Section 79 page 239 Problem 1 parts (a) and (c)

Residue at $z=0$:

1(a) $$\frac{1}{z+z^2} = \frac{1}{z}\cdot\frac{1}{1+z} = \frac{1}{z}\cdot\underbrace{\sum_{n=0}^{\infty}(-1)^n z^n}_{\frac{1}{1+z}} = \frac{1}{z} - 1 + z + \cdots$$

So the coefficient of $\frac{1}{z}$ in the Laurent series in the punctured disk $\{z : 0<|z|<1\}$ is 1

$$\boxed{\operatorname*{Res}_{z=0} \frac{1}{z+z^2} = 1.}$$

1(c) $$f(z) = \frac{z - \sin(z)}{z} = \frac{1}{z}\left(\frac{z^3}{3!} - \frac{z^5}{5!} + \cdots\right)$$

$$\sin(z) = \sum_{n=0}^{\infty}\frac{(-1)^n z^{2n+1}}{(2n+1)!} = z - \frac{z^3}{3!} \cdots$$

$$= \frac{z^2}{3!} - \frac{z^4}{5!} + \cdots$$

The coeff of $\frac{1}{z}$ is zero.

$$\boxed{\operatorname*{Res}_{z=0} f(z) = 0}$$