$\Rightarrow \int \cos(u)\,du = \sin(u)$

$\Rightarrow \frac{1}{11}\int \cos u\,(du)$

$= \frac{\sin(u)}{11}$ $\therefore$ undo substitution $u = 11x$

$\Rightarrow \frac{\sin(11x)}{11}$

$\int \cos x\,dx = \sin x$

$\Rightarrow \frac{1}{2}\int \cos(11x)\,dx + \frac{1}{2}\int \cos(x)\,dx$

$= \frac{\sin(11x)}{22} + \frac{\sin(x)}{2}$

$\therefore \int \cos(5x)\cos(6x)\,dx$

$\Rightarrow \frac{\sin(11x)}{22} + \frac{\sin(x)}{2} + C$

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

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

$= \int \frac{\sin(9x) + \sin(5x)}{2}\,dx$

$= \frac{1}{2}\int \sin(9x)\,dx + \frac{1}{2}\int \sin(5x)\,dx$.

$\Rightarrow \int \sin(9x)\,dx$. Now substitute $9x = u$

$\Rightarrow \frac{1}{9}\int \sin(u)\,du$,

$\Rightarrow \int \sin u\,du = -\cos(u)$

$\Rightarrow \frac{1}{9}\int \sin u\,(du) = -\frac{\cos(u)}{9}$

Undo subscitution $u = 9x$

$$= \frac{-\cos(9x)}{9}$$

$$\Rightarrow \int \sin(5x)\,dx$$

$\Rightarrow$ Subscitute $5x$ for u

$$\Rightarrow \frac{1}{5}\int \sin(u)\,du.$$

$$\int \sin u\,du$$

$$= -\cos u.$$

$$\Rightarrow \frac{1}{5}\int \sin(u)\,du = \frac{-\cos(u)}{5}.$$

$$\Rightarrow \frac{1}{2}\int \sin(9x)\,dx + \frac{1}{2}\int \sin(5x)\,dx$$

$$= \frac{-\cos(9x)}{18} - \frac{\cos(5x)}{10}$$

$$\therefore \int \sin(7x)\cos(2x)\,dx$$

$$\Rightarrow \frac{-\cos(9x)}{18} - \frac{\cos(5x)}{10}$$

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ASSIGNMENT.

Integrate the following functions

1. $2x^2 \ln x$.

Solution.

$2 \ln x^3$

$\Rightarrow 2\ln \cdot \int x^3 dx$

$\int x^3 dx = \int x^n dx = \frac{x^{n+1}}{n+1}$ with $n = 3$

$= \frac{x^4}{4}$

$\Rightarrow 2\ln \cdot \int x^3 dx$

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

$\Rightarrow \frac{\ln x^4}{2} + c$

2. $3te^{2t}$.

$\Rightarrow 3e^2 \cdot \int t^2 dt$.

$\int t^2 dt$

$\Rightarrow \int t^n dt = \frac{t^{n+1}}{n+1}$ with $n = 2$.

$= \frac{t^3}{3}$

$3e^2 \cdot \int t^2 dt$

$\Rightarrow e^2 t^3$

$\therefore \int 3e^2 t^2 dt$

$= e^2 t^3 + c$

3. $x^2 \sin x$.

$x^2 \sin x$

$\Rightarrow -x^2 \cos(x) - \int -2x \cos(x)\, dx$

$\Rightarrow \int -2x \cos x\, dx$

$\Rightarrow -2 \int x \cos x\, dx$

$\int x \cos x\, dx$

$\Rightarrow x \sin(x) - \int \sin x\, dx$

$\Rightarrow \int \sin x\, dx = -\cos(x).$

$\Rightarrow x \sin(x) - \int \sin(x)\, dx$

$= x \sin(x) + \cos(x).$

$\Rightarrow -2 \int x \cos x\, dx$

$= -2x \sin(x) - 2\cos(x)$

$-x^2 \cos x - \int -2x \cos(x)\, dx$

$= 2x \sin(x) - x^2 \cos(x) + 2\cos(x)$

$\therefore \int x^2 \sin x\, dx = 2x \sin x + (2 - x^2) \cos x + C$

4. $\cos 5x \cos 6x$.

$\int \cos 5x \cos 6x\, dx = \int \frac{\cos(11x) + \cos(x)}{2}\, dx$

$= \frac{1}{2} \int \cos(11x)\, dx + \frac{1}{2} \int \cos(x)\, dx$

$= \int \cos(11x)\, dx = \frac{1}{11} \int \cos(u)\, du.$