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COURSE: MAT 104
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ASSIGNMENT

~~1) Find the derivative of the fle following using first principle~~

~~a) $y = \sin\left(\frac{3}{x^2}\right)$~~

Integrate the following with respect to their variables.

1) $3te^{2t}$

$u = 3t$ $\qquad dv = e^{2t}$

$du = 3dx$ $\qquad v = \frac{e^{2t}}{2}$

$\int u\,dv = uv - \int v\,du$

$= 3t \times \frac{e^{2t}}{2} - \int \frac{e^{2t}}{2} . 3dx$

$= \frac{3te^{2t}}{2} - \int \frac{3e^{2t}}{2} dx = \frac{3te^{2t}}{2} - \frac{1}{2}\int 3e^{2t} dx$

$= \frac{3te^{2t}}{2} - \left[\frac{3e^{2t}}{2(2)} dx\right]$

$= \left[\frac{3te^{2t}}{2} - \frac{3e^{2t}}{4} dx\right] + c$

2) ~~$x^2 \sin x$~~ $\int x^2 \sin x\,dx$

$u = x^2$ $\qquad dv = \sin x$

$du = 2x\,dx$ $\qquad v = -\cos x$

$\int u\,dv = uv - \int v\,du$

$= x^2 \times -\cos x - \int -\cos x . 2x\,dx$

$= -x^2\cos x + \int \cancel{\cos}\, 2x\cos x\,dx$

$= -x^2\cos x + \int \begin{cases} u = 2x & dv = \cos x \\ du = 2dx & v = \sin x \end{cases}$

$\hookrightarrow 2x \times \sin x - \int \sin x \cdot 2dx$

$= -x^2\cos x + 2x\sin x - \int 2\sin x$

$= -x^2\cos x + 2x\sin x - [-2\cos x]$

$= [-x^2\cos x + 2x\sin x + 2\cos x] + c$

3.) $\int \sin 7x \cos 2x$

$A = 7x \quad B = 2x$

$\sin A \cos B = \frac{1}{2}[\sin(7x+2x) + \sin(7x-2x)]$

$\int \sin A \cos B = \frac{1}{2}[\sin 9x + \sin 5x]$

$= \frac{1}{2}\left[\frac{-\cos 9x}{9} \cancel{+} - \frac{\cos 5x}{5}\right]$

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

4.) $\int \frac{(2x-3x^2)}{1-x} = \int \frac{-3x^2+2x}{-x+1}$

First divide out to have

$$\begin{array}{r|l} & 3x+1 \\ \hline -x+1 & -3x^2+2x \\ & \underline{-3x^2+3x} \\ & \quad -x \\ & \quad \underline{-x+1} \\ & \quad\quad 1 \end{array}$$

$\int (3x+1)dx + \int \frac{1}{-x+1}$

$$= \cancel{\frac{3x^2}{2} + x +} \frac{3x^2}{2} + x - \ln(-x+1) + c$$