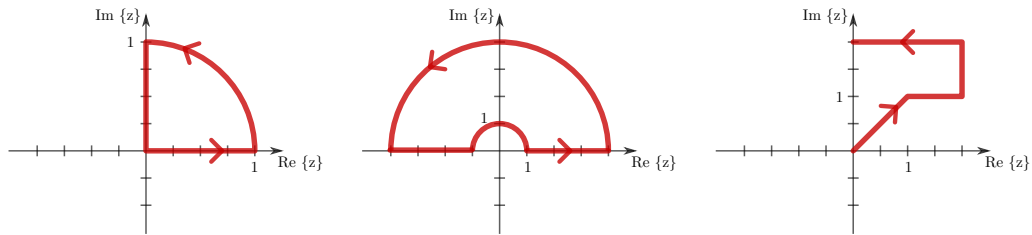


Mathematical Method of Physics

Problem 1

1.1. Let $\gamma(t) : [a, b] \rightarrow \mathbb{C}$ be one of the following contours (piecewise smooth curves).



Evaluate the complex integrals in the form

$$\mathcal{I} = \int_{\gamma} dz f(z),$$

where

- a) $f(z) = |z|^2$,
- b) $f(z) = z^2 - z^4$,
- c) $f(z) = z^*$,
- d) $f(z) = (z^*)^2 - z^4$,

for each of these contours.

1.2. Let $C(z_0, r)$ be a positively oriented circle with centre z_0 . Evaluate the following integrals in the form

$$\mathcal{I} = \oint_C dz f(z),$$

where

- a) $f(z) = \sin z / (z^2 + 1)$, and $C(0, 2)$,
- b) $f(z) = z^3 / (z^2 - 2z + 2)$, and $C(0, 2)$,
- c) $f(z) = e^z / (i\pi - 2z)$, and $C(0, 2)$,
- d) $f(z) = ze^{\pi z} / (z^2 + 4)^2$, and $C(-2i, 2)$,
- e) $f(z) = \cos z / [z(z - \pi)^3]$, and $C(3, 1)$.