

1. Find the residue at  $z = 0$  of the function

(a)  $\frac{z + 2}{z^2 + z}$

(b)  $\frac{\exp(z)}{z^3(1+z)}$

2. In each case, show that any singular point of the function is a pole. Determine the order  $m$  of each pole, and find the corresponding residue.

(a)  $\frac{2z + 3}{z^3 + z^2}$

(b)  $\frac{\cosh z}{z^2 + \pi^2}$

3. Show that

(a)  $\operatorname{Res}_{z=-i} \frac{\operatorname{Log} z}{(z^2 + 1)^2} = \frac{\pi - 2i}{8}$

(b)  $\operatorname{Res}_{z=-i} \frac{z^{1/2}}{(z^2 + 1)^2} = \frac{1+i}{8\sqrt{2}}$  ( $|z| > 0$ ,  $-\pi < \arg(z) < \pi$ )

4. Find the integral

$$\int_C \frac{4z^2 + 1}{(z+1)^2(z^2+1)} dz$$

taken counterclockwise around the circle (a)  $|z| = 2$ ; (b)  $|z+1| = 1$ .