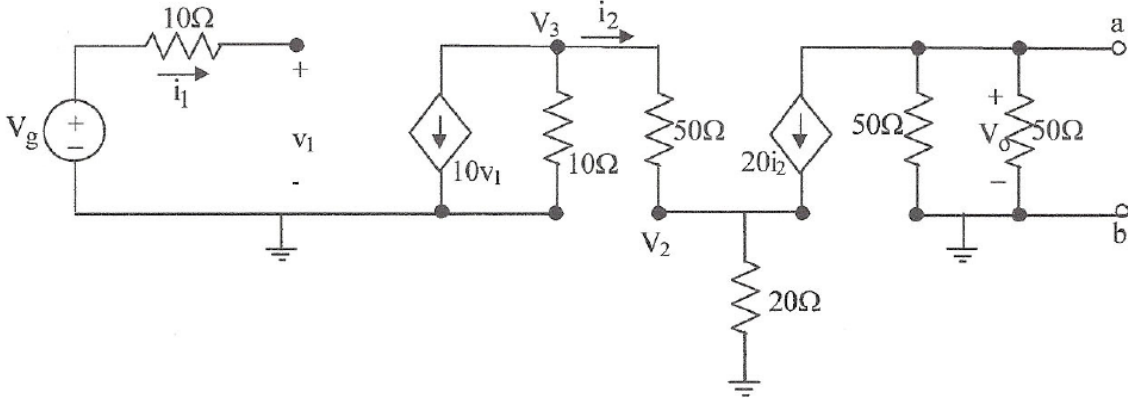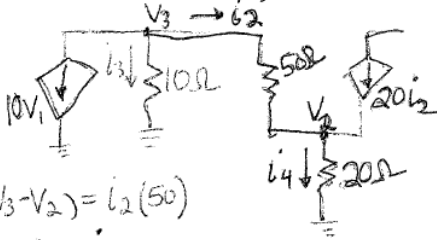1. Given V_g=10mV, find V_o. Find the Thevenin equivalent between terminals a-b.

1. $V_o = -20i_2(50\|50) = -20i_2(25)$

$(V_3 - V_2) = i_2(50)$

$i_2 + 20i_2 = i_4$

$V_2 = i_4(20) = 21\, i_2(20)$

$V_3 = i_3(10)$

$10V_1 + i_3 + i_2 = 0$

$i_3 = -10V_1 - i_2$

$\therefore V_3 = -10(10)V_1 - 10i_2$

$i_2 = \dfrac{V_3 - V_2}{50} = \dfrac{-10(10V_1 + i_2) - 21(20)i_2}{50}$

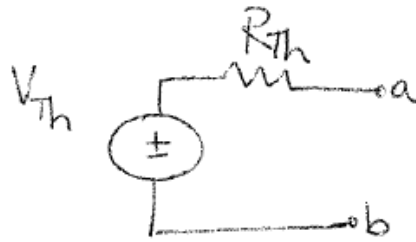$\dfrac{50}{50}i_2 + \dfrac{10}{50}i_2 + \dfrac{21(20)}{50}i_2 = -\dfrac{10(10V_1)}{50}$

$i_2 = -0.208V_1$

$V_1 = V_g$

$\therefore V_o = -20(25)(-.208)(10mV)$

$\Rightarrow \boxed{V_o = 1.04\ V}$
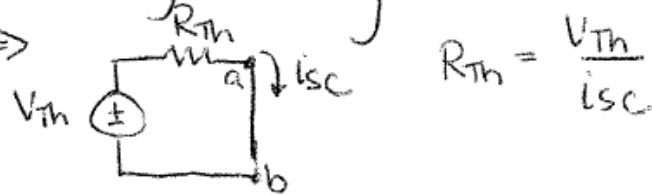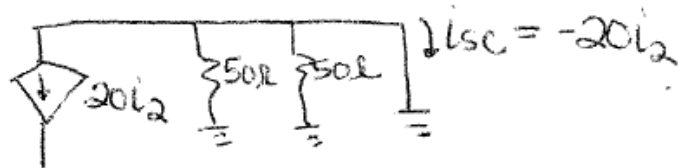
(cont.)

R_{Th}

V_{Th} ± ——/\/\/\—— a

————o b

$V_{th} = V_o$ (open-circuit voltage between a & b)

{Note that this is true since no current flows through R_{Th} when a to b is left open}

R_{Th} can be found by shorting a to b and leaving V_{Th} ⟹

V_{Th} ± R_{Th} ——/\/\/\—— a ↓i_{sc}

——————o b

$R_{Th} = \dfrac{V_{Th}}{i_{sc}}$

i_{sc} ⟹

↓ $20i_2$ ⟩50Ω ⟩50Ω ↓$i_{sc} = -20i_2$

V_{Th} (in terms of i_2) $= V_o = -20i_2 (50 || 50)$

∴ $R_{Th} = \dfrac{-20i_2 (25)}{-20i_2} = \boxed{25\Omega}$