1. $V_{OUT} = -5 + \frac{10 R_2}{R_1 + R_2}$

$V_{OUT}\Big|_{R_{Smin}} = -5 + \frac{10(500)}{1000+500} = -1.67V = V_{OUT_{min}}$

$V_{OUT}\Big|_{R_{Smid}} = -5 + \frac{10(1000)}{1000+1000} = 0V = V_{OUT_{mid}}$

$V_{OUT}\Big|_{R_{Smax}} = -5 + \frac{10(1500)}{1000+1500} = 1V = V_{OUT_{max}}$

2. $V_{OUT} = \frac{10 R_2}{R_1 + R_2}$

$V_{OUT}\Big|_{min}$: R_{2min} and R_{1max}

$R_{2min} = 1000 - 100 = 900\Omega$

$R_{1max} = 1000 + 100 = 1100\Omega$

$\therefore V_{OUT}\Big|_{min} = \frac{10(900)}{900+1100} = 4.5V$

$V_{OUT}\Big|_{max}$: R_{2max} and R_{1min}

$R_{2max} = 1000\Omega$

$R_{1min} = 1000\Omega$

$\therefore V_{OUT}\Big|_{max} = \frac{10(1000)}{1000+1000} = 5V$

3. At $0^\circ C \rightarrow \rho = 5\times10^{-6}\ \Omega\text{-cm}$

$R = \rho \frac{L}{S}$

$\frac{L}{S} = \frac{5\times10^{-3}}{(50\times10^{-6})(1\times10^{-6})} = 1\times10^{8}\,m^{-1} = 1\times10^{6}\,cm^{-1}$

$\therefore R\Big|_{T=0^\circ C} = (5\times10^{-6})(1\times10^{6}) = 5\Omega$

At $100^\circ C \rightarrow \rho = 5\times10^{-6}(1 + 100(5\times10^{-3})) = 7.5\times10^{-6}\ \Omega\text{-cm}$

$R\big|_{T=100^\circ C} = (7.5\times10^{-6})(1\times10^{6}) = 7.5\Omega$

4. $\varepsilon_1 = 1\% = 0.01$

$GF = \frac{\Delta R/R}{\varepsilon_1} \rightarrow \Delta R = R\varepsilon_1 GF = (10{,}000)(0.01)(1.8) = 180\Omega$

$R_{new} = R + \Delta R = 10{,}000 + 180 = 10{,}180\Omega$

5. $\varepsilon_1 = -1\% = -0.01$

$\Delta R = R\varepsilon_1 GF = (10{,}000)(-0.01)(1.8) = -180\Omega$

$R_{new} = R + \Delta R = 10{,}000 - 180 = 9820\Omega$

6. $V_{out}\big|_{\text{no strain}} = \frac{10R_p}{R_n + R_p} = \frac{10(1000)}{1000+1000} = 5V$

$R_{n_{new}} = R_n + R_n\varepsilon_1 GF_n = 1000 + 1000(0.002)(-30) = 940\Omega$

$R_{p_{new}} = R_p + R_p\varepsilon_1 GF_p = 1000 + 1000(0.002)(30) = 1060\Omega$

$V_{out}\big|_{\text{strain}} = \frac{10(1060)}{940+1060} = 5.3V$

7. $R_{n_{new}} = 1000 + 1000(0.001)(-30) = 970\Omega$

$R_{p_{new}} = 1000 + 1000(0.001)(30) = 1030\Omega$

$V_0 = V_2 - V_1 = \frac{10(1030)}{970+1030} - \frac{10(970)}{970+1030} = 0.3V$