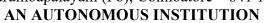


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1	UNIT-Y product interest symmetric	1
	COMPLEX INTEGRATION	
	Cauchy's Integral Theorem:	
	If f(x) is analytic and f'(x) is continuous on and	
	inside a simple closed everve c, then { f(x)dx = 0	
	Problame:	
	Evaluate $\int \frac{dx}{x+4}$ , where c is the circle $ x =2$ .	
	7+4 = 0 : + o :	
	₩ = -4	
	C &	
	Z = -4 => 1 × 1 = 1 - 4 > &	
	: × = -4 lies outside C.	
	By Cauchy's Integral theorem, J dx = 0.	
	2) Evaluate 1 dx , where c is the circle 121=1.	
	sofo: net a retail is a applie when it inverte	
	2x-3=0 => x = 3/3	
	C is	
	$z = 3/2 =  z  = \left \frac{3}{2}\right  = \frac{3}{2} > 1$	
	$z = \frac{3}{3}$ dies outside C.	
	By cauchy's Integral theorem, $\int_{c}^{a} \frac{dz}{2z-3} = 0$ .	
	3) Evaluate of a dr where c is  x =1.	
	8 of 1	
	f(x) = 0x	
	· j(x) lies inside c.	
	$\int_{C} Q^{x} dx = 0  [By  C.I.T]$	



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Cauchy's Integral formula:
Let fix) be an analytic function inside and on a simple closed contour c, taken in the positive sense. If a is any point interior to c, then.  $\frac{1}{2\pi i} \int \frac{1}{x-a} dx$  $\int \frac{f(x)}{x-a} dx = 2\pi i f(a).$ J π-a dπ = Jaπizca), a dies inside c
, a dies outside c  $\int_{C} \frac{f(x)}{(x-a)^{n+1}} dx = \int_{C} \frac{a\pi i}{n!} t^{n}(a), \quad a \text{ lies inside } C$ , a dies outside c Problems: 1) Evaluate 1 = dx where c is |x|=1 & |x|=8. 80fn : Given J = dx 2-2=0=> => 2 :. × lies outside c, |x| = 2  $\int_{0}^{\infty} \frac{x}{x-x} dx = 0$ z dies outido c, 1x1=3.  $\int \frac{x}{x-2} dx = 2\pi i \int (2)$ = 2TTi (2) = 4TTi 2) Evaluate 1 = +1 dx where c is the circle 1x+1+i1=2 using cauchy's integral formula.



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Sch.:

Given, 
$$\int_{C} \frac{x+1}{x^2+2x+4} dx$$

$$x^{\frac{1}{2}} + 3x + 4 = 0$$

$$x = -\frac{3}{2} \pm \sqrt{4-16}$$

# S COLLUS COLUMN COLUMN

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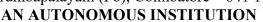
X = T/6 dies inside c, 1x1=1.

 $\int \frac{\sin^6 x}{(x-\pi/6)^3} dx = \frac{2\pi i}{2!} \frac{d^2}{dx^2} \left[ \sin^6 x \right]_{x=\pi/6}$ 

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$$\frac{d^{2}}{dx^{2}} [8in^{6}x] = \frac{d}{dx} \left[ \frac{d}{dx} (8in^{6}x) \right]$$

$$= \frac{d}{dx} \left[ 68in^{6}x (-8in^{2}x) + \cos x (-8in^{4}x \cos x) \right]$$

$$= 6 \left[ 8in^{6}x (-8in^{2}x) + \cos x (-8in^{4}x \cos^{2}x) \right]$$

$$= 6 \left[ -8in^{6}x + 5 (8in^{4}x \cos^{2}x) \right]$$

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8) Evaluate 1 = 1-82 dx whoma c is the circle 121-3/2.

$$\int_{C} \frac{A-3x}{x(x-1)(x-2)} dx = \int_{C} \frac{A-3x}{x-2} dx$$

$$\frac{1}{\chi(\chi-1)} = \frac{\lambda}{\chi} + \frac{\beta}{\chi-1} = \frac{\lambda(\chi-1) + \beta(\chi)}{\chi(\chi-1)}$$

$$\frac{x(x-1)}{1} = \frac{x}{-1} + \frac{x-1}{1}$$

$$\int_{C} \frac{\frac{4-8x}{x-2}}{x(x-1)} dx = -\int_{C} \frac{\frac{4-8x}{x-2}}{x(x-1)} dx + \int_{C} \frac{\frac{4-8x}{x-2}}{x-1} dx$$

$$= -\frac{8\pi i}{3}(0) + \frac{8\pi i}{3}(1)$$

$$= -2\pi i \left(\frac{4}{-2}\right) + 2\pi i \left(\frac{1}{-1}\right) = 4\pi i - 2\pi i = 2\pi i$$

Falsan Artistanti

9) Evaluate  $\int \frac{x dx}{(x-1)(x-2)^2}$  where c is  $|x-2| = \frac{1}{2}$  using cauchy's integral jonnula.

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$$(x-1)(x-a) = 0$$

$$x = 1/2$$

$$|x-2| = |1-2| = |-1| = 1 > 1/2$$

$$x = 1 \text{ dies outside } C.$$

$$|x-2| = |2-2| = 0 < 1/2$$

$$x = 2 \text{ dies inside } C.$$

$$x = 2 \text{ dies inside } C.$$

$$\frac{x}{(x-1)(x-2)^2} = \int_{C} \frac{x}{(x-2)^2} dx$$

$$= 2\pi i \int_{-1}^{1} (2)$$

$$= 2\pi i \left[ \frac{(\chi_{-1})(1) - \chi_{(1)}}{(\chi_{-1})^{2}} \right] \chi = 2$$

$$= 2\pi i \left[ \frac{1-2}{1^{2}} \right] = 2\pi i (-1) = -2\pi i.$$

Taylori Sories:

$$f(x) = f(a) + (x-a) \frac{f'(a)}{f(a)} + (x-a)^2 \frac{2!}{f''(a)} + \cdots$$

This is known as Taylor's series q = (x) at x = a.

Maclaurins Bories:

Put 
$$a = 0$$
 in the Taylor series for  $f(z)$  then
$$f(z) = f(0) + \frac{f'(0)}{1!} z + \frac{f''(0)}{2!} z^2 + \frac{f'''(0)}{3!} z^3 + \cdots$$
This series is called Madagini series

This series is called Maclaurini series 9 1(x).

Problems :

1) Expand f(x) = 8in x in a Taylor series about x = 0. 8oth:

Function

At 
$$x = 0$$

$$\begin{cases}
(x) = 8 \text{ in } x & f(0) = 0 \\
f'(x) = \cos x & f''(0) = 1
\end{cases}$$

$$\begin{cases}
(x) = -\cos x & f''(0) = -1 \\
f'''(x) = -\cos x & f'''(0) = 0
\end{cases}$$

$$\begin{cases}
f'''(x) = -\cos x & f'''(0) = 0
\end{cases}$$