

Name: _____

Integration by Parts

Example: $\int x \ln x \, dx \rightarrow$

$u = \ln x$	$dv = x \, dx$
$du = \frac{dx}{x}$	$v = \frac{x^2}{2}$

 \rightarrow

uv	$-\int v \, du$
$\downarrow \quad \swarrow$	$\downarrow \quad \swarrow$
$\frac{x^2}{2} \ln x$	$-\int \frac{x^2}{2} \frac{dx}{x}$

$$\rightarrow \frac{x^2}{2} \ln x - \int \frac{x}{2} \, dx \rightarrow \frac{x^2}{2} \ln x - \frac{x^2}{4} + C$$

Remember that when the integrand includes a polynomial expression combined with a transcendental expression (non-polynomial like $\ln x$, $\sin x$, $\cos x$, etc.), use tabular integration

1) $\int \sqrt{t} \ln t \, dt$

2) $\int x^3 e^x \, dx$

$$3) \int x \csc^2 x \, dx$$

$$4) \int \cos x \ln(\sin x) \, dx \quad (\text{Hint: Substitution could also help here})$$

$$5) \int (\ln x)^2 \, dx \quad (\text{Hint: The answer to #4 could also help here})$$