

MATH 3D Prep: Integration by Parts

Facts to Know:

Steps of integrating by parts:

1. Choose u and dv such that the integral you want to calculate is $\int u dv$.
2. Calculate du and v .
3. Conclude that $\int u dv = uv - \int v du$

Examples:

1. Evaluate $\int 3xe^{2x} dx$.

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

$$du = 3 dx \quad v = \frac{1}{2} e^{2x}$$

$$\int 3xe^{2x} dx = \int u dv$$

$$= uv - \int v du$$

$$= \frac{3}{2} x e^{2x} - \int \frac{1}{2} e^{2x} \cdot 3 dx$$

$$= \frac{3}{2} x e^{2x} - \frac{3}{2} \int e^{2x} dx$$

$$= \frac{3}{2} x e^{2x} - \frac{3}{4} e^{2x} + C$$

2. Evaluate $\int e^x \cos(x) dx$.

$$u = e^x \quad dv = \cos(x) dx$$

$$du = e^x dx \quad v = \sin(x)$$

$$I = \int u dv = uv - \int v du = e^x \sin(x) - \int e^x \sin(x) dx$$

$$-\int e^x \sin(x) dx = \int e^x \cdot (-\sin(x) dx) = \int$$

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$$\left(\begin{array}{l} u = e^x, \quad dv = -\sin(x) dx \\ du = e^x dx, \quad v = \cos(x) \end{array} \right)$$