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Integration II Handout #16

$f(x)$	$\int f(x)\,dx$
K , K is a Constant Examples: $\int 5\,dx$ $\int dx$	Kx + C 5x + C x + C
x^n , $n \neq -1$ Examples: $\int x^7 dx$ $\int (2x^3 - 5x - 1)dx$	$\frac{x^{n+1}}{n+1}$ + C $\frac{x^{7+1}}{7+1} + C = \frac{x^8}{8} + C$ $2\frac{x^4}{4} - 5\frac{x^2}{2} - x + C = \frac{x^4}{2} - \frac{5x^2}{2} - x + C$
e^x e^{ax} Examples: $\int e^{3x} dx$ $\int e^x (e^x - 2)dx$	e^x + C $\frac{1}{a}e^{ax}$ + C $\frac{1}{3}e^{3x}$ + C $\int (e^{2x} - 2e^x)dx = \frac{1}{2}e^{2x} - 2e^x + C$
$\int \frac{dx}{x}$ $\int \frac{dx}{ax+b}$ Example: $\int (t+1-\frac{4}{t+2})dt$	Ln x + C $\frac{1}{a}\ln(ax+b)$ $\frac{t^2}{2} + t - 4\ln(t+2) + C$

$f(x)$	$\int f(x)\,dx$
Sinx Sin ax Example: $\int (x+\sin 2x)dx$	- Cos x + C $\frac{-1}{a}Cos\,ax$ + C $\frac{x^2}{2}-\frac{1}{2}\cos 2x$ + C
Cosx Cos ax Example: $\int (2+\cos 3x)dx$	Sin x + C $\frac{1}{a}Sin\,ax$ + C $2+\frac{1}{3}\sin 3x$ + C

Example:

Calculate: $\int_1^2 \frac{\sin(\ln x)}{x}\,dx$

Let u = ln x $\Rightarrow$ du = $\frac{dx}{x}$ $\Rightarrow \int_1^2 \frac{\sin(\ln x)}{x}\,dx = \int_1^2 \sin u\,du$ = -cos u

$= \left[-\cos(\ln x)\right]_1^2$ = -cos(ln2) – [-cos(ln1)] = -cos(ln2) + cos 0

= -cos(ln2) + 1 = 1 – cos(ln2) *{since ln1 = 0 }*

Example: $\int te^{t^2}dt$

Let u = t^2 $\Rightarrow$ du = 2t dt $\Rightarrow$ t dt = $\frac{du}{2}$

$\int te^{t^2}dt = \int e^u \frac{du}{2} = \frac{1}{2}\int e^u du = \frac{1}{2}e^u + C = \frac{1}{2}e^{t^2} + C$