1. Prove $\sum_{n=0}^{\infty} z^n$ does NOT converge uniformly on the domain $0 < |z| < 1$.
2. Show that the function defined by

$$f(z) = \begin{cases} \frac{1-\cos z}{z^2}, (z \neq 0) \\ \frac{1}{2}, (z = 0) \end{cases}$$

   is entire.
3. Find the Taylor series expansion for $f(x) = \frac{1}{(1-z)^2}$ at $z_0 = 0$ by differentiating the Taylor series expansion $\frac{1}{1-z} = \sum_{n=0}^{\infty} z^n$ $(|z| < 1)$
4. m is a positive integer. Prove that if f is analytic at z_0 and $f(z_0) = f'(z_0) = ... = f^{(m)}(z_0) = 0$, then the function

$$g(z) = \begin{cases} \frac{f(z)}{(z-z_0)^{m+1}}, (z \neq z_0) \\ \frac{f^{(m+1)}(z_0)}{(m+1)!}, (z = z_0) \end{cases}$$

   is analytic at z_0.
5. Find the Laurent series expansion of

$$f(z) = \frac{1}{(z-1)(z-2)}$$

   in the domain $1 < |z| < 2$
6. $f(z) = \frac{1}{z-z^2}$.

   (i). Find the Laurent series expansion of $f(z)$ in the domain $0 < |z| < 1$

   (ii). Find the Laurent series expansion of $f(z)$ in the domain $1 < |z| < \infty$

   (iii). Find the Laurent series expansion of $f(z)$ in the domain $0 < |z-1| < 1$

   (iv). Find the Laurent series expansion of $f(z)$ in the domain $1 < |z-1| < \infty$