Due Date: 27.11.2019 – Monday – Morning 10:00 AM

HOMEWORK 5

Que1: (35 p) Calculate the integrals given below. (Hint: Consider Euler expansion). Assume that $a \geq 0$ and $b \geq 0$

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

b-) $$\int_{0}^{\infty} \frac{x \sin 2x}{x^2 + 3} dx$$

c-) $$\int_{-\infty}^{\infty} \frac{x \sin ax}{x^4 + 4} dx$$

d-) $$\int_{0}^{\infty} \frac{\cos ax}{x^2 + 1} dx$$

e-) $$\int_{0}^{2\pi} \frac{d\theta}{5 + 4 \sin \theta}$$

f-) $$\int_{-\pi}^{\pi} \frac{d\theta}{1 + \sin^2 \theta}$$

e-) $$\int_{0}^{\infty} \frac{\sqrt[3]{x}}{(x + a)(x + b)} dx$$

Que2: (20p) Calculate the integrals given below by using contour.

a-) $$\int_{0}^{\infty} \frac{\ln x}{x^2 + 1} dx$$

b-) $$\int_{0}^{\infty} \frac{\ln x}{(x^2 + 1)^2} dx$$

c-) $$\int_{0}^{\infty} \frac{\sin x}{x} dx$$

d-) $$\int_{0}^{\infty} \frac{\sin^2 x}{x^2} dx$$

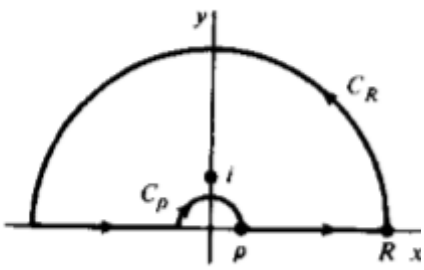

Figure 1: Contour

Que3: (30 p)

1. By differentiating the Maclaurin series expansion

$$\frac{1}{1-z} = \sum_{n=0}^{\infty} z^n$$

obtain the representations

a-) $\frac{1}{(1-z)^2}$ b-) $\frac{2}{(1-z)^3}$ c-) $\frac{6}{(1-z)^4}$ a-) $\frac{24}{(1-z)^5}$

Que4:(15p)

Find the Taylor series for the function

$$\frac{1}{z} = \frac{1}{2+(z-2)} = \frac{1}{2}\left[\frac{1}{1+(z-2)/2}\right]$$

about the point $z_0 = 2$. Then, by differentiating that series term by term,

Find series expansion of $\frac{1}{z^2}, \frac{1}{z^3}, \frac{1}{z^4}$