EXERCISE SET 8.2

1. $u = x,\ dv = e^{-2x}dx,\ du = dx,\ v = -\frac{1}{2}e^{-2x}$;

$$\int xe^{-2x}dx = -\frac{1}{2}xe^{-2x} + \int \frac{1}{2}e^{-2x}dx = -\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + C$$

2. $u = x,\ dv = e^{3x}dx,\ du = dx,\ v = \frac{1}{3}e^{3x}$; $\int xe^{3x}dx = \frac{1}{3}xe^{3x} - \frac{1}{3}\int e^{3x}dx = \frac{1}{3}xe^{3x} - \frac{1}{9}e^{3x} + C$

3. $u = x^2,\ dv = e^x dx,\ du = 2x\,dx,\ v = e^x$; $\int x^2e^x dx = x^2e^x - 2\int xe^x dx.$

For $\int xe^x dx$ use $u = x,\ dv = e^x dx,\ du = dx,\ v = e^x$ to get

$$\int xe^x dx = xe^x - e^x + C_1 \text{ so } \int x^2e^x dx = x^2e^x - 2xe^x + 2e^x + C$$

4. $u = x^2,\ dv = e^{-2x}dx,\ du = 2x\,dx,\ v = -\frac{1}{2}e^{-2x}$; $\int x^2e^{-2x}dx = -\frac{1}{2}x^2e^{-2x} + \int xe^{-2x}dx$

For $\int xe^{-2x}dx$ use $u = x,\ dv = e^{-2x}dx$ to get

$$\int xe^{-2x}dx = -\frac{1}{2}xe^{-2x} + \frac{1}{2}\int e^{-2x}dx = -\frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + C$$

so $\int x^2e^{-2x}dx = -\frac{1}{2}x^2e^{-2x} - \frac{1}{2}xe^{-2x} - \frac{1}{4}e^{-2x} + C$

5. $u = x,\ dv = \sin 3x\,dx,\ du = dx,\ v = -\frac{1}{3}\cos 3x$;

$$\int x\sin 3x\,dx = -\frac{1}{3}x\cos 3x + \frac{1}{3}\int \cos 3x\,dx = -\frac{1}{3}x\cos 3x + \frac{1}{9}\sin 3x + C$$