$\frac{d}{dx}\sin x = \cos x$

$\frac{d}{dx}\cos x = -\sin$

① $\int 3te^{2t}\,dt$

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

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

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

$du = 3dt$

$\therefore uv - \int v\,du$

$= 3t\left(\frac{e^{2t}}{2}\right) - \int e^{2t}\,3dt$

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

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

$= \frac{3e^{2t}(t-1)}{2} + C$

② $\int x^2 \sin x$

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

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

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

$du = 2x\,dx$

$\therefore uv - \int v\,du$

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

$x^2\cos x + \int \cos x\, 2x\,dx$

$u = 2x \quad dv = \cos x$

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

$du = 2dx$

$2x\sin x - 2\int \sin x\,dx$

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

$2x\sin x + 2\cos x$

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

$+ C$

④ $\int \frac{(2x-3x^2)}{1-x}$

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

$$\therefore \int \frac{2x-3x^2}{1-x} = \int 3x+1 + \int \frac{1}{1-x}$$

$$= 3\int x + \int 1 + \ln(1-x) + C$$

$$= \frac{3x^2}{2} + x + \ln(1+x) + C$$