1. Assume that $\text{ord}_n a = k$ and that $d|k$. Show that there is some $b$ with $\text{ord}_n b = d$.

2. Suppose that $\bar{r}$ is an inverse of $r$ modulo $n$. Show that $\text{ord}_n r = \text{ord}_n \bar{r}$.

3. Show that 20 has no primitive roots.

4. Find all primitive roots of 18. Explain carefully, and express your answers as least positive residues. Show all necessary calculations – you do not need a calculator.

5. How many incongruent roots does $x^3 + 12$ have modulo 13? Explain carefully.

**NOTE:** Explain your work clearly. Your solutions must include enough detail to justify your conclusions.