Same instruction as Mission 1. Enjoy ! Topics covered here include classification of singularities, calculation of Laurent series and residues, calculation of integrations and series via residue theory.

Problem 76 Find the Laurent series for the function $f(z) = \dfrac{z}{(z+1)(z-2)}$ in each of the following domains:

(a.) $|z| < 1$

(b.) $1 < |z| < 2$

(c.) $2 < |z|$.

Problem 77 Saff and Snider §5.5#4 (Laurent series for $sin(2z)/z^3$ for $|z| > 0$)

Problem 78 Saff and Snider §5.5#7 (find first few terms of Laurent series)

Problem 79 Saff and Snider §5.6#1 (find and classify isolated singularities)

Problem 80 Saff and Snider §5.6#5 (polarizing true/false question)

Problem 81 Saff and Snider §5.7#1 (behavior at ∞, zero or pole of what order)

Problem 82 Saff and Snider §6.1#1a, b, c, g, h, i (calculate residues)

Problem 83 Saff and Snider §6.1#3a, b, c, d, g (calculate integrals via residue theorem)

Problem 84 Saff and Snider §6.3#14 (set-up for series calculation via residue theorem)

Problem 85 Saff and Snider §6.3#15 (calculation of series via residue theory)

Problem 86 Calculate $\displaystyle\int_{-\infty}^{\infty} \frac{x \sin x dx}{x^4+1}$

Problem 87 Let $-1 < a < 1$. Show $\displaystyle\int_0^{2\pi} \frac{\cos(2\theta)d\theta}{1-2a\cos(\theta)+a^2} = \frac{2\pi a^2}{1-a^2}$.

Problem 88 Show $\displaystyle\int_0^{\infty} \frac{\sqrt{x}\,dx}{x^2+2x+5} = \frac{\pi}{2\sqrt{2}}\sqrt{\sqrt{5}-1}$.

Problem 89 Determine the number of zeros of $p(z) = 4z^3 - 12z^2 + 2z + 10$ in the annulus $\frac{1}{2} < |z-1| < 2$.

Problem 90 Let $p(z)$ and $q(z)$ be polynomials of degree n. If $p(z) = q(z)$ at $(n+1)$-distinct points in $\mathbb{C}$ then $p(z) = q(z)$ for all $z \in \mathbb{C}$.