19 Considere o circuito da Figura 13. A tensão de alimentação dos AmpOp´s é ±12 V e a sua tensão de saturação é ±10 V. Esboce, no mesmo sistema de eixos, a forma de ondas nos pontos *B*, *C*, e *D*, quando à entrada do circuito (ponto *A*) se aplica uma tensão constante e igual a 1 V. (Indique de forma clara as escalas de tensão e de tempo utilizadas.)

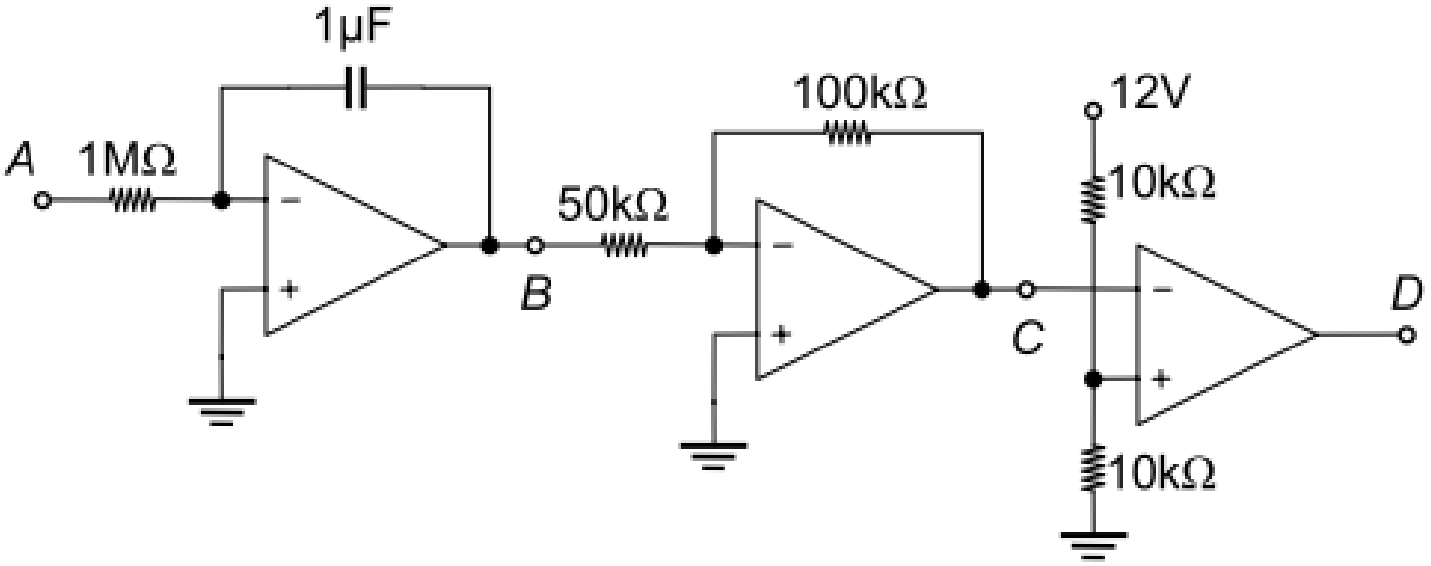
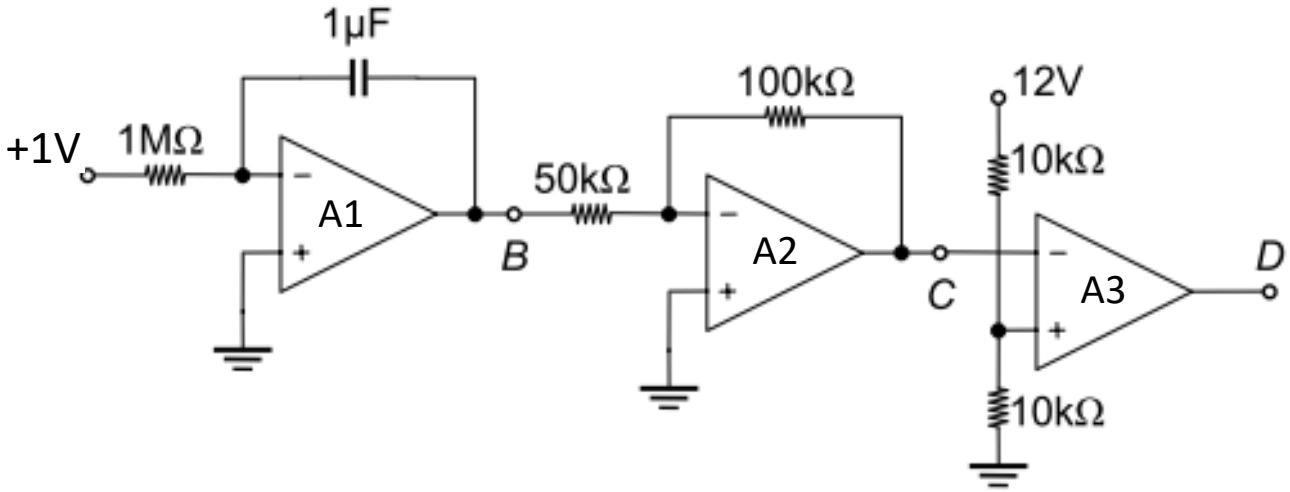
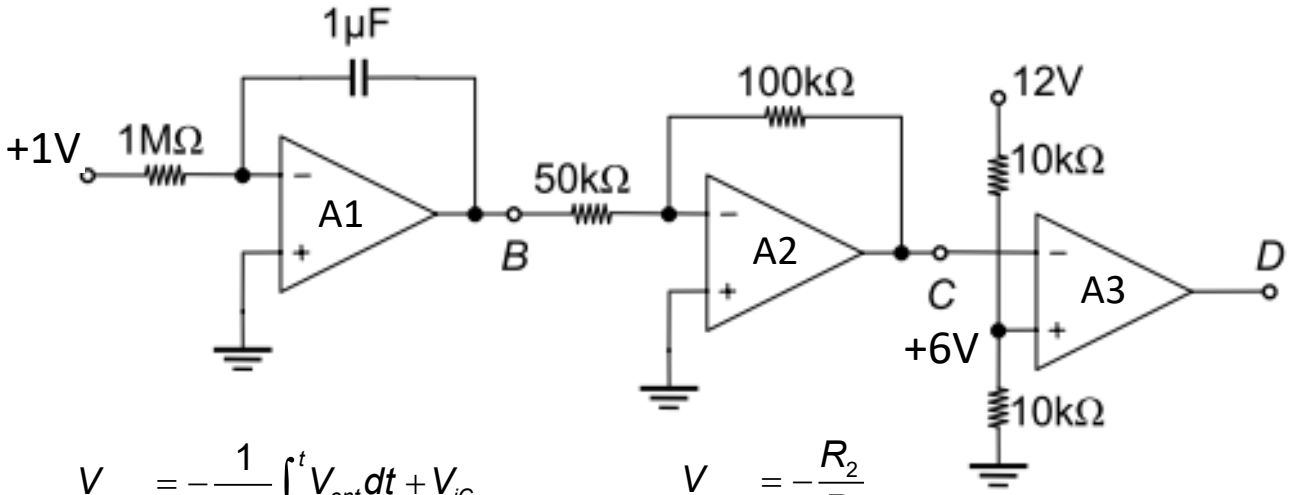


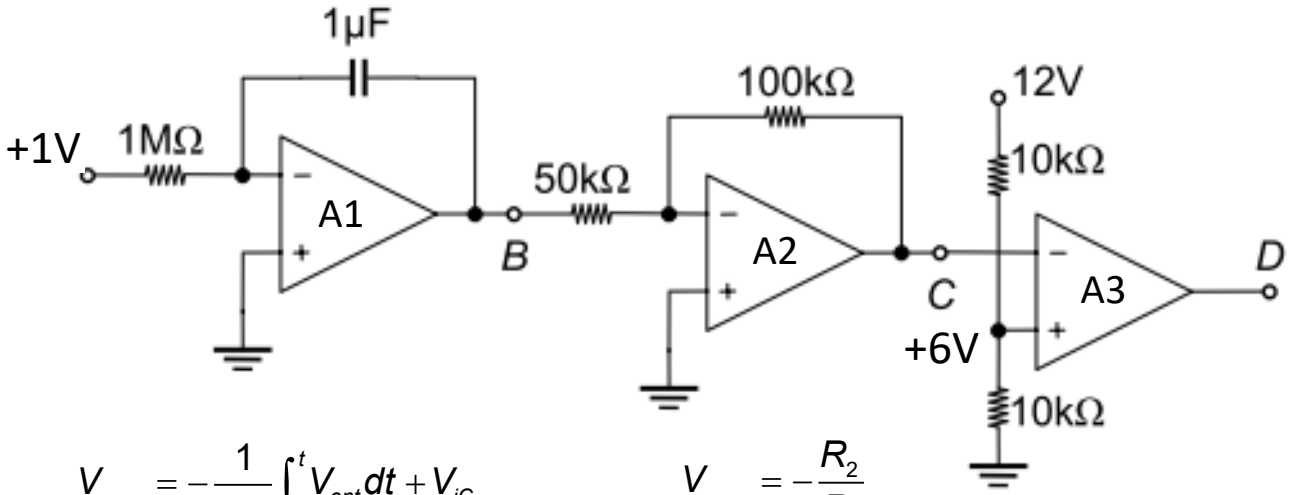
Figura 13


1μF
+1V
1MΩ
A1
B
50kΩ
100kΩ
A2
C
12V
10kΩ
A3
D
10kΩ



$$V_{saída} = -\frac{1}{RC}\int_0^t V_{ent}\,dt + V_{iC}$$

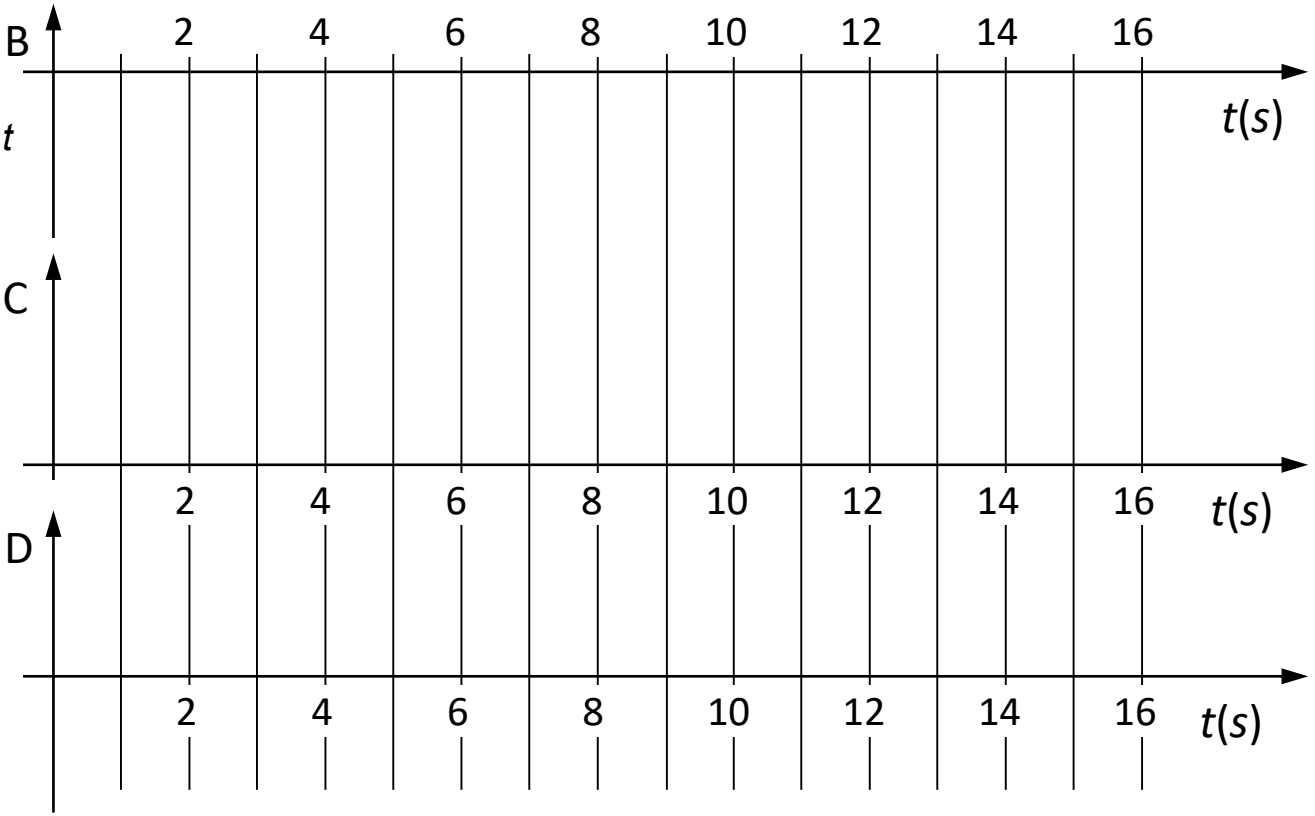
$$V_{saída} = -\frac{R_2}{R_1}$$

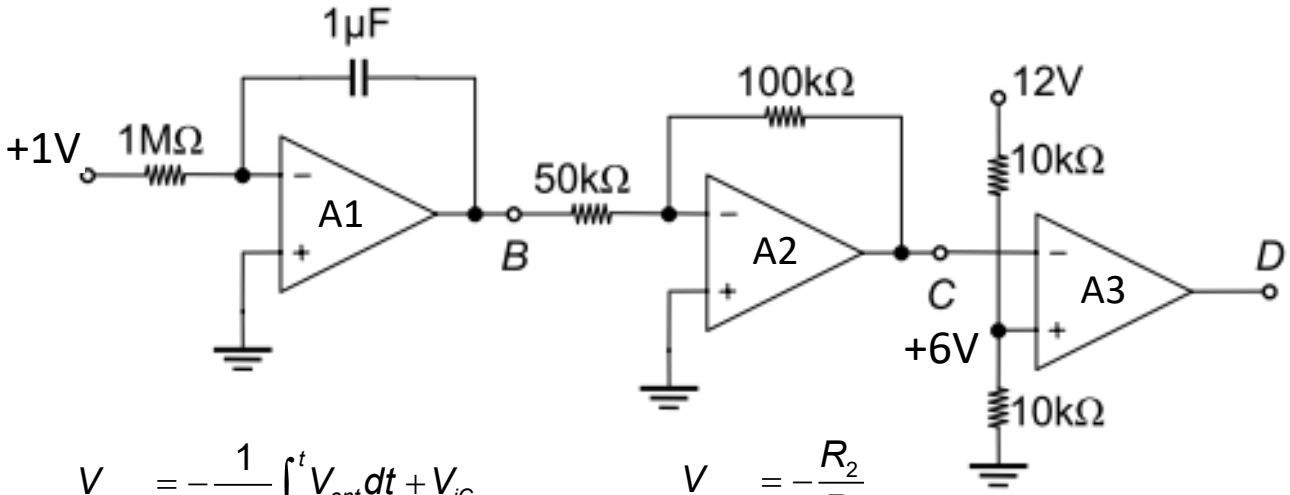


$$V_{saída} = -\frac{1}{RC}\int_0^t V_{ent}\,dt + V_{iC} \qquad V_{saída} = -\frac{R_2}{R_1}$$

$$V_B = -\frac{1\,\text{V}}{1\,\text{seg.}}t$$

$$V_C = -2 \cdot V_B$$

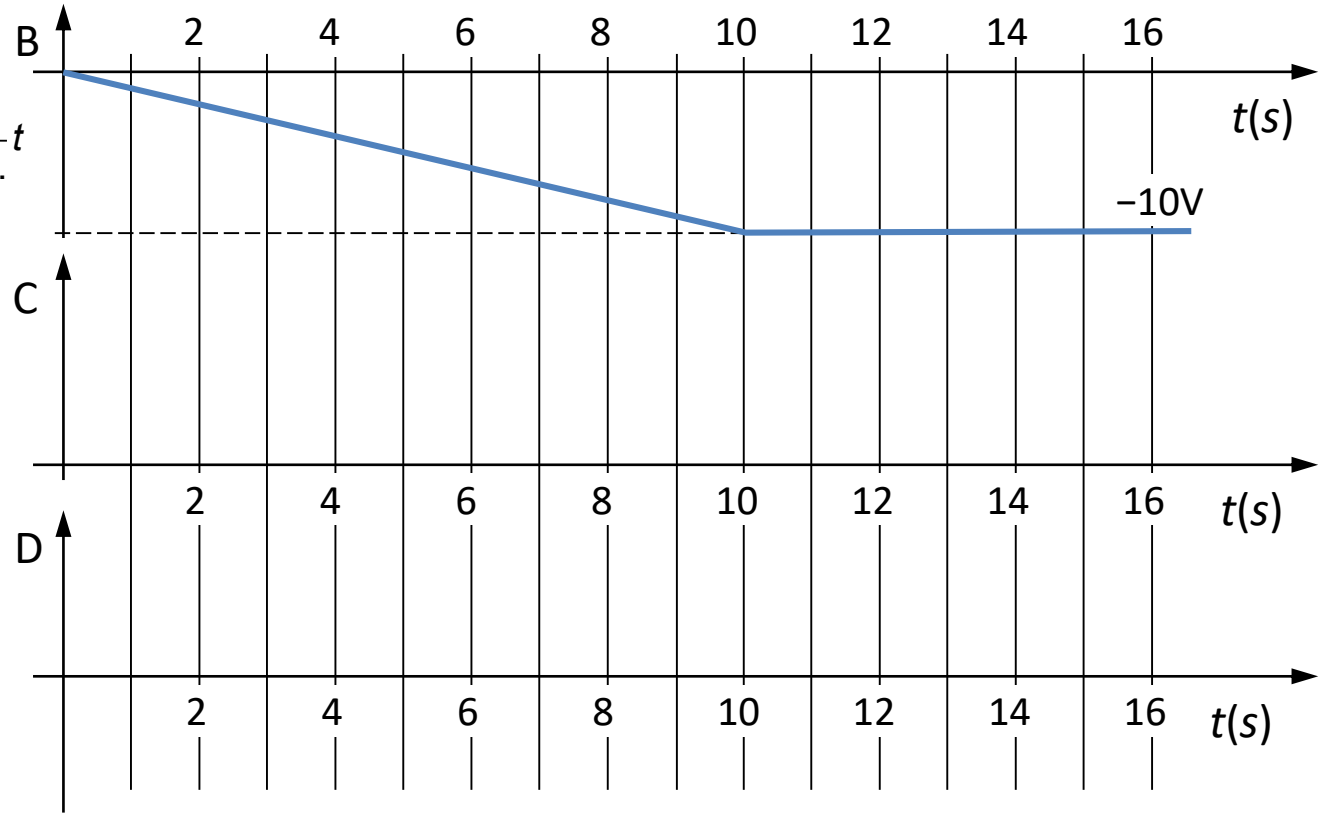


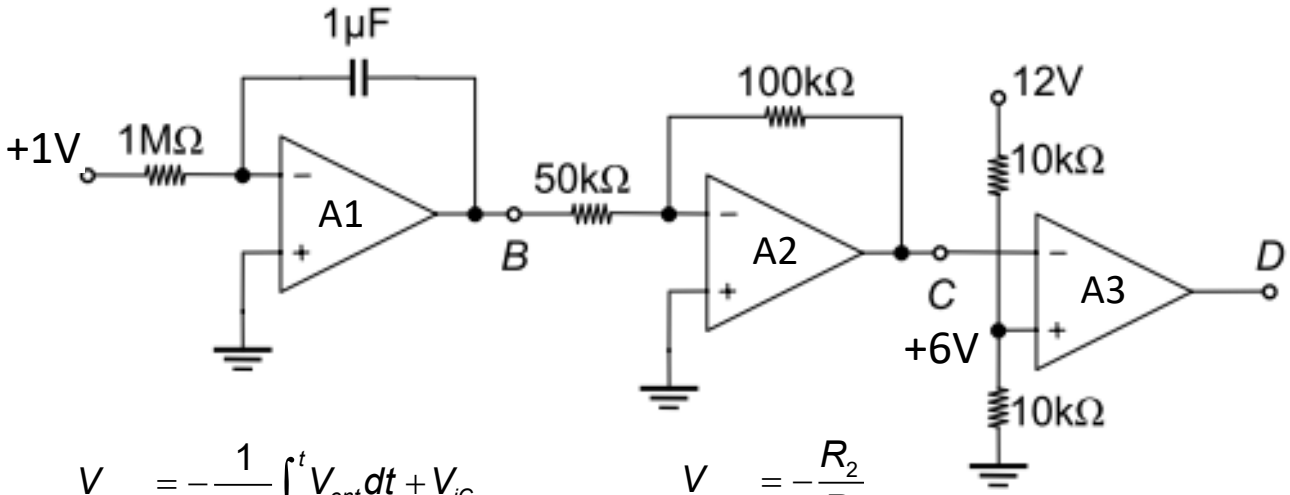


$$V_{saída} = -\frac{1}{RC}\int_0^t V_{ent}\,dt + V_{iC} \qquad V_{saída} = -\frac{R_2}{R_1}$$

$$V_B = -\frac{1\,\text{V}}{1\,\text{seg.}}t$$

$$V_C = -2 \cdot V_B$$

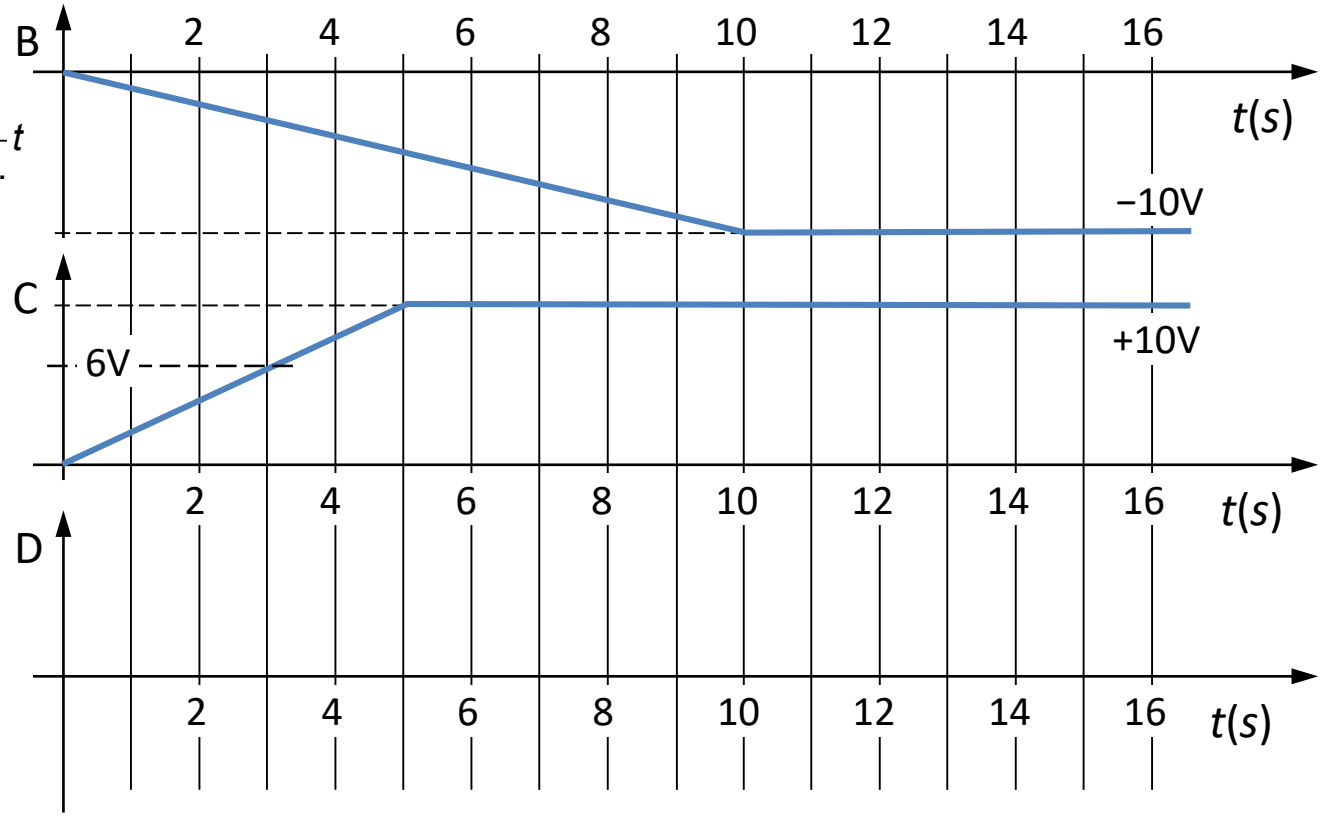


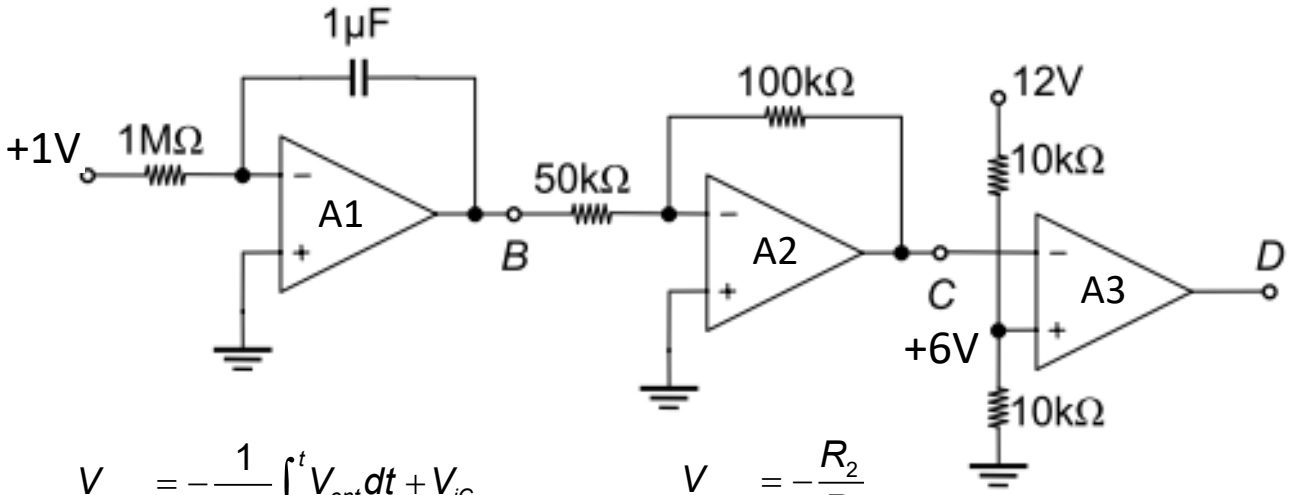


$$V_{saída} = -\frac{1}{RC}\int_0^t V_{ent}\,dt + V_{iC} \qquad V_{saída} = -\frac{R_2}{R_1}$$

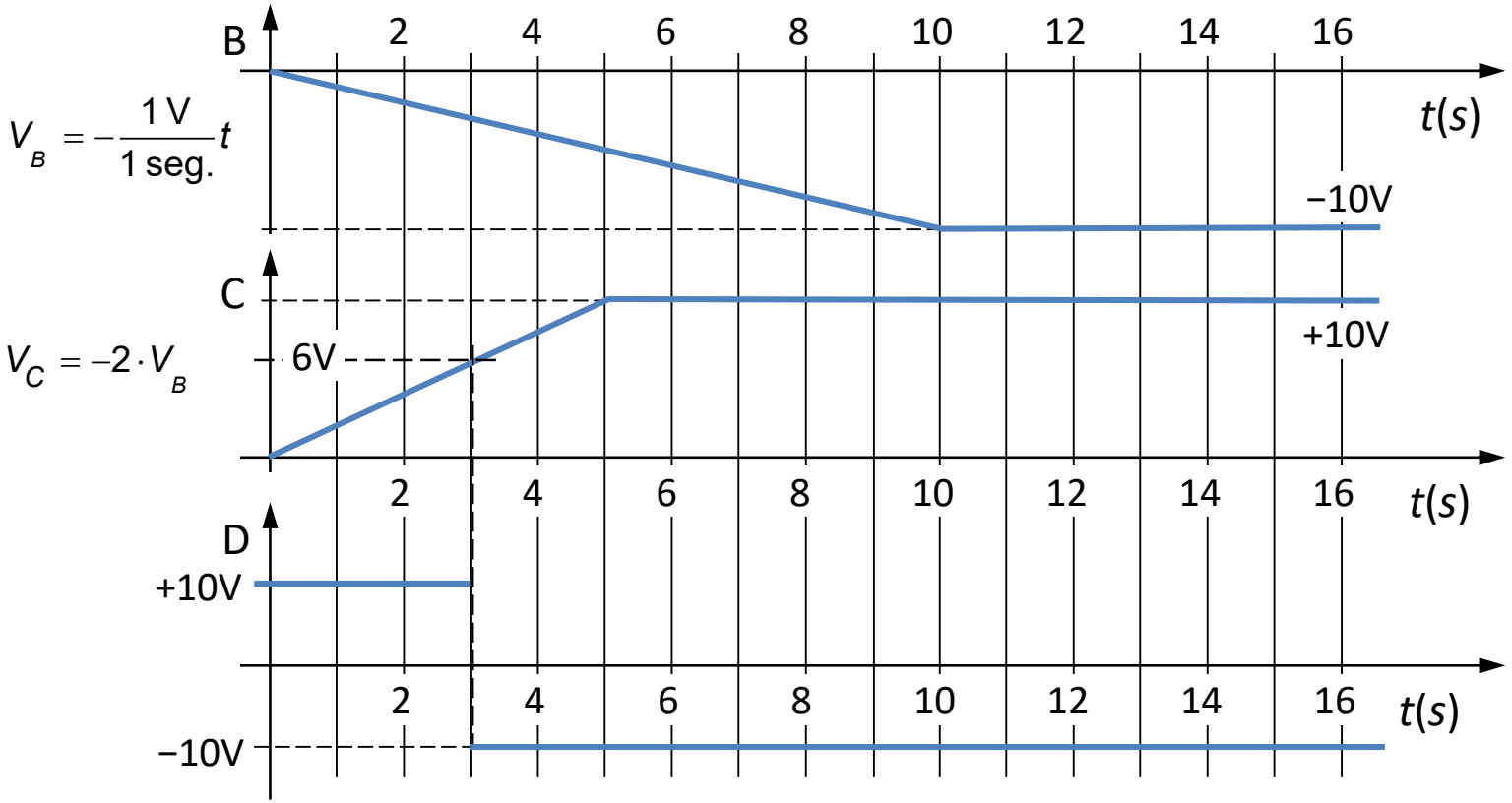
$$V_B = -\frac{1\,\text{V}}{1\,\text{seg.}}t$$

$$V_C = -2 \cdot V_B$$

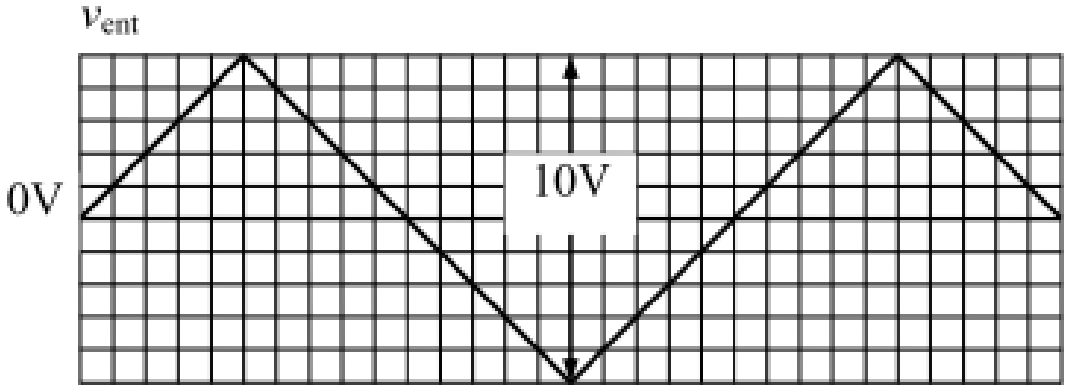




$$V_{saída} = -\frac{1}{RC}\int_0^t V_{ent}\,dt + V_{iC} \qquad V_{saída} = -\frac{R_2}{R_1}$$



21 A tensão de saturação do AmpOp da Figura 15 é $V_{sat} = \pm 10V$. Admitindo que o sinal aplicado à sua entrada (v_{ent}) é que se apresenta na figura ao lado, esboce o sinal obtido na saída ($v_{saída}$).



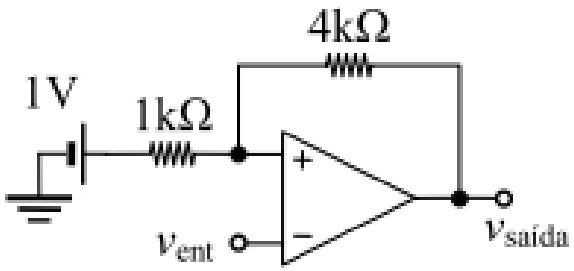


Figura 15

22 Esboce, para o circuito da Figura 16, a forma de onda de saída quando à entrada se aplica uma entrada sinusoidal. Obtenha ainda a sua característica de transferência (o gráfico da relação $V_{saída} = f(V_{ent})$

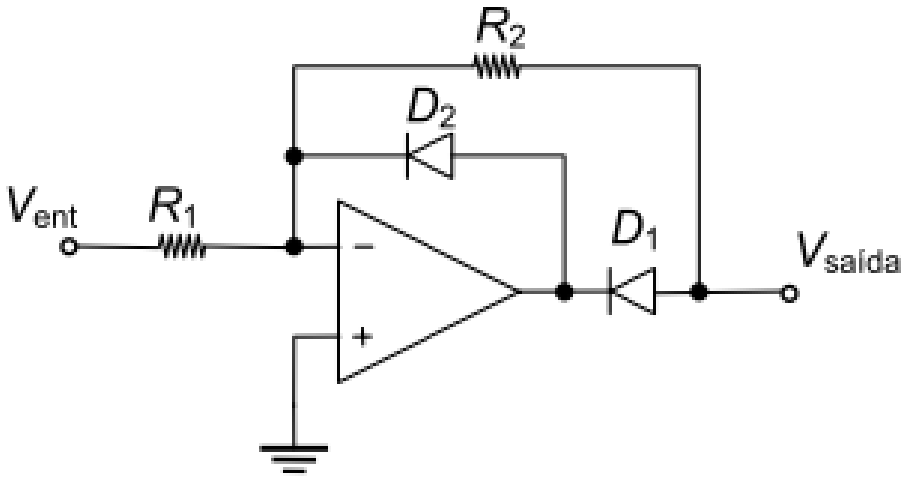
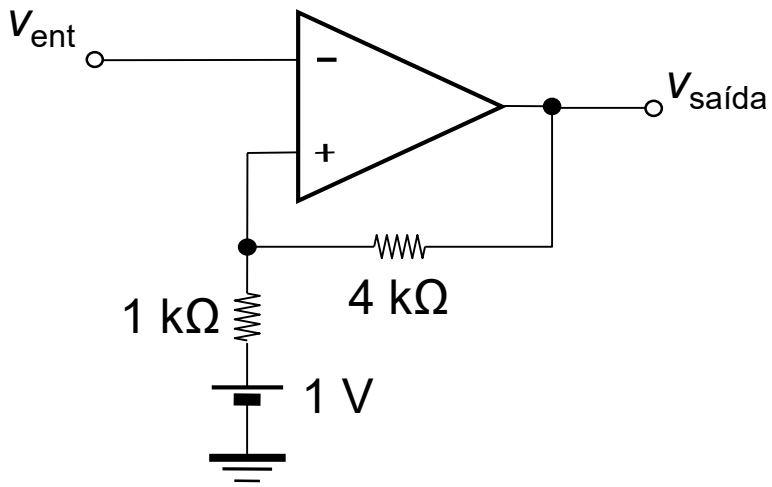
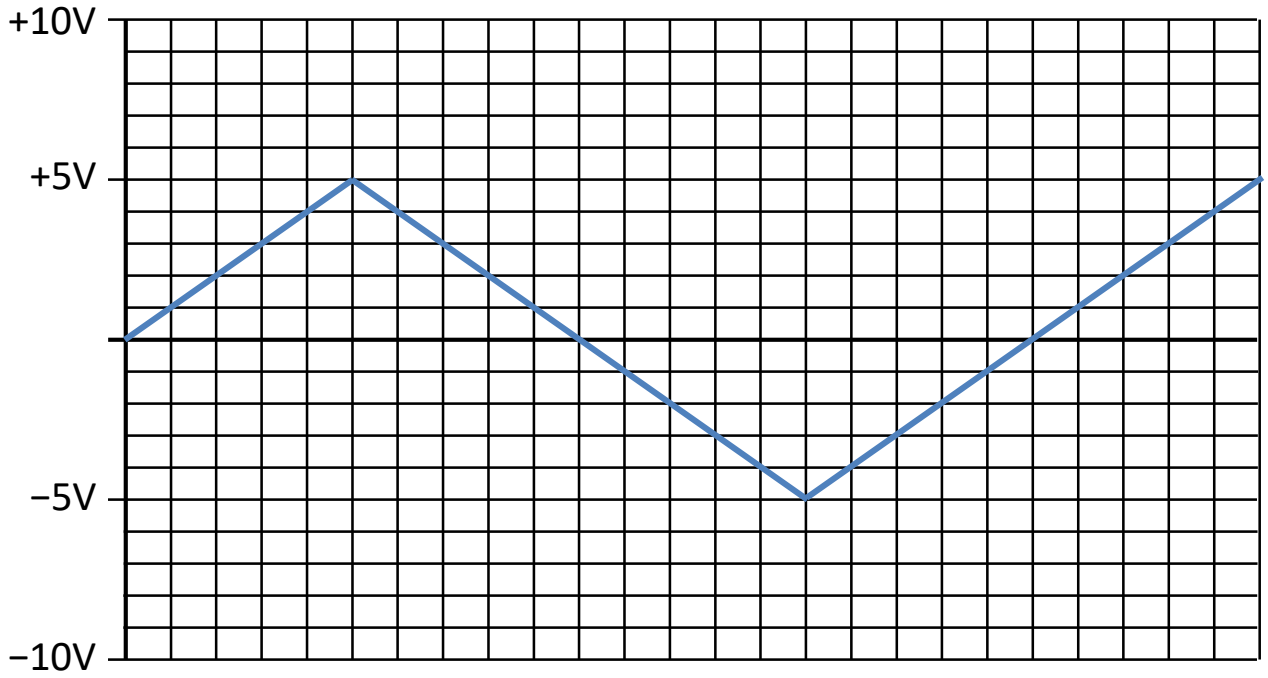
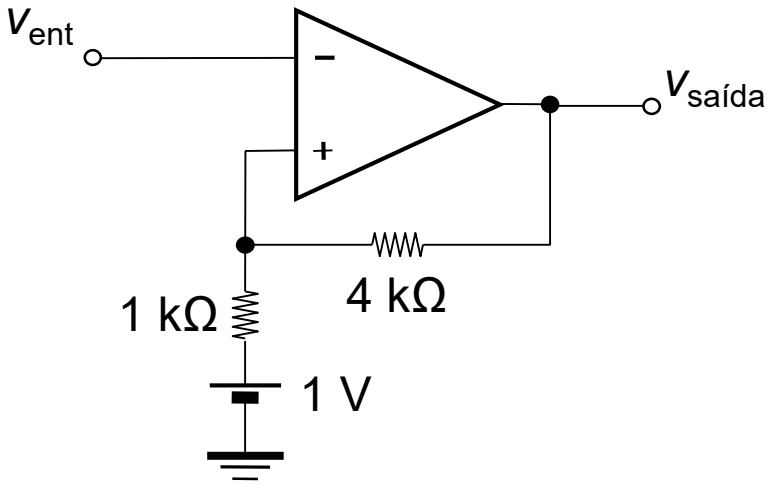


Figura 16

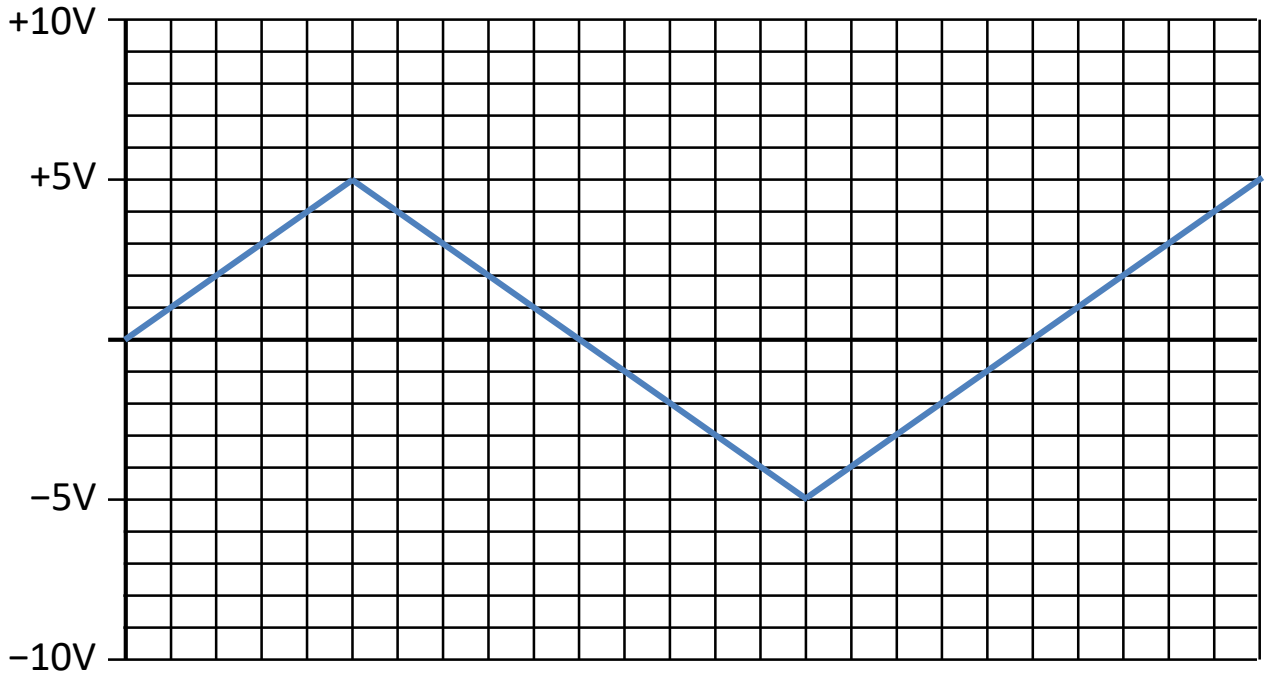
Exerc. 21

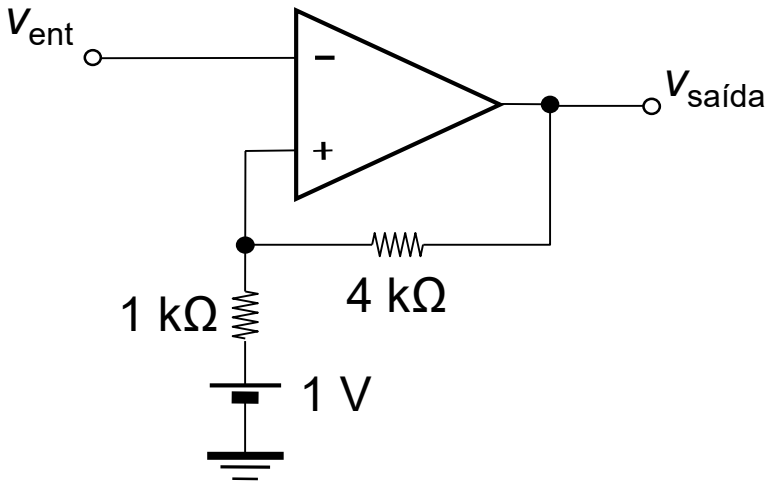






$$V_{CEN} = V_{REF}\frac{R_2}{R_1 + R_2} = 1\text{V}\frac{4\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 0{,}8\text{V}$$



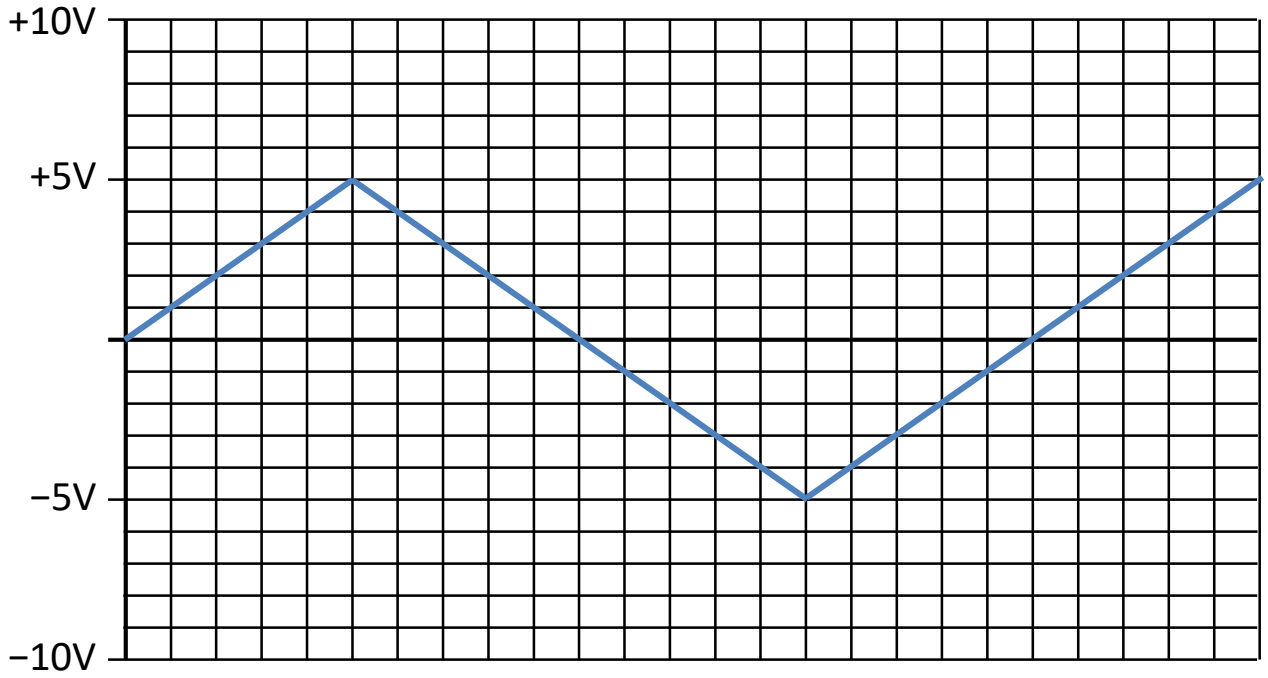


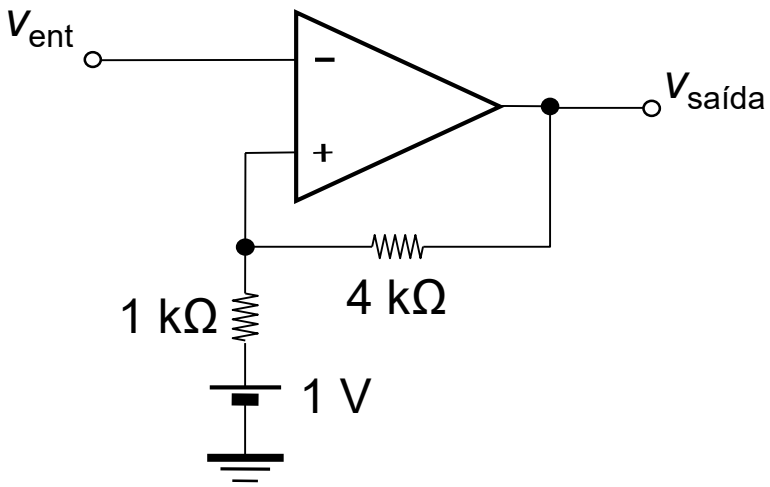
$$V_{CEN} = V_{REF}\frac{R_2}{R_1 + R_2} = 1\text{V}\,\frac{4\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 0{,}8\text{V}$$

$$\Delta h = 2V_{sat}\frac{R_1}{R_1 + R_2} = 20\text{V}\,\frac{1\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 4\text{V}$$

$$V_{CS} = V_{CEN} + \frac{\Delta h}{2} = 0{,}8\text{V} + 2\text{V} = \boxed{+2{,}8\text{V}}$$

$$V_{CI} = V_{CEN} - \frac{\Delta h}{2} = 0{,}8\text{V} - 2\text{V} = \boxed{-1{,}2\text{V}}$$



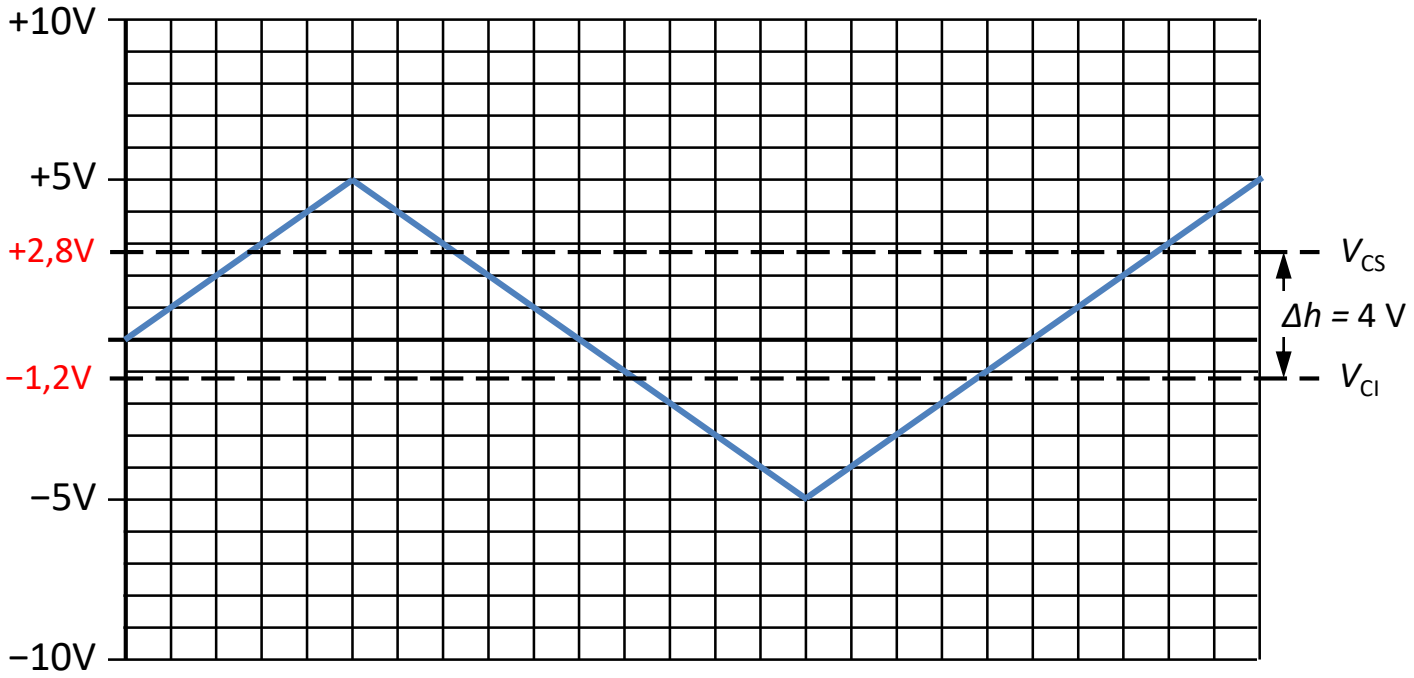


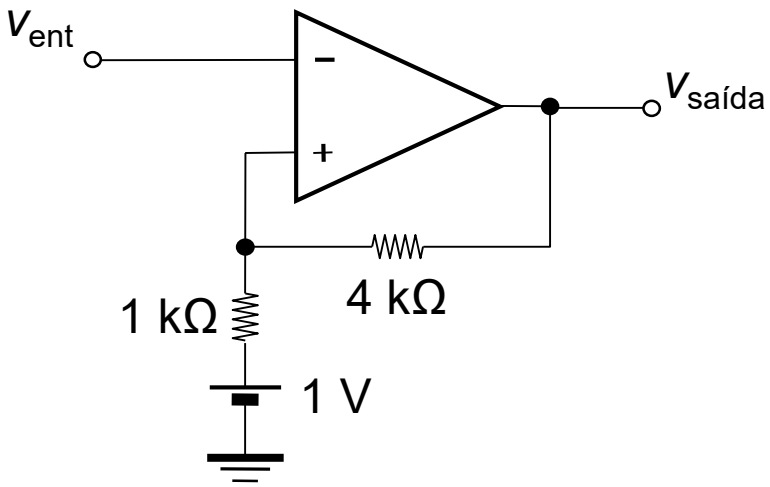
$$V_{CEN} = V_{REF}\frac{R_2}{R_1 + R_2} = 1\text{V}\,\frac{4\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 0{,}8\text{V}$$

$$\Delta h = 2V_{sat}\frac{R_1}{R_1 + R_2} = 20\text{V}\,\frac{1\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 4\text{V}$$

$$V_{CS} = V_{CEN} + \frac{\Delta h}{2} = 0{,}8\text{V} + 2\text{V} = \boxed{+2{,}8\text{V}}$$

$$V_{CI} = V_{CEN} - \frac{\Delta h}{2} = 0{,}8\text{V} - 2\text{V} = \boxed{-1{,}2\text{V}}$$





$$V_{CEN} = V_{REF}\frac{R_2}{R_1 + R_2} = 1\text{V}\,\frac{4\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 0{,}8\text{V}$$

$$\Delta h = 2V_{sat}\frac{R_1}{R_1 + R_2} = 20\text{V}\,\frac{1\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 4\text{V}$$

$$V_{CS} = V_{CEN} + \frac{\Delta h}{2} = 0{,}8\text{V} + 2\text{V} = \boxed{+2{,}8\text{V}}$$

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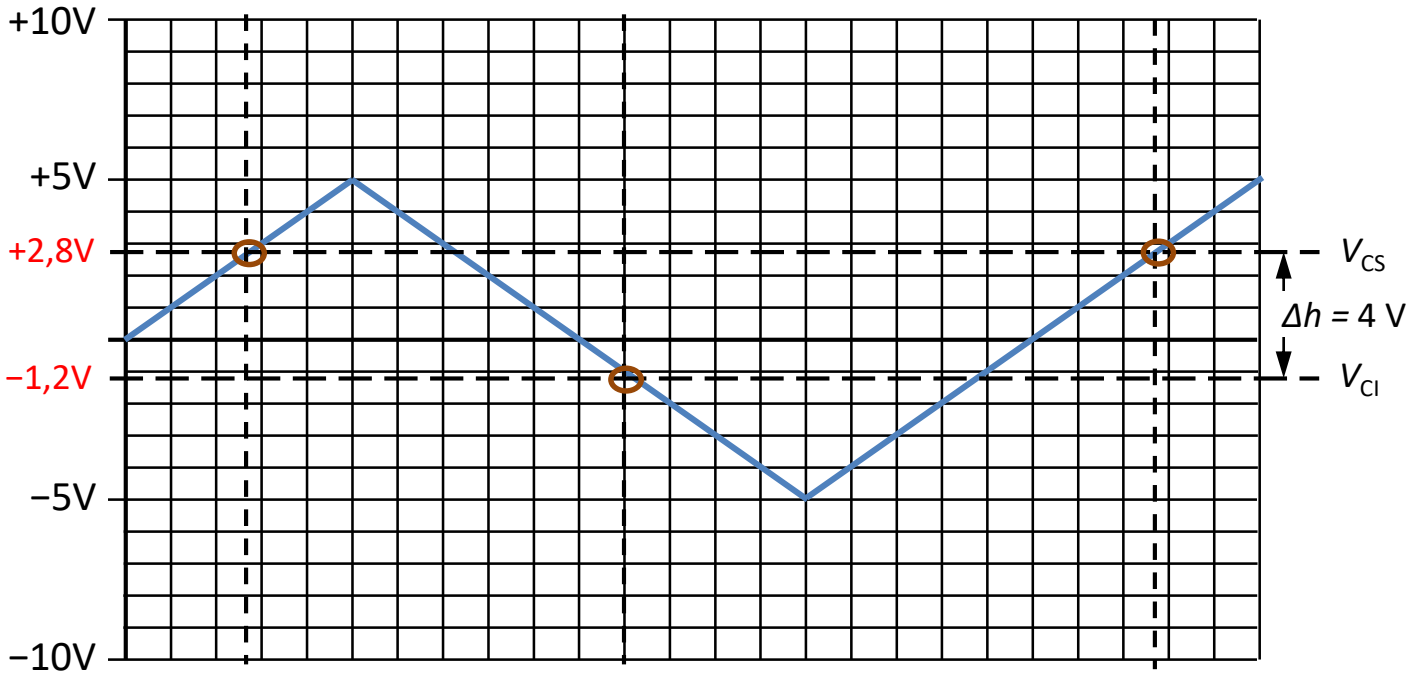

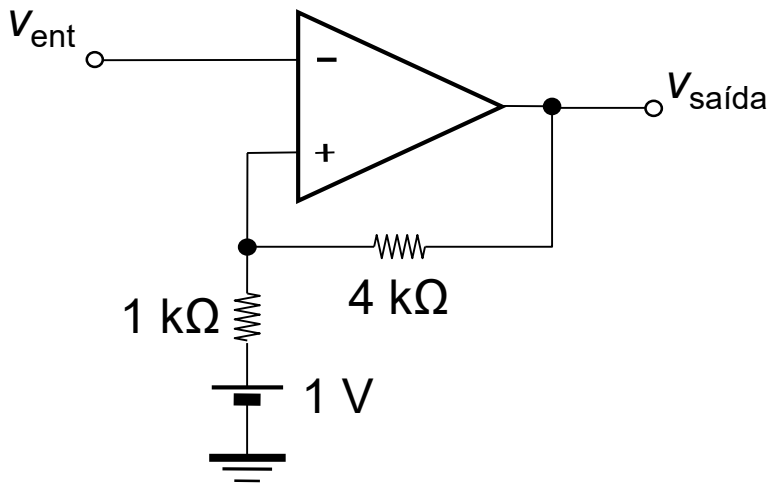

$$V_{CEN} = V_{REF}\frac{R_2}{R_1 + R_2} = 1\text{V}\,\frac{4\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 0{,}8\text{V}$$

$$\Delta h = 2V_{sat}\frac{R_1}{R_1 + R_2} = 20\text{V}\,\frac{1\text{k}\Omega}{1\text{k}\Omega + 4\text{k}\Omega} = 4\text{V}$$

$$V_{CS} = V_{CEN} + \frac{\Delta h}{2} = 0{,}8\text{V} + 2\text{V} = \boxed{+2{,}8\text{V}}$$

$$V_{CI} = V_{CEN} - \frac{\Delta h}{2} = 0{,}8\text{V} - 2\text{V} = \boxed{-1{,}2\text{V}}$$