

## Section 4: Integration by parts

## Crucial points

1. Be careful with signs when using the integration by parts formula

Example Find  $\int x \sin x \, dx$

✗ **Wrong**  $u = x \quad \frac{dv}{dx} = \sin x \Rightarrow v = -\cos x$

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

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

✓ **Right**  $u = x \quad \frac{dv}{dx} = \sin x \Rightarrow v = -\cos x$

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

$$= -x \cos x + \int \cos x \, dx$$

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

2. When using the integration by parts formula, remember to integrate to find 'v' rather than differentiating.

Example Find  $\int x e^{2x} \, dx$

✗ **Wrong**  $\int x e^{2x} \, dx \quad u = x, \frac{dv}{dx} = e^{2x} \Rightarrow v = 2e^{2x} \text{ (etc)}$

✓ **Right**  $\int x e^{2x} \, dx \quad u = x, \frac{dv}{dx} = e^{2x} \Rightarrow v = \int e^{2x} \, dx = \frac{1}{2} e^{2x} \text{ (etc)}$