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19/MHS01/276
MEDICINE & SURGERY

1) $2x^2 \ln x$

$u = \ln x \quad dv = 2x^2$

$\frac{du}{dx} = \frac{1}{x} \quad v = \frac{2x^3}{3}$

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

$\int u\,dv = \ln x \times \frac{2x^3}{3} - \int \frac{2x^3}{3} \times \frac{1}{x}$

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

$\int u\,dv = \ln x \times \frac{2x^3}{3} - \frac{2x^3}{3} \times \frac{1}{4}$

$\int u\,dv = \frac{2x^3 \ln x}{3} - \frac{x^3}{6}$

$\int u\,dv = \frac{x^3}{3}\left(2\ln x - \frac{1}{2}\right) + c$

2) $3te^{2t}$

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

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

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

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

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

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

$\int 3te^{2t} = \frac{3e^{2t}}{2}\left(t - \frac{1}{2}\right) + c$

3) $x^2 \sin$ ...

3. $x^2 \sin x$

Solution

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

$\frac{du}{dx} = 2x \qquad v = -\cos x$

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

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

$\int x^2 \sin x = -x^2 \cos x + \Big[\quad u = 2x \qquad dv = \cos x$

$\qquad \frac{du}{dx} = 2 \qquad v = \sin x \Big]$

$\cancel{x^2 co}$

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

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

$\int x^2 \sin x = -x^2 \cos x + \Big[2x \sin x - (-2\cos x) \Big]$

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

$= \cancel{\cos x [2 - x^2] + 2}$ divide through by $\cancel{x \cos x}$ $2\cos x$

$= \frac{-x^2 \cos x}{2\cos x} + \frac{2x \sin x}{2\cos x} + \frac{2\cos x}{2\cos x}$

$\frac{-x^2}{2} + x\tan x + 1 + c$

4. $\cos 5x \cos 6x$ when $A = 5x, B = 6x$

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

$= \frac{1}{2}\left[\cos(5x+6x) - \cos(5x-6x)\right]$

$= \frac{1}{2}\left[\cos(11x) + \cos x\right]$

$\int \cos 5x \cos 6x = \frac{1}{2}\left[\frac{\sin 11x}{11} + \sin x\right] + C$

5. $\sin 7x \cos 2x$

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

when $A = 7x$, $B = 2x$

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

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

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

$= \frac{1}{2}\left[\cancel{\frac{\sin 9x}{9}}\right.$

$= \frac{1}{2}\left(-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right)$

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

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