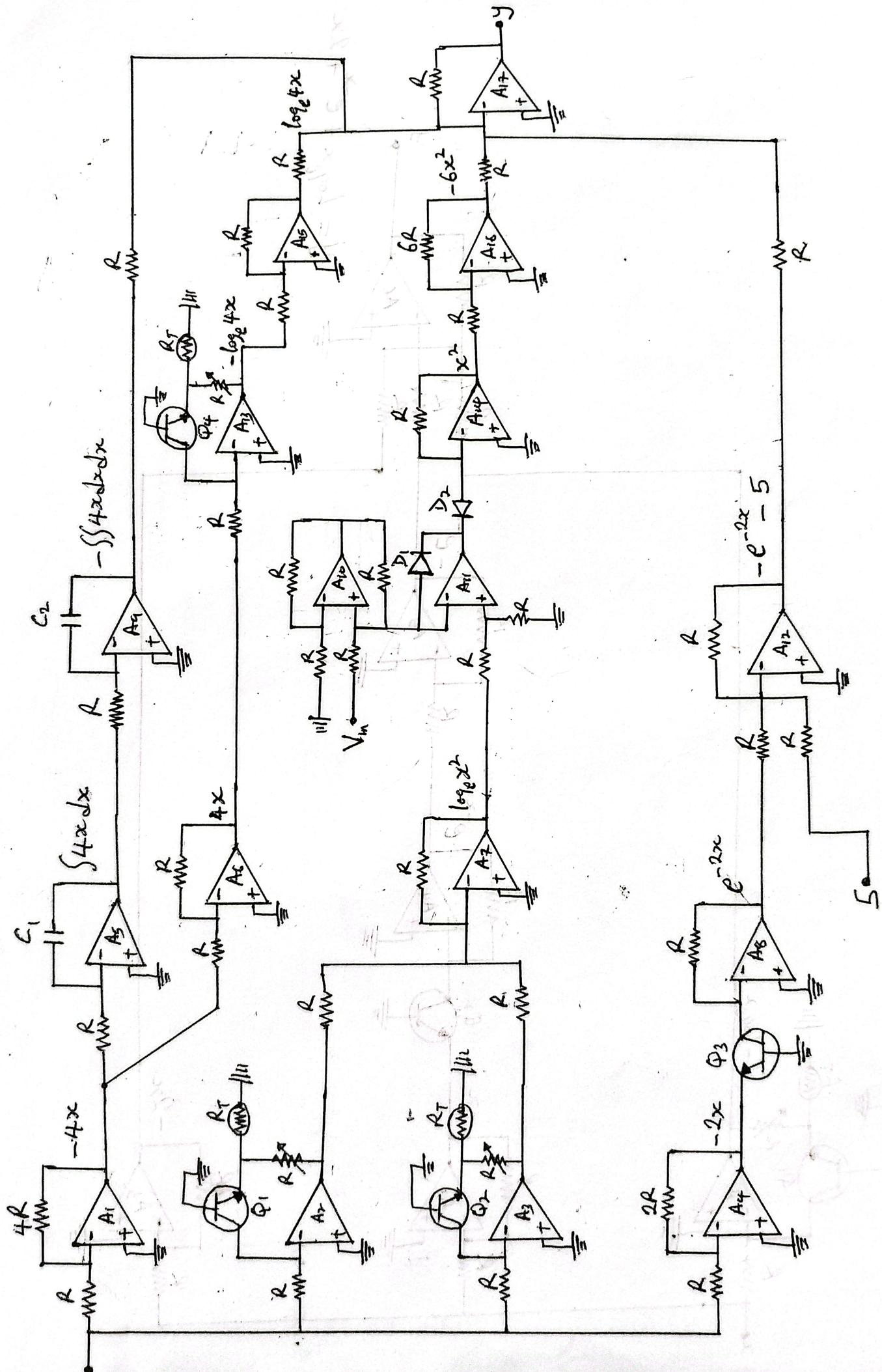
$$y = 2x + e^{-2x} - \int 3x dx - \log_e 4x$$



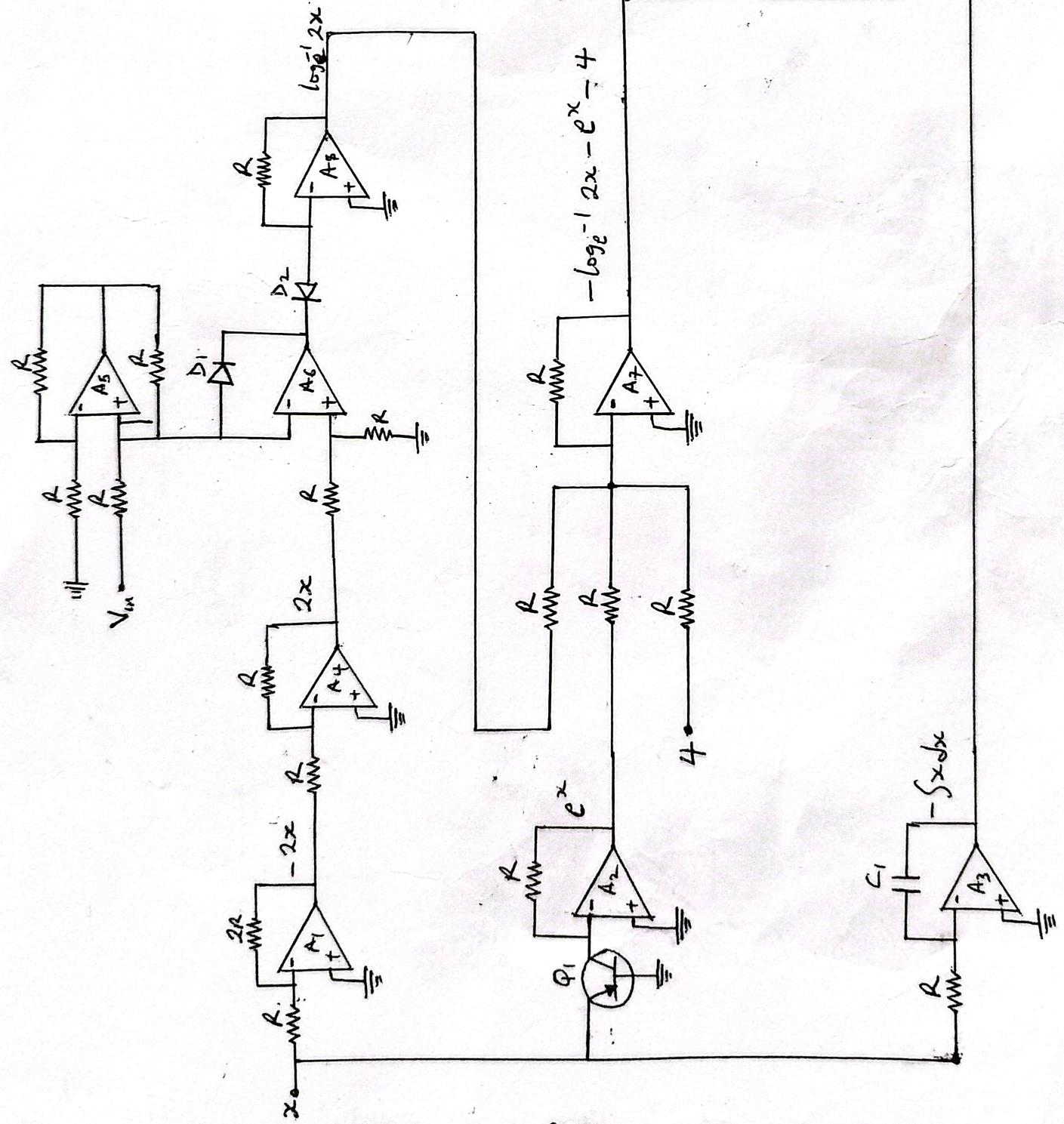
$$Y = \log_e x + e^{-x} + 2x$$



$$LC = \int \int 4x dx dx + 6x^2 + e^{-2x} - \log_e 4x + 5.$$



$$20) \log_e^{-1} 2x + \int x dx + e^x + \varphi$$



$$Y = \log(-2x + \int x dx + e^x + 4)$$