1. Determine $\beta(G), \omega(G), \sigma(G), \chi(G)$ and $\chi'(G)$ for the graph $G$ shown below.

![Graph G](image)

2. Determine $\beta(G), \omega(G), \sigma(G), \chi(G)$ and $\chi'(G)$ for the graph $G$ shown below.

![Graph G](image)

3. Draw two bridgeless 3-regular graphs of order 10; one with edge chromatic number 3, and the other with edge chromatic number 4.

4. Prove that $\chi(K_p) = p$ for all odd $p$.

5. Show that if $G$ is a graph with $p$ vertices then $\chi(G) \leq p + 1 - \beta(G)$.

6. Determine $\chi'(Q_n)$ for all $n \geq 1$. Justify your answer.

7. If $\chi(G) \leq 4$, must $G$ be planar?

8. Show that, for every integer $p \geq 4$, there exists a planar graph of order $p$ such that $\chi(G) = 4$.

End of Problem Sheet 5