1. Let $\alpha = (1365)(24)$, $\beta = (152643)$, $\gamma = (163)$. Find each of the following. For (a)-(e), write each result first as a product of disjoint cycles, then as a product of 2-cycles, then say if the element is even or odd:

(a) $\alpha \beta$
(b) $\beta \alpha$
(c) $\alpha^2 \beta \gamma^2$
(d) $\alpha^{-1}$
(e) $\eta$ such that $\eta \beta = (1243)(56)$
(f) $|\alpha|$

2. No proof is required for each of these, just give a brief answer:

(a) How many elements of order 5 are in $A_6$?
(b) Find a generator of a cyclic subgroup of $A_8$ which has order 4.
(c) Find an element in $S_{10}$ with order 12.
(d) What is the smallest value of $n$ so that $S_n$ contains at least one element of order 18? Give the $n$, justify and give an example of such an element.

3. In $S_5$, find each of the following. You need not justify that your answers are subgroups but you should convince yourself!

(a) A cyclic subgroup of order 6. List the elements and a generator.
(b) A non-Abelian subgroup of order 6. List the elements and specify two which don’t commute.

4. Let $n$ be an even positive integer. Prove that $A_n$ has an element of order greater than $n$ iff $n \geq 8$.

5. Find $Z(S_n)$ for all $n$. Note that $n = 1$ and $n = 2$ are different than all the others and you should account for this. This problem takes some fiddling!