TRUE OR FALSE. No partial credit.

1. The dihedral group $D_4$ contains a subgroup isomorphic to $\mathbb{Z}_2 \times \mathbb{Z}_2$.
   TRUE: for example, the group generated by $x$ and $y$.
2. The quaternion group $Q$ contains an element of order 8.
   FALSE.
3. If a group $G$ has the property that all elements (except the identity) are of order two, then $G$ is abelian.
   TRUE. We proved this in class (and its in the daily update).
4. If all subgroups of a group $G$ are normal, the group is abelian.
   FALSE: The quaternion group is a counter example.
5. The group $\mathbb{Z}_2 \times \mathbb{Z}_3$ is cyclic.
   TRUE: It is isomorphic to $\mathbb{Z}_6$.
6. The group $\mathbb{Z}_2 \times \mathbb{Z}_2$ is cyclic.
   FALSE: It contains no element of order 4, yet has 4 elements.
7. If a group contains an element of order $d$, it also contains a cyclic subgroup of order $d$.
   TRUE: If $x$ has order $d$, then the subgroup generated by $x$ is cyclic of order $d$.
8. A group $G$ of order 200 may contain a non-normal subgroup of order 100.
   FALSE: Every group of index 3 is normal.
9. There is an isomorphism $\mathbb{Z}_{34} \rightarrow \mathbb{Z}_{17} \times \mathbb{Z}_2$.
   TRUE: Proved in class. This is basically the Chinese Remainder Theorem.
10. Every proper subgroup of the quaternion group $Q$ is cyclic.
    TRUE: You found them all on the worksheet.

11. Write one question you have about group theory or algebra in general. It can be specific things from the class, or general stuff beyond. (For example: What is a nilpotent group? Does a group of order $ab$ have to have subgroups of orders $a$ and $b$? What is the “category of groups”? How can we tell how many subgroups a group has? How are groups used in chemistry? When were groups first studied and why?)