1. Suppose $f(z)$ is analytic in a neighborhood of a point $a$ and has a simple zero at $a$, i.e., $f(a) = 0$, but $f'(a) \neq 0$. Prove a formula for the residue of $1/f(z)^2$ at $z = a$ involving values of derivatives of $f$ at $a$. (Derive your formula without using any results from the practice problems.)

2. Compute
\[
\int_{-\infty}^{\infty} \frac{e^{-ist}}{t^2 + 2t + 5} \, dt
\]
if $s > 0$. Explain.

3. Suppose $f(z)$ has an isolated singularity at the origin and satisfies an estimate
\[
|f(z)| \leq \frac{1}{\sqrt{|z|}} \quad \text{for } 0 < |z| < r
\]
for some radius $r > 0$. Prove that the origin is a removable singularity of $f$.

4. Suppose $f$ is an entire function that satisfies an estimate of the form
\[
c|z|^N \leq |f(z)| \quad \text{if } |z| > R
\]
for some positive integer $N$ and positive real constants $c$ and $R$. Prove that $f$ must be a polynomial. What can you say about the degree of the polynomial?