

All curves are positively oriented unless otherwise noted.

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1. Compute the integral

$$\int_{-\infty}^{\infty} \frac{x^3 \sin(ax)}{x^4 + 4} dx, \quad (a > 0).$$

2. Compute the integrals

$$(a) \int_0^{2\pi} \frac{d\theta}{5 + 4 \sin \theta}, \quad (b) \int_0^{\pi} \sin^{2n} \theta d\theta, \quad (n \geq 1).$$

3. Using summation by parts, as we did in class, show Abel's inequality: If  $m \leq \sum_{j=1}^k a_j \leq M$ , for  $k = 1, 2, \dots, n$ , and  $b_1 \geq b_2 \geq \dots \geq b_n > 0$  then

$$b_1 m \leq \sum_{j=1}^n a_j b_j \leq b_1 M.$$