Homework Set *"Integration Using Residues"*

(part of HW#4, Physics 835, due Thursday, February 12, 2009)

The whole problem set is worth 20 pts. (2 pts. each for (1–6), 4 pts. each for (7,8))

Perform the following integrals using residues (a, b are real, $a \neq b$, $\epsilon > 0$):

$$\int_{-\infty}^{\infty} dx \, \frac{1}{(x - a - i\epsilon)\,(x - b + i\epsilon)} \tag{1}$$

$$\int_{-\infty}^{\infty} dx \, \frac{1}{(x - a - i\epsilon)\,(x - b - i\epsilon)} \tag{2}$$

$$\int_{-\infty}^{\infty} dx \, \frac{e^{i\,x}}{(x - a - i\epsilon)\,(x - b - i\epsilon)} \tag{3}$$

$$\int_{-\infty}^{\infty} dx \, \frac{1}{x - a - i\epsilon} \, \mathcal{P}\frac{1}{x - b} \tag{4}$$

$$\int_{-\infty}^{\infty} dx \, \left(\mathcal{P}\frac{1}{x - a}\right) \left(\mathcal{P}\frac{1}{x - b}\right) \tag{5}$$

$$\int_{-\infty}^{\infty} dx \, \frac{1}{(x^2 + a^2)\,(x^2 + b^2)} \tag{6}$$

$$\int_{-\infty}^{\infty} dx \, \frac{\cos x}{x^2 + a^2} \tag{7}$$

$$\int_{-\infty}^{\infty} dx \, \frac{\sin x}{x} \tag{8}$$