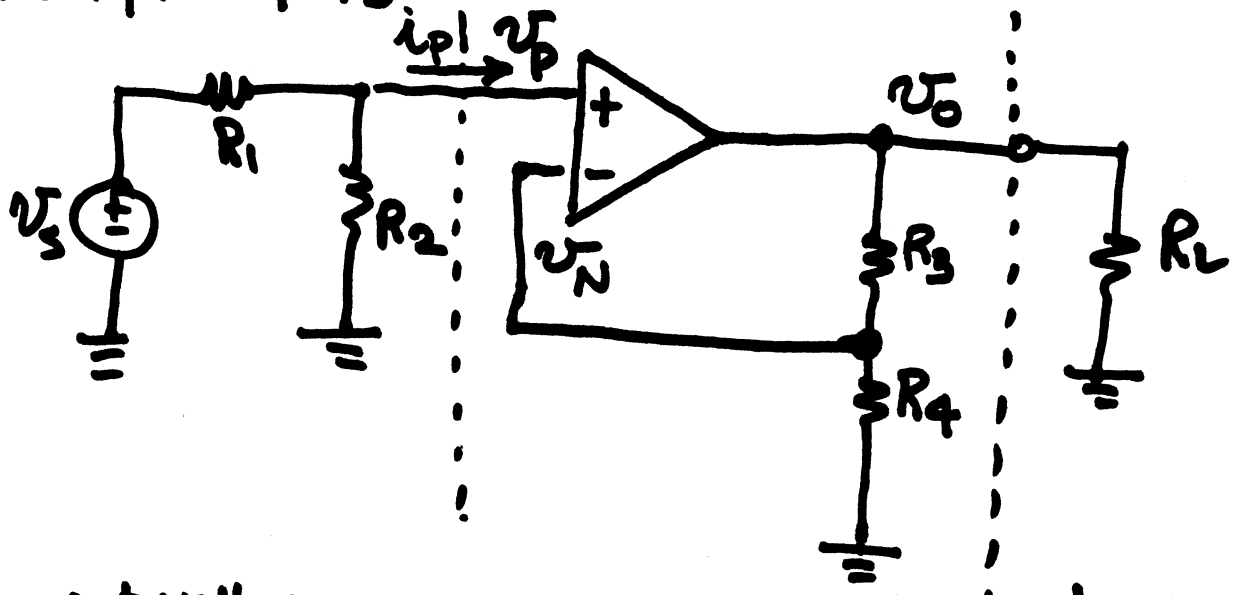
Example 4-13



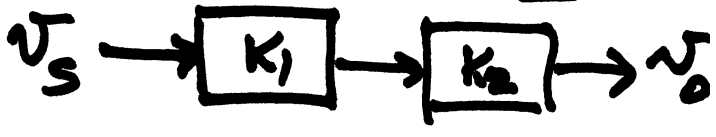
input voltage divider — op AMP amplifier — load

$$v_p = \frac{R_2}{R_1+R_2} v_s \qquad v_N = \frac{R_4}{R_3+R_4} v_o$$

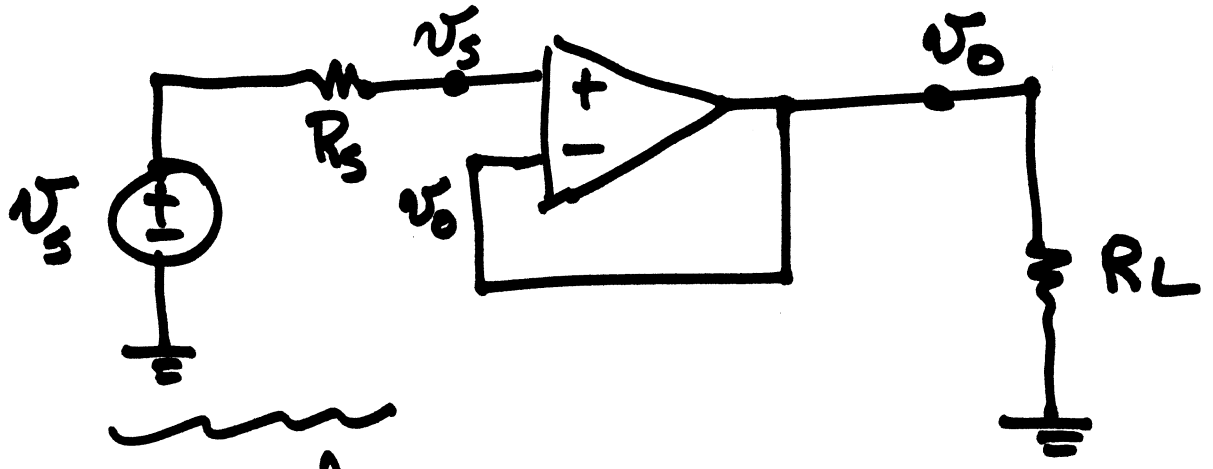
block diagrams

$$\frac{v_o}{v_s} = K_1 K_2$$

$$v_o = \frac{\dfrac{R_2}{R_1+R_2}}{K_1} \; \frac{\dfrac{R_3+R_4}{R_4}}{K_2} \; v_s$$



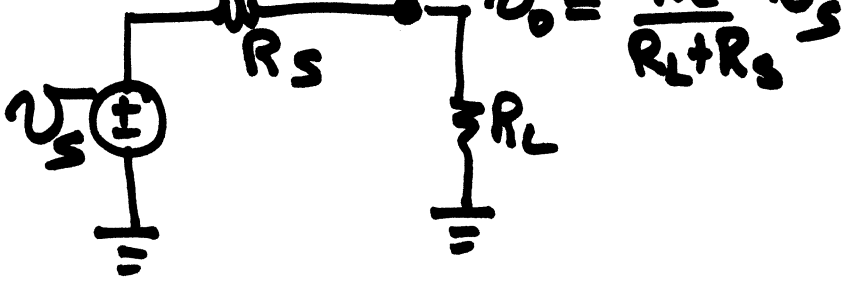
Voltage Follower



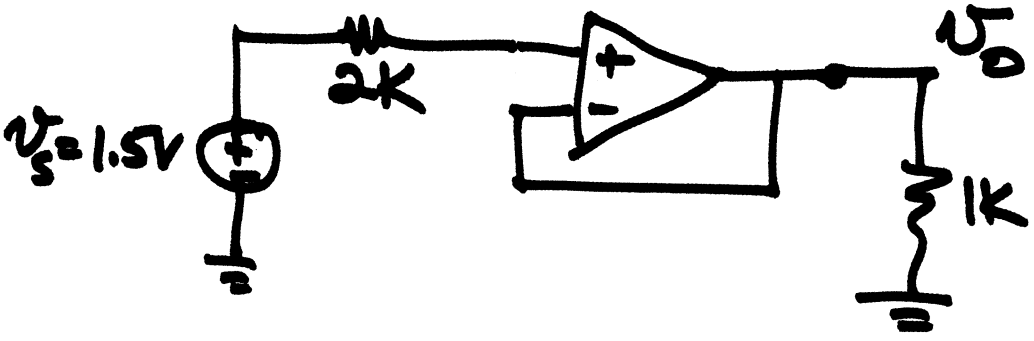
Thevenized input source

increases output voltage and power to load

$$v_o = v_s$$

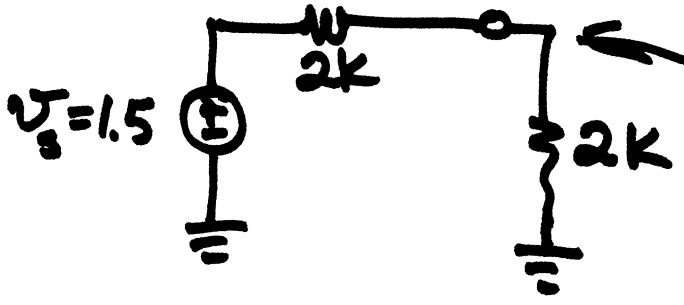


Exercise 4-10



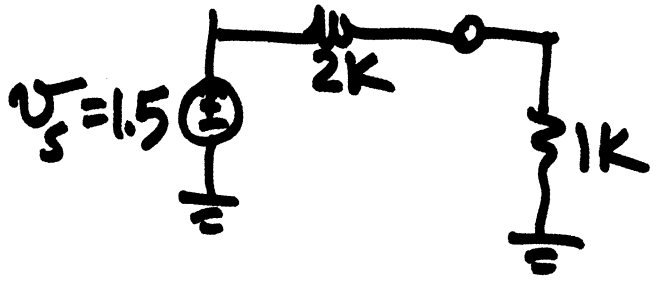
$v_o = 1.5$

$P_{OUT} = \frac{(1.5)^2}{1000} = 2.25m$



$v_o = \frac{2K}{2K+2K} v_s = \frac{1}{2}(1.5)$

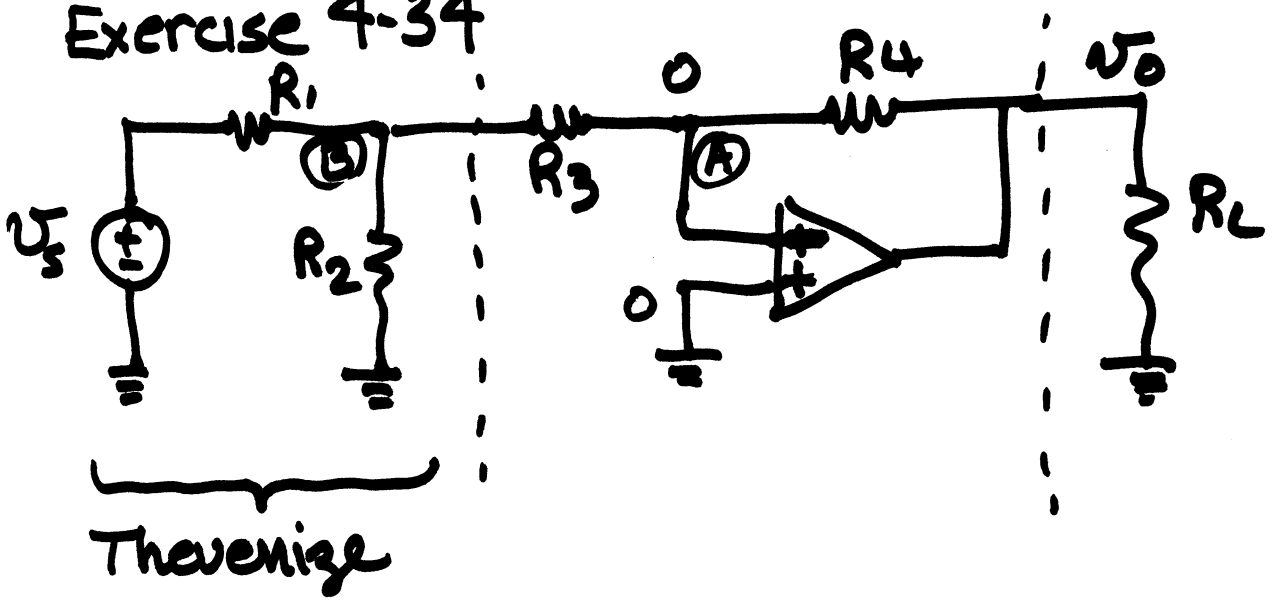
$P_{OUT} = \frac{v_o^2}{R} = \frac{(\frac{1}{2}1.5)^2}{2000} = 0.281mW$



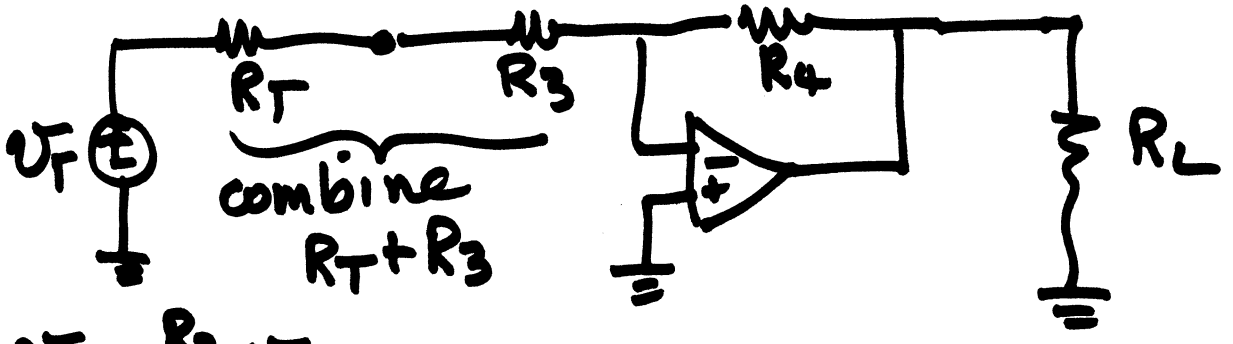
$v_o = \frac{1K}{2K+1K} v_s = \frac{1}{3}(1.5)$

$P_{OUT} = \frac{(\frac{1}{3}1.5)^2}{1000} = 0.25mW$

Exercise 4-34



Thevenize



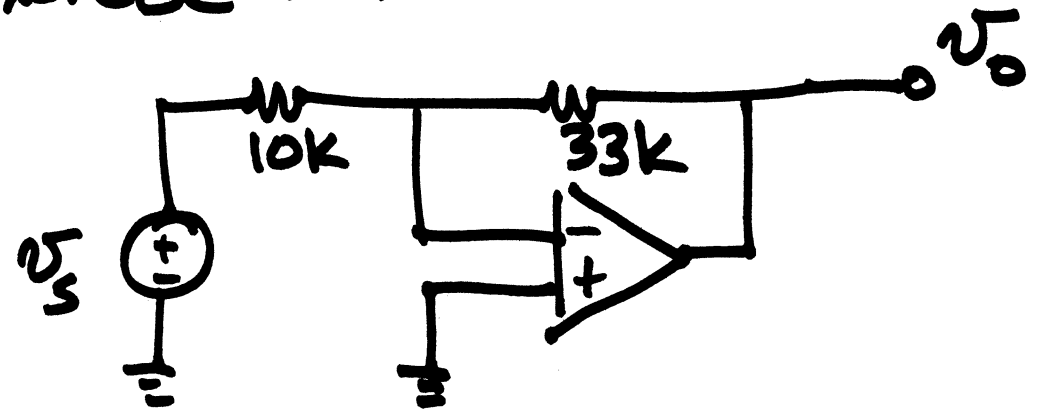
$$v_T = \frac{R_2}{R_1+R_2} v_s$$

$$R_T = R_1 \| R_2 = \frac{R_1 R_2}{R_1+R_2}$$

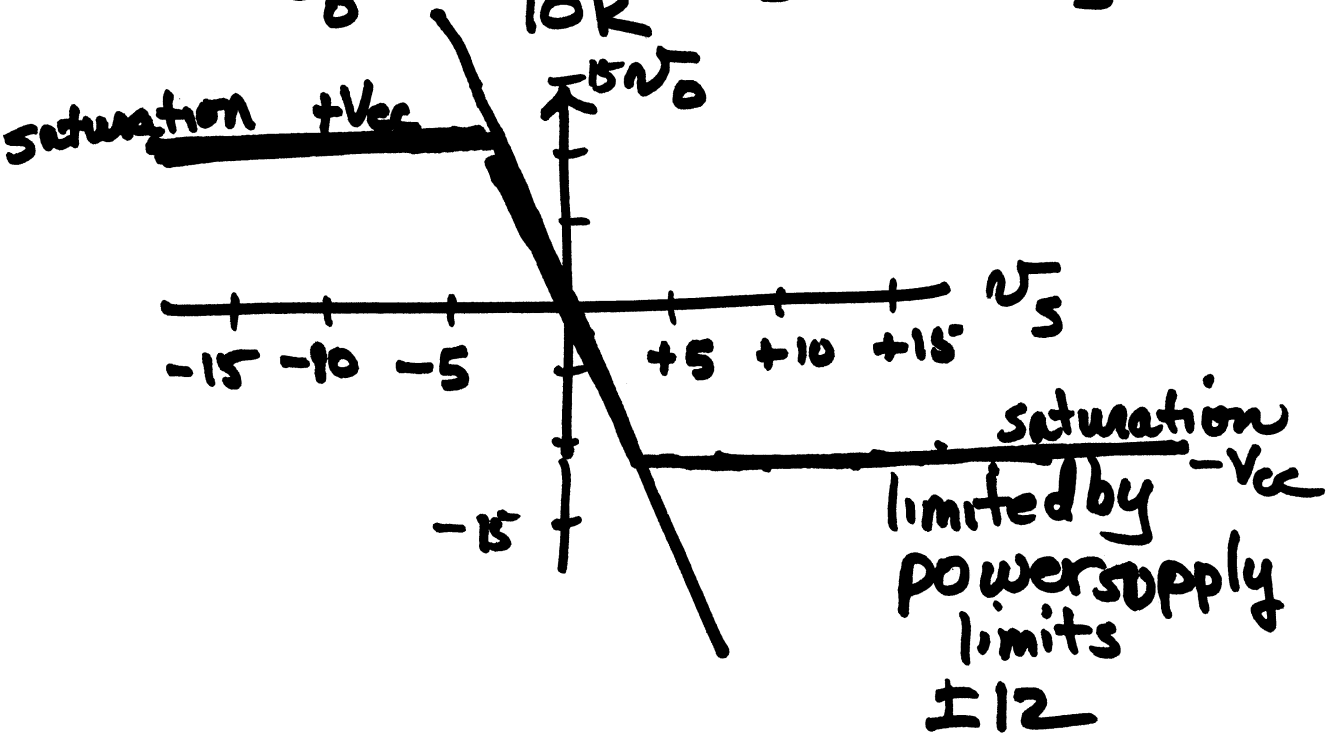
amplifier $\quad v_o = -\frac{R4}{R_T+R_3} v_T$

$$v_o = -\frac{R_2 R_4}{R_1R_2+R_1R_3+R_2R_3} v_s$$ after algebra

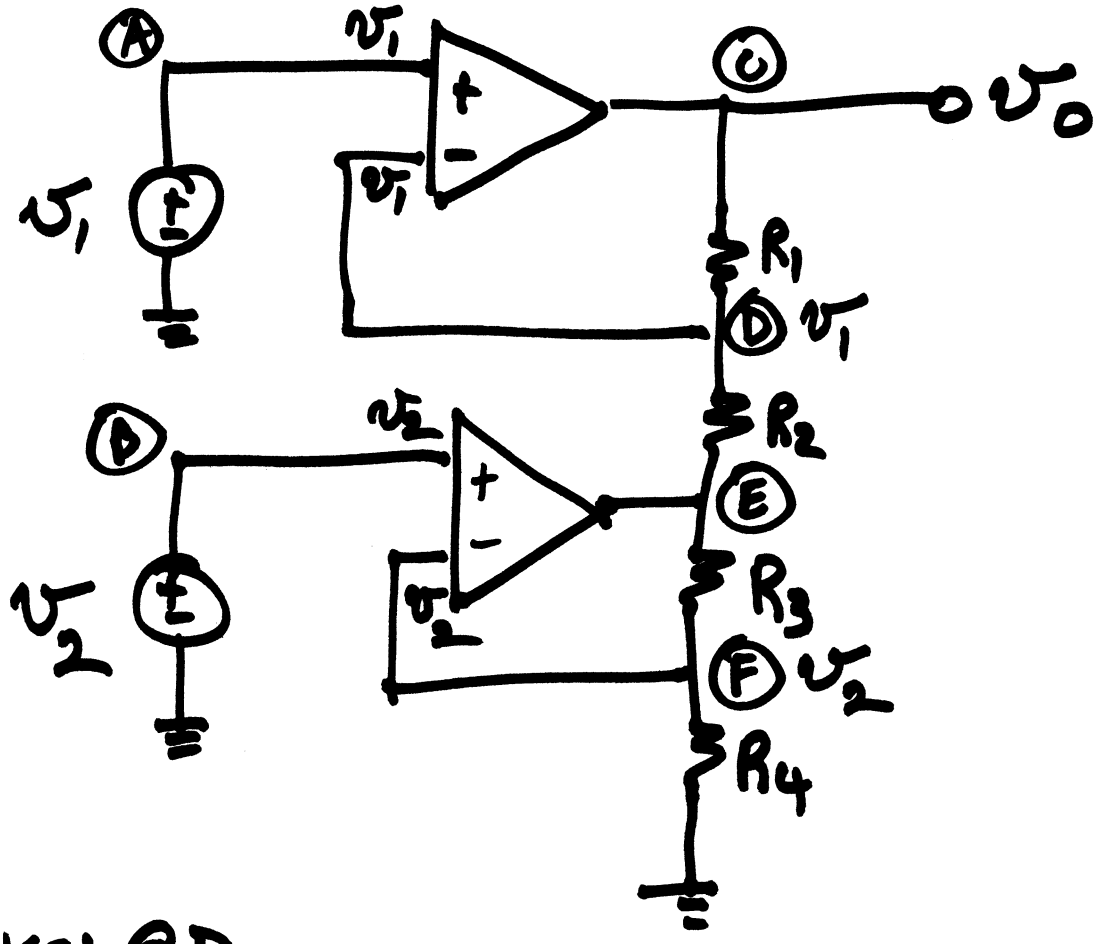
Exercise 4-11



$$v_o = -\frac{33K}{10K} v_s = -3.3 v_s$$



Example 4-18



KCL@D

$$\frac{v_o - v_1}{R_1} - \frac{v_1 - v_E}{R_2} = 0$$

KCL@F

$$\frac{v_E - v_2}{R_3} - \frac{v_2 - 0}{R_4} = 0$$

$$v_o = \frac{R_1 + R_2}{R_2} v_1 - \frac{R_1}{R_2 R_4}(R_3 + R_4) v_2$$