Name_____ ~~No Calculators~~. Present neatly. Score_____.

1.

Suppose that we have two resistors connected in parallel with resistances R_1 and R_2 measured in ohms (Ω). The total resistance, R, is then given by,

$$\frac{1}{R}=\frac{1}{R_1}+\frac{1}{R_2}$$

Suppose that R_1 is increasing at a rate of 0.4 Ω /min and R_2 is decreasing at a rate of 0.7 Ω /min. At what rate is R changing when $R_1=80\Omega$ and $R_2=105\Omega$?

Your work:

$$\frac{1}{R}=\frac{1}{80}+\frac{1}{105}=\frac{37}{1680} \qquad \Rightarrow \qquad R=\frac{1680}{37}=45.4054\Omega$$

$$-\frac{1}{R^2}R'=-\frac{1}{\left(R_1\right)^2}R_1'-\frac{1}{\left(R_2\right)^2}R_2'$$

$$R'=R^2\left(\frac{1}{\left(R_1\right)^2}R_1'+\frac{1}{\left(R_2\right)^2}R_2'\right)$$

Finally, all we need to do is plug into this and do some quick computations.

$$R'=(45.4054)^2\left(\frac{1}{80^2}(0.4)+\frac{1}{105^2}(-0.7)\right)=-0.002045$$

So, it looks like R is decreasing at a rate of 0.002045 Ω /min.