$$\int u \frac{dv}{dx}\, dx = uv - \int v \frac{du}{dx}\, dx$$

1/

$$\int x \quad \sin x \quad dx$$

$$u = x \qquad \frac{dv}{dx} = \sin x$$

$$\frac{du}{dx} = 1 \qquad v = -\cos x$$

$$-x \cos x - \int -\cos x \quad dx$$

$$-x \cos x - - \sin x + c$$

$$-x \cos x + \sin x + c$$

$$\underline{\sin x - x \cos x + c}$$

2/ $\int 2x\ e^x \ dx$

$u = 2x \quad \frac{dv}{dx} = e^x$

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

$2x\,e^x - \int 2\,e^x \ dx$

$\underline{2x\,e^x - 2e^x + C}$

3/ $\int x \ \sec^2 x \ dx$

$u = 2x \quad \frac{dv}{dx} = \sec^2 x$

$\frac{du}{dx} = 2 \quad v = \tan x$

$2x \tan x - \int 2 \tan x \ dx$

$2x \tan x - 2 \ln|\sec x| + C$

4/ $\int x\, e^{3x}\, dx$

$u = x \qquad \frac{dv}{dx} = e^{3x}$

$\frac{du}{dx} = 1 \qquad v = \frac{1}{3}e^{3x}$

$\frac{1}{3}x e^{3x} - \int \frac{1}{3}e^{3x}\, dx$

$\frac{1}{3}x e^{3x} - \frac{1}{9}e^{3x} + c$

5/ $\int_0^{\pi/6} 2x \cos x\, dx$

$u = 2x \qquad \frac{dv}{dx} = \cos x$

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

$\left[2x \sin x - \int 2 \sin x\, dx \right]_0^{\pi/6}$

$\left[2x \sin x + 2 \cos x \right]_0^{\pi/6}$

$\left[2\left(\frac{\pi}{6}\right) \sin\left(\frac{\pi}{6}\right) + 2 \cos\left(\frac{\pi}{6}\right) \right] - \left[0 + 2\cos(0) \right]$

$\left(\frac{\pi}{6} + \sqrt{3} \right) - 2$

$\frac{\pi}{6} + \sqrt{3} - 2$

6/

$$\int x^2 e^x \, dx$$

$u = x^2 \qquad \frac{dv}{dx} = e^x$

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

$$x^2 e^x - \int 2x e^x \, dx$$

$u = 2x \qquad \frac{dv}{dx} = e^x$

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

$$x^2 e^x - \left[2x e^x - \int 2 e^x \, dx \right]$$

$$x^2 e^x - 2x e^x + 2 e^x + C$$

7/ $\int \ln x \quad dx$

$u = \ln x \qquad \frac{dv}{dx} = 1$

$\frac{du}{dx} = \frac{1}{x} \qquad v = x$

$x \ln x - \int 1 \quad dx$

$\underline{x \ln x - x}$

8/ $\int_1^2 x^2 \ln x \quad dx$

$u = \ln x \qquad \frac{dv}{dx} = x^2$

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

$\left[\frac{1}{3}x^3 \ln x - \int \frac{1}{3}x^2 \, dx \right]_1^2$

$\left[\frac{1}{3}x^3 \ln x - \frac{1}{9}x^3 \right]_1^2$

$\left[\frac{8}{3}\ln 2 - \frac{8}{9} \right] - \left[-\frac{1}{9} \right]$

$\frac{8}{3}\ln 2 - \frac{7}{9}$