

In your solutions, you may use any results from the course notes but must give precise references.

1. Prove Liouville's Theorem (see course notes on Week 9).
2. Prove the fundamental theorem of algebra (see course notes on Week 9).
3. Evaluate  $\int_{\gamma} \frac{\sin z}{z} dz$  over a closed contour  $\gamma$ .
4. Evaluate  $\int_{\gamma} \frac{1}{z} dz$  over the closed clockwise oriented contour whose trace coincides with the boundary of the square with corners at  $1 + i$ ,  $-1 + i$ ,  $-1 - i$  and  $1 - i$ .