Physics 745 - Group Theory

Homework Set 20
Due Wednesday, March 25

1. Prove, using only the commutation relations, the first three identities (2.9) from the notes, namely

$$\left[\mathbf{T}^2, T_a\right] = 0, \quad \left[T_3, T_\pm\right] = \pm T_\pm, \quad \text{and} \quad \mathbf{T}^2 = T_\mp T_\pm + T_3^2 \pm T_3$$

These are, in fact, three, two, and two identities respectively. On the first one, it is very helpful to use the identity $\left[A^2, B\right] = A\left[A, B\right] + \left[A, B\right]A$.