1 Using integration by parts, show that

$$\int x \cos x \ dx = x \sin x + \cos x + c.$$

2 Use integration by parts to find

a $\int x e^x \ dx$　　　　　**b** $\int 4x \sin x \ dx$　　　　　**c** $\int x \cos 2x \ dx$

d $\int x\sqrt{x+1} \ dx$　　　　**e** $\int \dfrac{x}{e^{3x}} \ dx$　　　　　**f** $\int x \sec^2 x \ dx$

3 Using

　i integration by parts,
　ii the substitution $u = 2x + 1$,

　find $\int x(2x + 1)^3 \ dx$, and show that your answers are equivalent.

4 Show that

$$\int_0^2 x e^{-x} \ dx = 1 - 3e^{-2}.$$

5 Evaluate

a $\int_0^{\frac{\pi}{6}} x \cos x \ dx$　　　　**b** $\int_0^1 x e^{2x} \ dx$　　　　**c** $\int_0^{\frac{\pi}{4}} x \sin 3x \ dx$

6 Using integration by parts twice in each case, show that

a $\int x^2 e^x \ dx = e^x(x^2 - 2x + 2) + c$,

b $\int e^x \sin x \ dx = \frac{1}{2} e^x(\sin x - \cos x) + c$.

7 Find

a $\int x^2 \sin x \ dx$　　　　**b** $\int x^2 e^{3x} \ dx$　　　　**c** $\int e^{-x} \cos 2x \ dx$

8 **a** Write down the derivative of $\ln x$ with respect to x.
　b Use integration by parts to find

$$\int \ln x \ dx.$$

9 Find

a $\int \ln 2x \ dx$　　　　**b** $\int 3x \ln x \ dx$　　　　**c** $\int (\ln x)^2 \ dx$

10 Evaluate

a $\int_{-1}^0 (x + 2)e^x \ dx$　　　**b** $\int_1^2 x^2 \ln x \ dx$　　　**c** $\int_{\frac{1}{3}}^1 2x e^{3x-1} \ dx$

d $\int_0^3 \ln (2x + 3) \ dx$　　　**e** $\int_0^{\frac{\pi}{2}} x^2 \cos x \ dx$　　　**f** $\int_0^{\frac{\pi}{4}} e^{3x} \sin 2x \ dx$