**Problem 1:**

**Problem 2:**

**Problem 3:**

**Problem 4:**

**Problem 5:**

**Problem 6:**

**Problem 7:**

**Problem 8:**

**Problem 9:**

Consider $f$, holomorphic on some disk, $\Omega$, centered at $z$. Consider $g(w) = \frac{f(w)}{w-z}$; then we have that $\int\limits_{\partial Om} g(w)dw = 2\pi i \text{Res}_z g$. (Note that $g$'s only singularity is at $z$.) Moreover, note that $g(w) = \frac{\sum\limits_{n=0}^{\infty} a_n(w-z)^n}{w-z}$. Thus, by the residue theorem, $\int\limits_{\partial\Omega} \frac{f(w)}{w-z}dw = f(z)$.

**Problem 10:**

**Problem 11:**

**Problem 12:**

**Problem 13:**

**Problem 14:**

**Problem 15:**

**Problem 16:**

**Problem 17:**

**Problem 18:**

**Problem 19:**

**Problem 20:**

**Problem 21:**

**Problem 22:**

**Problem 23:**