

# How do I integrate that!?

is it in the form  $\frac{dy}{dx} = f(y)g(x)$ ? A combination of variables that need to be separated?

YES

then separate the variables

$$\frac{dy}{dx} = f(x)g(y) \Rightarrow \int \frac{1}{g(y)} dy = \int f(x) dx$$

Done?

Use standard integral functions and adjust for any simple chain rules

YES

is it a standard result?  
(use the formula book if unsure and triggy)

NO

is it a subtle reverse chain rule?

YES

$$\int \frac{f'(x)}{f(x)} dx = \ln|f(x)| + c$$

$$\int f'(x)[f(x)]^n dx = \frac{[f(x)]^{n+1}}{n+1} + c \quad (n \neq -1)$$

$\frac{f'(x)}{f(x)}$  or  $f'(x)[f(x)]^n$

$\sin^5 x \cos x$   $\int \frac{\sin x - \cos x}{\sin x + \cos x} dx$   $\frac{x}{(x^2 + 1)^2}$

NO

Use partial fractions to simplify the integral

YES

Is it in the form  $\frac{ax+b}{(x+c)(x+d)}$  or other fraction?

NO

Then use one!

YES

if trig is involved, can it be made into a standard result by rewriting  $\cos x$  or  $\sin x$  or by using a **trig identity**?

NO

Use integration by parts to simplify the integral

YES

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

use LATE to pick u

special case:  $\ln(x) = 1 \times \ln(x)$

Is the integral a product of 2 functions?

$$\int f(x)g(x) dx$$

NO

Use a substitution to make things easier  
(remember to find dx and replace so the integral is in respect to u)

NO

Is it made up from two (parametric) equations?

$$y = f(t), x = g(t),$$

eg.  $\int_0^9 y dx, x = t^2, y = 2t(3-t)$

YES

use  $\int y dx = \int y \frac{dx}{dt} dt$   
and change the limits

NO

Done?

(use the formula book if unsure and triggy)

Use a substitution to make things easier