Special Problem 2.A-1

Show by **direct substitution** that the expressions for $V(z)$ and $I(z)$:

$$V(z) = V_0^+ e^{-j\beta z} + V_0^- e^{+j\beta z}$$

$$I(z) = \frac{V_0^+}{Z_0} e^{-j\beta z} - \frac{V_0^-}{Z_0} e^{+j\beta z}$$

are in fact valid solutions to the lossless **telegrapher's equations:**

$$\frac{\partial V(z)}{\partial z} = -\left(j\omega L\right) I(z)$$

$$\frac{\partial I(z)}{\partial z} = -\left(j\omega C\right) V(z)$$

as well as both transmission line **wave equations**.

$$\frac{\partial^2 V(z)}{\partial z^2} = -\beta^2 V(z)$$

$$\frac{\partial^2 I(z)}{\partial z^2} = -\beta^2 I(z)$$

In other words, show (by evaluating the derivatives and performing algebraic manipulation) that for **each** of the four differential equations—once the solutions $V(z)$ and $I(z)$ are inserted—the quantity left of the equal sign is **precisely** the **same** as the quantity on the right of the equal sign.

Hint: Don't for get the definition of Z_0 **and** β !!