

# Derivatives that show up regularly in Integration by Parts

u	du
x	1
nx	n
x <sup>n</sup>	nx <sup>n-1</sup>
sin x	cos x
cos x	-sin x
-sin x	-cos x
-cos x	sin x
ln x	1/x
ln x	1/x
ln -x	1/x
sec x	sec x tan x

u	du
n <sup>x</sup>	(ln n) n <sup>x</sup>
log <sub>n</sub> x	1/(x ln n)
e <sup>x</sup>	e <sup>x</sup>
arcsin x aka sin <sup>-1</sup> x	1/√(1-x <sup>2</sup> )
arccos x aka cos <sup>-1</sup> x	-1/√(1-x <sup>2</sup> )
arctan x aka tan <sup>-1</sup> x	1/(x <sup>2</sup> +1)

aka means **Also Known As**

Note: this is *not* a complete list of derivatives & integrals, but it will get you started.

# INTEGRATION

BY PARTS

Facts to have on hand

dv	v	dv	v
n	nx	sin x	-cos x
x <sup>n</sup>	x <sup>n+1</sup> / n+1	cos x	sin x
1/x	ln x	-cos x	-sin x
e <sup>x</sup>	e <sup>x</sup>	-sin x	cos x
n <sup>x</sup>	n <sup>x</sup> / ln(n)	cot x	ln sin x
		sec <sup>2</sup> x	tan x
		csc <sup>2</sup> x	-cot x
ln x	x ln x - x		
sec x	ln( sec x + tan x )		
sec x tan x	sec x		
csc x	ln( csc x + cot x )		

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

Facts to have handy when evaluating

dv	v	dv	v
e <sup>2x</sup>	e <sup>2x</sup> / 2	sin 4x	-cos 4x
e <sup>-3x</sup>	-e <sup>-3x</sup> / 3	cos 4x	sin 4x
e <sup>2x</sup>	e <sup>2x</sup> / 2	sin 4x	-cos 4x
e <sup>-3x</sup>	-e <sup>-3x</sup> / 3	cos 4x	sin 4x
e <sup>2x</sup>	e <sup>2x</sup> / 2	sin 4x	-cos 4x
e <sup>-3x</sup>	-e <sup>-3x</sup> / 3	cos 4x	sin 4x
e <sup>2x</sup>	e <sup>2x</sup> / 2	sin 4x	-cos 4x
e <sup>-3x</sup>	-e <sup>-3x</sup> / 3	cos 4x	sin 4x

**Chain Rule:**  $\frac{d}{dx} f(g(x)) = f'(g(x)) \cdot g'(x)$   
**Product Rule:**  $\frac{d}{dx} [f(x)g(x)] = f(x)g'(x) + g(x)f'(x)$

u	du	v	dv
ex	e <sup>x</sup>	x <sup>2</sup>	2x
e <sup>-1</sup> x	e <sup>-1</sup>	x	1
e <sup>3x</sup>	3e <sup>3x</sup>	x <sup>2</sup>	2x
e <sup>-x</sup>	-e <sup>-x</sup>	x	1
2e <sup>x</sup>	2e <sup>x</sup>	x <sup>2</sup>	2x
u	du	x	1
u	du	x <sup>2</sup>	2x
u	du	x <sup>3</sup>	3x <sup>2</sup>

Tabular Integration:  $\int x^n \sin x \, dx = ?$

signs  $n = x^4$   
 $dv = \sin x \, dx$

(+) x<sup>4</sup> sin x

(-) 4x<sup>3</sup> -cos x

(+) 12x<sup>2</sup> -sin x

(-) 24x cos x

(+) 24 sin x

0

-x<sup>4</sup> cos x + 4x<sup>3</sup> sin x +

12x<sup>2</sup> cos x - 24x sin x - 24 cos x + C

• Rearrange:  $\int u \, dv = uv - \int v \, du$  IBP formula:  
 (hey, remember to finish evaluations by attaching + C to indefinite integrals)

• Rewritten:  $uv = \int u \, dv + \int v \, du$

$g(x) = v$       $g'(x) \, dx = dv$   
 $f(x) = u$       $f'(x) \, dx = du$

• Rewrite in IBP friendly notation such that:  
 $f(x)g(x) = \int f'(x)g(x) \, dx + \int g(x)f'(x) \, dx$   
 Integrate all terms in the Product Rule:

Four Steps from Product Rule to IBP formula