

1. Use Contour Integration to Compute

a)  $\int_{-\infty}^{+\infty} \frac{\cos x}{x^4+1} dx$

b)  $\int_{-\infty}^{+\infty} \frac{\sin x}{x^2+2x+3} dx$

c)  $\int_{-\infty}^{+\infty} \frac{\cos x}{x-i\pi} dx$

d)  $\int_{-\infty}^{+\infty} \frac{1}{\cosh x} dx$

e)  $\int_0^{+\infty} \frac{1}{x^{\frac{1}{3}}(1+x^2)} dx$

f)  $\int_0^{+\infty} \frac{\log x}{x^2+4} dx$

g)  $\int_0^{+\infty} \frac{\sqrt{x} \log x}{x^2+4} dx$

h)  $\int_0^{+\infty} \frac{\log x}{x^3+1} dx$

i)  $\int_0^{+\infty} \frac{x}{(x+1)(x^2+2x+5)} dx$

j)  $\int_{-1}^1 \frac{\sqrt{1-x^2}}{x^2+1} dx$

2. Find the Fourier transforms of

(a)  $f(x) = \frac{1}{x^4+1}$

(b)  $f(x) = \frac{1}{x^2+2x+3}$

(c)  $f(x) = \frac{1}{(x^2+1)^2}$

3. Use Fourier Transforms to solve

(a)  $u'''' + u = h(t), \quad u(\pm\infty) = 0$

Hint: Use 2(a)

(b) 
$$\begin{cases} u_t + u_{xxxx} = 0, & -\infty < x < +\infty, t > 0 \\ u(x, 0) = f(x) \end{cases}$$