

[gex89] **Definite integral via residue theorem I**

(a) Employ a semicircular contour in the upper-half complex plane to determine the following definite integral via contour integration:

$$I = \int_{-\infty}^{\infty} dx \frac{x^2}{(x^2 + 1)(x^2 + 2x + 2)}.$$

Identify the (isolated) singularities of the integrand in the upper-half plane and determine their residues. Show that the semicircular line integral vanishes in the limit of infinite radius.

(b) Check your result by using the Mathematica command `Integrate` for the definite integral.

Solution: