1. Compute the Laurent expansion of \( w(z) = \frac{z^{122} + 3z^{41} + 1}{z^{568}} \) around \( z = 0 \). Use the formula, and then check your answer as we did in class.

2. Compute the Laurent expansion of \( w(z) = \frac{e^z}{z} \) around \( z = 0 \).

3. Evaluate the integral \( I = \oint_C \frac{4z^3 - 1}{z(z-1)} \, dz \) around a contour centered around \( z = 0 \) and of radius \( |z| = 5 \).

4. Verify the following re-structuring of integral limits: \( \int_a^x dx' \int_a^{x'} f(x') \, dx' = \int_a^x f(x')dx' \int_x^x dx'' \) for the functions \( f(x) = 1 \) and \( f(x) = x^2 \).

5. Verify that the Green’s function that we ended with at the end of class satisfies the usual defining relation: \( G(x, x') = \delta(x - x') \). That is \( G(x, x') = \Theta(x - x') \frac{e^{\frac{b}{2}(x-x')}}{\sqrt{b-a^2}} \sin \left[ \sqrt{\frac{b-a^2}{4}} (x - x') \right] \) and \( L = \frac{d^2}{dx^2} + a \frac{d}{dx} + b \).

6. Re-evaluate the integral from class: \( F_0 e^{-\gamma t} \int_0^t \frac{1}{\sqrt{\omega_0^2 - \gamma^2}} \sin \left[ \sqrt{\frac{\omega_0^2 - \gamma^2}{\omega_0^2 + a^2 - 2\alpha \gamma}} \right] e^{-\gamma t} dt' \) to obtain the result \( \frac{F_0}{\sqrt{\omega_0^2 - \gamma^2}} \sin \left[ \sqrt{\frac{\omega_0^2 - \gamma^2}{\omega_0^2 + a^2 - 2\alpha \gamma}} \right] e^{-\gamma t} + \frac{F_0}{\omega_0^2 + a^2 - 2\alpha \gamma} e^{-\alpha t} \) where \( \tan \delta = \frac{\sqrt{\omega_0^2 - \gamma^2}}{a-\gamma} \).