Integration by parts

"Integration by parts" is a technique of integration that is used when integrating products of algebraic functions with transcendental functions such as $\int x \ln x \, dx$ or $\int x^2 \sin x \, dx$, inverse trig functions, odd powers of $\csc$ and $\sec$, and the natural logarithm function.

Recall $\frac{d}{dx}(uv) =$

Recall $\int \frac{d}{dx}(uv)\, dx =$

$\therefore$ If u and v are functions of x and have continuous derivatives, then $\int u \, dv = uv - \int v \, du$.

Examples:

1. $\int xe^x dx$

Hint: Pick u so that du becomes simpler

Pick dv so that it can be integrated

2. $\int x^2 e^x \, dx$

3. $\int e^x \sin(2x) dx$

4. $\int \ln x \, dx$

5. $\int \frac{dx}{x(\ln x)^3}$

6. $\int x^3 e^{x^2} dx$

7. $\int x^2 \cos x \, dx$

8. $\displaystyle\int \frac{\ln 2x}{x^2}\,dx$

9. $\displaystyle\int \cos^{-1} x\,dx$

10. $\int \sec^3 x \, dx$