③ $\int x^2 \sin x$ $u = x^2$ $du = 2x$
$dv = \sin x\,dx$ $v = -\cos x$

$\int u\,dv = uv - \int v\,du$
$= x^2(-\cos x) - \int -\cos x \cdot 2x\,dx$
$= -x^2\cos x - \int -2x\cos x$
$= -x^2\cos x + 2x\sin x - 1$
$= -x^2\cos x - \int -2x\cos x - a$

↑ integrate this by parts

$-x^2\cos x - -2x\sin x - \int \sin x$ let $u = -2x$
$du = -\cos x\,dx$
$dv = -2$
$v = \sin x$
$-x^2\cos x + 2x\sin x - \int \sin x \cdot -2$
$-x^2\cos x + 2x\sin x + \cos x \cdot -2$
$-x^2\cos x + 2x\sin x + 2\cos x + C$ //

④ $\cos 5x \cos 6x$
recall: ~~$\cos A \cos B = \cos \Lambda$~~

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

$A = 5x, B = 6x$ $= \frac{1}{2}[\sin(5x+6x) - \sin(5x-6x)]$
$= \frac{1}{2}[\sin 11x + \sin x]$
$= \frac{1}{2}\int \sin 11x + \sin x$
$= \frac{1}{2}\left[\frac{-\cos 11x}{11} - \cos x\right]$
$= -\frac{\cos 11x}{22} - \frac{\cos x}{2} + C$ //

⑤ $\sin 7$
recall
$A = 7x$

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19/MHS01/308 — Medicine and Surgery
MAT 104 Assignment

① $\int 2x^2 \ln x \, dx$

Let $u = \ln x$ $\quad du = \frac{1}{x}$

$dv = 2x^2 dx$ $\quad v = \frac{2x^3}{3}$

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

$= \ln x \times \frac{2x^3}{3} - \int \frac{2x^3}{3} \cdot \frac{1}{x}$

$= \ln x \times \frac{2x^3}{3} - \int \frac{2x^3}{3x}$

$= \frac{2x^3}{3} \ln x - 2\int \frac{x^2}{3} dx$

$= \frac{2}{3}x^3 \ln x - \frac{2x^3}{4}$

$= \frac{2}{3} \ln x^3 \ln x - \frac{1}{2}x^3$

$= \frac{2x^3}{3} \ln x - \frac{x^3}{2} + C$

② $\int 3t\, e^{2t} \, dx$

Let $u = 3t$ $\quad du = 3$

$dv = e^{2t} dx$ $\quad v = \frac{1}{2}e^{2t}$

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

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

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

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

$= \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + C$

(5) $\sin 7x \cos 2x$

recall: $\cos A \cos B = \frac{1}{2}\left[\sin(A+B) + \sin(A-B)\right]$

$A = 7x, \; B = 2x$ $= \frac{1}{2}\left[\sin(7x+2x) + \sin(7x-2x)\right]$

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

$= \frac{1}{2}\int \sin 9x + \sin 5x$

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

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

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