Homework 3a: **Using the Residue Theorem**

Course: Physics 231, *Methods of Theoretical Physics* (2021)
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Due by: Wed, Nov 3

1 Which contour?

Suppose you would like to calculate the integral

$$\int_{-\infty}^{\infty} dx \, \frac{e^{iax}}{x^4+1} \, , \tag{1.1}$$

where a is either $+1$ or -1.

1. Identify the poles of the integrand and the residue of each pole.
2. There are two natural contours you can use to compute the integral using the residue theorem. Draw the contours: one is in the upper half-plane, the other is in the lower-half plane. Note whether the have positive or negative orientation.
3. When $a = +1$, which contour has an integral that converges (goes to zero) on the arc? Which poles are enclosed and contribute their residues to the integral?
4. When $a = -1$, which contour has an integral that converges (goes to zero) on the arc? Which poles are enclosed and contribute their residues to the integral?

You do not have to perform the integral, but if you feel like your life would not be complete without doing so, you can feel free to do so for $a = \pm 1$.