Exercise 1
Find the maximal open set, where the sequence $f_n$ converges compactly (uniformly on every compactum):
(i) $f_n(z) = (z + 1/n)^2$;
(ii) $f_n(z) = z^{n^2}$;
(iii) $f_n(z) = \cos z^{2^n}$.

Exercise 2
Let $\Omega \subset \mathbb{C}$ be bounded open set and $(f_n) \in C(\overline{\Omega}) \cap \mathcal{O}(\Omega)$ be a sequence of functions. Given that $(f_n)$ converges uniformly on $\partial \Omega$, prove that it also converges uniformly on $\Omega$. (Hint. Use the Maximum Principle.)

Exercise 3
Determine the Laurent series expansion of the function $f$ at $a$ and its ring of convergence:
(i) $f(z) = (z^2 + 1)^{-1}, a = i$;
(ii) $f(z) = (z - 1)^{-2} \log z, a = 1$;
(iii) $f(z) = z(z - 2)^2 \cos \pi z, a = 2$;

Exercise 4
Let $f(z) = \sum_{n=-\infty}^{\infty} a_n(z - z_0)^n$ and $g(z) = \sum_{n=-\infty}^{\infty} b_n(z - z_0)^n$ be Laurent series converging in a ring $r < |z - z_0| < R$. Find the formula for the Laurent series expansion of the product $fg$ and show that it converges in the same ring.

Exercise 5
Determine the mutiplicity with which $f$ takes its value at $z_0$:
(i) $f(z) = e^z \cos z, z_0 = 0$;
(ii) $f(z) = (\log(\cos z))^2, z_0 = 2\pi$.
(iii) $f(z) = (1 + z^2 - e^{z^2})^4, z_0 = 0$. 