NAME: OPUTA CLINTON CHUKWUDUBEM
DEPT: AERONACTICAL ENGINEERING
COURSE TITLE / CODE: GENERAL MATHEMATICS (MAT10H)
MATRIC NO:- 19/ENG09/019

ASSIGNMENT FOR DR. OYELAMI'S GROUP

1) find the Integral of the following

(i) $\sin 7x \cos 2x \, dx$

Solution

$\int \sin 7x \cos x \, dx$, using identity, we have.

$\sin a \cdot \cos b = \frac{1}{2}(\sin(a+b) + \sin(a-b))$

$\therefore a = 7x,\ b = 2x$

$\therefore \sin 7x \cos 2x = \frac{1}{2}(\sin(7x+2x) + \sin(7x-2x))$

$\sin 7x \cos 2x = \frac{1}{2}(\sin 9x + \sin 5x)$

$\therefore \frac{1}{2}\int \sin 9x \, dx + \frac{1}{2}\int \sin 5x \, dx = \int \sin 7x \cos 2x \, dx$

$$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\left(\frac{-\cos 9x}{9}\right) + \frac{1}{2}\left(\frac{-\cos 5x}{5}\right) + C$$

$$\Rightarrow -\frac{1}{18}\cos 9x + \frac{1}{2}\left(\frac{-\cos 5x}{5}\right) + c$$

$$= -\frac{1}{18}\cos 9x + \frac{1}{10}\cos 5x + c$$

ans.

2) $\cos 3x \cos x \, dx$

solution

$\int \cos 3x \cos x \, dx$, using

$\cos a \cos b = \frac{1}{2}(\cos(a-b) + \cos(a+b))$ where $a = 3x$, $b = x$

$\therefore \cos 3x \cos x = \frac{1}{2}(\cos(3x-x) + \cos(3x+x))$

$\cos 3x \cos x = \frac{1}{2}(\cos 2x + \cos 4x)$

$\therefore \int \cos 3x \cos x \, dx = \frac{1}{2}\int \cos 2x \, dx + \frac{1}{2}\int \cos 4x \, dx$

$= \frac{1}{2}\left(\frac{1}{2}\sin 2x\right) + \frac{1}{2}\left(\frac{1}{4}\sin 4x\right) + C$

$\therefore \int \cos 3x \cos x \, dx = \frac{1}{4}\sin 2x + \frac{1}{8}\sin 4x + C$

ans.

3) $\frac{\cos x}{\sin^2 x} dx$

solution

$\int \frac{\cos x}{\sin^2 x} dx$

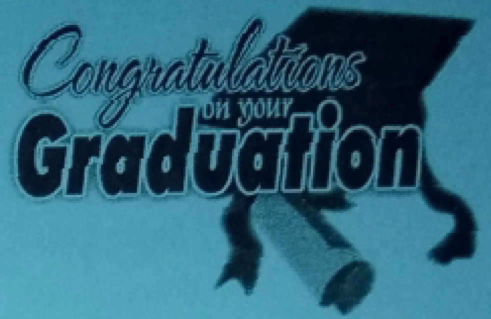
let $u = \sin x$, $du = \cos x \, dx$

$\therefore \int \frac{\cos x}{\sin^2 x} dx = \int \frac{du}{u^2} = -\frac{1}{u}$

$\therefore = -\frac{1}{\sin x} = -\text{cosecant } x$ or $-\csc x$

ans

(4) Double Integral with limits from 1 to 2, from 0 to 3 $(9x^2y)\,dx\,dy$



solution

$$\therefore \int_1^2\int_0^3 9x^2y\,dx\,dy = \int_1^2\left[\int_0^3 9x^2y\,dx\right]dy$$

$$\therefore \int_1^2\left[\frac{9x^3y}{3}\Big|_0^3\right]dy = \int_1^2\left[\frac{9(3)^3y}{3} - \frac{9(0)^3y}{3}\right]dy$$

$$= \int_1^2 3^4y\,dy = \frac{3^4y^2}{2}\Big|_1^2$$

$$= \left[\frac{3^4(2)^2}{2} - \frac{3^4(1)^2}{2}\right] = \frac{162}{1} - \frac{81}{2} = \frac{324-81}{2}$$

$$= \frac{243}{2}$$ ans.