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

Choose u to be the first part appearing in the acronym:

**L**ogarithmic
**I**nverse Trig
**A**lgebraic
**T**rigonometric
**E**xponential

Ex:

$$\int \underbrace{x}_{\substack{u \\ \text{algebraic}}} \underbrace{e^x\,dx}_{\substack{dv \\ \text{exponential}}}$$

Ex: $\int \underbrace{x}_{\text{alg}} \underbrace{\cos x}_{\text{trig}}\,dx$

$$\left(\begin{array}{ll} u = x & dv = \cos x\,dx \\ du = dx & v = \sin x \end{array}\right)$$

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

$$= \boxed{x\sin x + \cos x + C}$$

Ex: $\int x \ln x \, dx$ $\quad \begin{pmatrix} u = \ln x & dv = x\,dx \\ du = \frac{1}{x}dx & v = \frac{1}{2}x^2 \end{pmatrix}$

$$= \frac{1}{2}x^2 \ln x - \int \frac{1}{2}x^2 \cdot \frac{1}{x}\,dx = \frac{1}{2}x^2 \ln x - \int \frac{1}{2}x\,dx$$

$$= \boxed{\frac{1}{2}x^2 \ln x - \frac{1}{4}x^2 + C}$$

Ex: $\int x^2 e^x \, dx$ $\quad \begin{pmatrix} u = x^2 & dv = e^x dx \\ du = 2x\,dx & v = e^x \end{pmatrix}$

$$= x^2 e^x - \int 2x e^x \, dx \quad \begin{pmatrix} u = 2x & dv = e^x dx \\ du = 2\,dx & v = e^x \end{pmatrix}$$

$$= x^2 e^x - \left(2xe^x - \int 2e^x \, dx\right)$$

$$= \boxed{x^2 e^x - 2xe^x + 2e^x + C}$$

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Ex: $\int \ln x \, dx$ $\quad \begin{pmatrix} u = \ln x & dv = dx \\ du = \frac{1}{x}dx & v = x \end{pmatrix}$

$$= x \ln x - \int x \cdot \frac{1}{x}\,dx = x \ln x - \int 1 \cdot dx$$

$$= \boxed{x \ln x - x + C}$$

$\underline{\text{Ex}}$: $\int \arctan x \, dx$ $\left( \begin{array}{ll} u = \arctan x & dv = dx \\ du = \frac{1}{1+x^2}\,dx & v = x \end{array} \right)$

$= x\arctan x - \int \frac{x}{1+x^2}\,dx$ $\left( \begin{array}{l} u = 1+x^2 \\ du = 2x\,dx \\ \hookrightarrow \frac{1}{2}du = x\,dx \end{array} \right)$

$= x\arctan x - \frac{1}{2}\int \frac{1}{u}\,du$

$= x\arctan x - \frac{1}{2}\ln|u| + C$

$= \boxed{x\arctan x - \frac{1}{2}\ln|1+x^2| + C}$

$\underline{\text{Ex}}$: $\int \arcsin x \, dx$ $\left( \frac{d}{dx}[\arcsin x] = \frac{1}{\sqrt{1-x^2}} \right)$

$\left( \begin{array}{ll} u = \arcsin x & dv = dx \\ du = \frac{1}{\sqrt{1-x^2}}\,dx & v = x \end{array} \right)$

$\int \arcsin x \, dx = x\arcsin x - \int \frac{x}{\sqrt{1-x^2}}\,dx$ $\left( \begin{array}{l} u = 1-x^2 \\ du = -2x\,dx \end{array} \right)$

$= x\arcsin x + \frac{1}{2}\int \frac{1}{\sqrt{u}}\,du = x\arcsin x + \frac{1}{2}\int u^{-1/2}\,du$

$= x\arcsin x + u^{1/2} + C = \boxed{x\arcsin x + \sqrt{1-x^2} + C}$

Ex: $\int e^x \sin x \, dx$ $\quad \begin{pmatrix} u = \sin x & dv = e^x dx \\ du = \cos x \, dx & v = e^x \end{pmatrix}$

$$= e^x \sin x - \int e^x \cos x \, dx \quad \begin{pmatrix} u = \cos x & dv = e^x dx \\ du = -\sin x \, dx & v = e^x \end{pmatrix}$$

$$= e^x \sin x - \left( e^x \cos x - \int -e^x \sin x \, dx \right)$$

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

$$\underbrace{\int e^x \sin x \, dx}_{+\int e^x \sin x \, dx} = e^x \sin x - e^x \cos x \cancel{- \underbrace{\int e^x \sin x \, dx}_{+\int e^x \sin x \, dx}}$$

$$2 \int e^x \sin x \, dx = e^x \sin x - e^x \cos x + C$$

$$\hookrightarrow \boxed{\int e^x \sin x \, dx = \frac{1}{2} \left( e^x \sin x - e^x \cos x \right) + C}$$