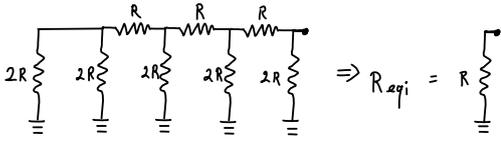
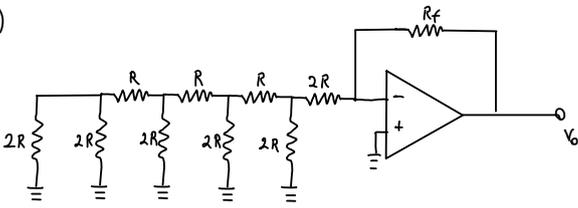
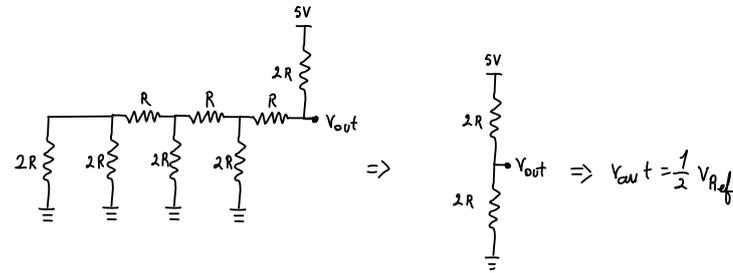
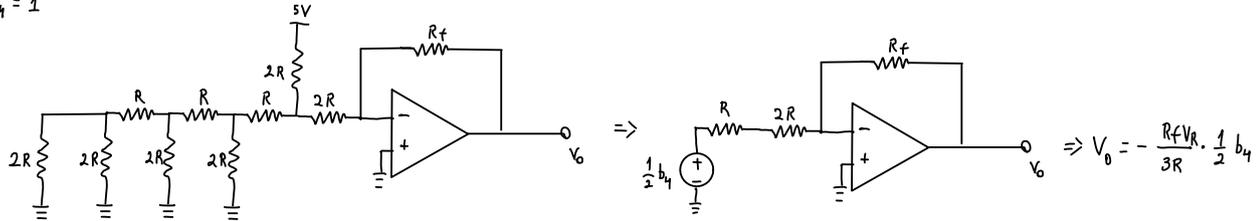


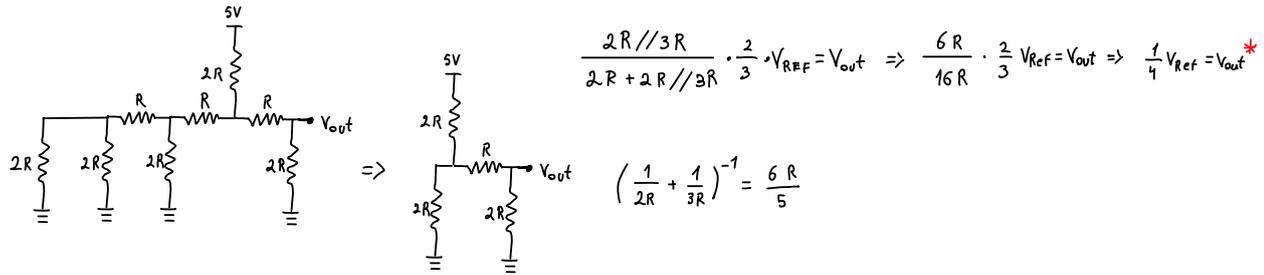
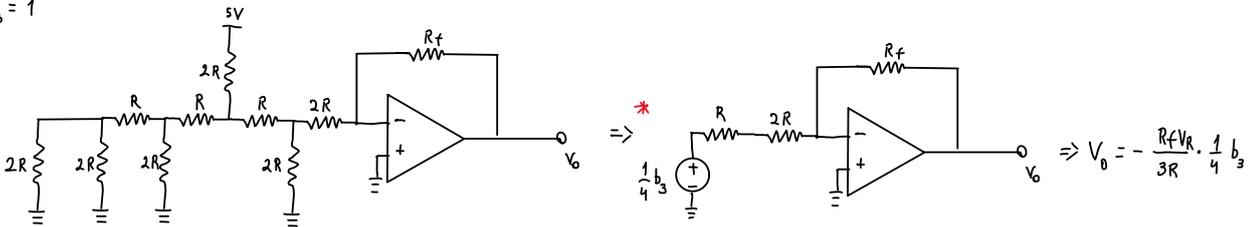
4.1.1)



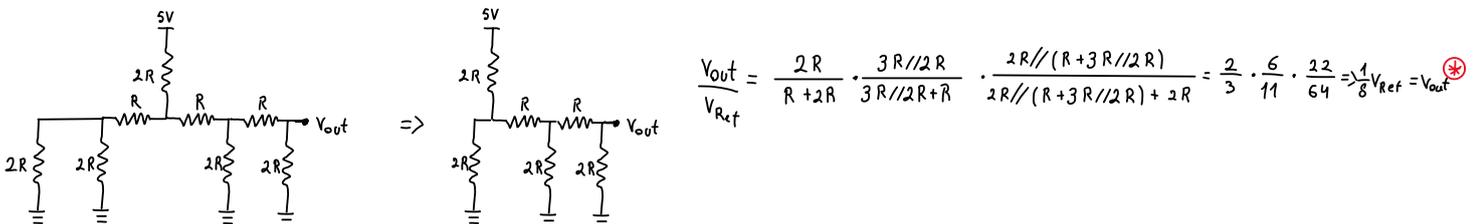
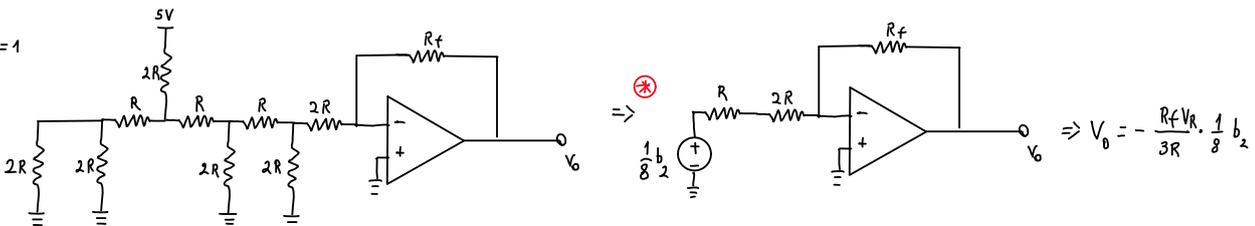
$b_4 = 1$

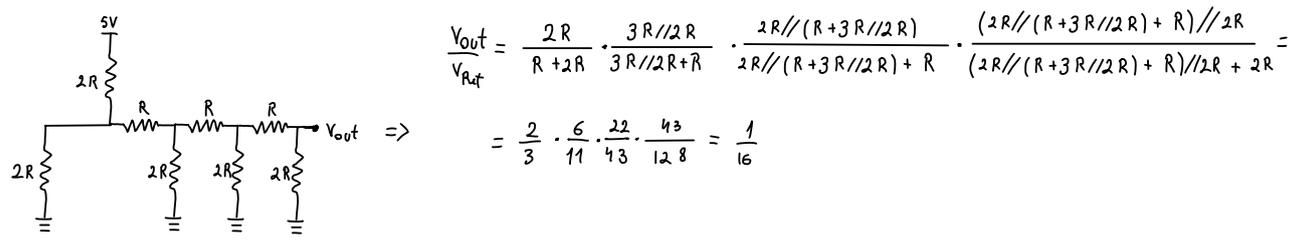
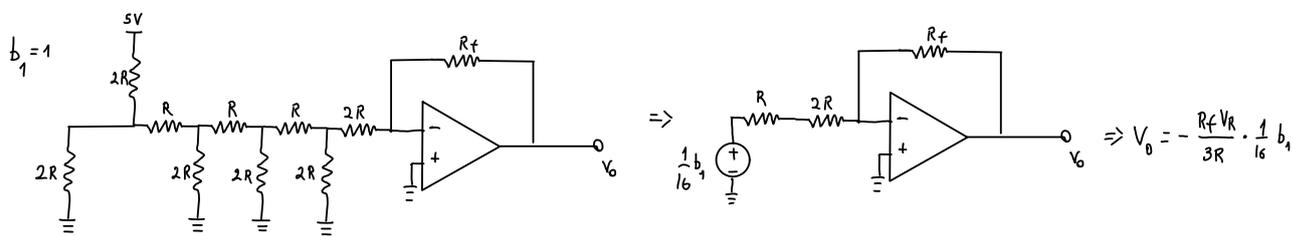


$b_3 = 1$



$b_2 = 1$





Logo:

$$V_0 = -\frac{R_f V_R}{3R} \left( \frac{1}{16} b_1 + \frac{1}{8} b_2 + \frac{1}{4} b_3 + \frac{1}{2} b_4 \right) = -\frac{R_f V_R}{6R} \left( \frac{1}{8} b_1 + \frac{1}{4} b_2 + \frac{1}{2} b_3 + b_4 \right)$$

$$R_f = 2R \qquad R_f = 4R$$

$$V_0 = -\frac{5}{3} \left( \frac{1}{8} b_1 + \frac{1}{4} b_2 + \frac{1}{2} b_3 + b_4 \right) \qquad V_0 = -\frac{10}{3} \left( \frac{1}{8} b_1 + \frac{1}{4} b_2 + \frac{1}{2} b_3 + b_4 \right)$$

S. 1. 1) Com recurso a MatLab

S. 1. 2)

Variar  $R_1$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{R} \left[ b_1 \frac{R}{16(R_1+R)} + b_2 \frac{3R_1+2R}{64(R_1+R)} + b_3 \frac{R_A}{8(R_1+R)} + b_4 \frac{R_B}{4(R_1+R)} \right]$

$$R_A = (R_1 // 2R + R) // 2R + R$$

$$R_B = R_A // 2R + R$$

Se  $R_1 = R$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{R} \left[ b_1 \frac{1}{32} + b_2 \frac{5}{128} + b_3 \frac{21}{256} + b_4 \frac{85}{512} \right]$

Variar  $R_2$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{8} \left[ b_1 \frac{R_2}{(R_2+2R)R_A} + b_2 \frac{1}{R_2+R} + b_3 \frac{(R_A-R)}{R \cdot R_A} + 2b_4 \frac{R_B-R}{R_B} \right]$

$$R_A = 2R + (2R // R_2)$$

$$R_B = 2R + (2R // R_A)$$

Se  $R_2 = R$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{R} \left[ b_1 \frac{1}{64} + b_2 \frac{1}{32} + b_3 \frac{5}{64} + b_4 \frac{21}{128} \right]$

Variar  $R_3$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{4} \left( b_1 \frac{2R \cdot R_3}{(R_3+2R)(R+R_A)(R+R_B)} + b_2 \frac{R_3}{(R_A+R)(R_3+2R)} + b_3 \frac{1}{R_3+R} + b_4 \frac{R_A-R}{RR_A} \right)$

$$R_A = 2R + (2R // R_3)$$

$$R_B = 2R + (2R // R_A)$$

Se  $R_3 = R$ :  $V_0 = -\frac{V_{Ref} \cdot R_f}{R} \cdot \left( b_1 \frac{1}{64} + b_2 \frac{1}{32} + b_3 \frac{1}{8} + b_4 \frac{5}{32} \right)$

Varian  $R_4$ :

$$V_0 = -\frac{V_{R_{ef}} \cdot R_f}{2} \left( b_1 \frac{4 R^2 R_4}{R_c (R_B + R)(R + R_c)(2R + R_4)} + b_2 \frac{2 R_4 R}{R_B (R_A + R)(R_4 + 2R)} + b_3 \frac{R_4}{R_A (R_4 + 2R)} + b_4 \frac{1}{R + R_4} \right)$$

$$R_A = 2R + (2R // R_4)$$

$$R_B = 2R + (2R // R_A)$$

$$R_C = 2R + (2R // R_B)$$

$$\text{Se } R_4 = R: V_0 = -\frac{V_{R_{ef}} \cdot R_f}{R} \left( b_1 \frac{1}{64} + b_2 \frac{1}{32} + b_3 \frac{1}{16} + b_4 \frac{1}{4} \right)$$

6.1.1)

$$SR = \frac{|\Delta V|}{\Delta t} \Leftrightarrow \Delta t = \frac{|\Delta V|}{SR} = \frac{3.125}{0.5} \mu s = 6.25 \mu s //$$

$$\Delta V_{max} \rightarrow 0000 \text{ para } 1111 \text{ e } 0V \text{ para } -\frac{25}{8} V = -3.125$$