Calculus

Contents

Basics

Elementary Derivatives

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

f	C	x^n	$\sin x$	$\cos x$	a^x	$\ln x$
f'	0	nx^{n-1}	$\cos x$	$-\sin x$	$a^x \ln a$	$\frac{1}{x}$

Composition Laws

Let f and g be differentiable functions over x.

The $'$ mark denotes the derivative with respect to x, so $f' = \frac{df}{dx}$ and $g' = \frac{dg}{dx}$.

The $\circ$ symbol denotes function composition, so $(f \circ g)(x) = f(g(x))$.

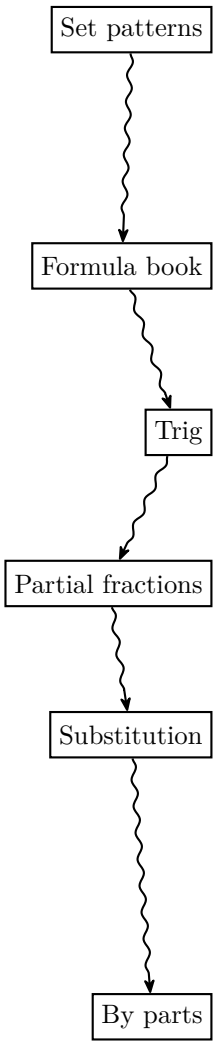
$$(f \pm g)' = f' \pm g'$$

$$(fg)' = fg' + f'g$$

$$(f \circ g)' = (f' \circ g)g'$$

$$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$$

Integration



If it's a pattern that you know, then just use the pattern. Here are some examples:

$\int kf'f^n \, dx$	f^{n+1}
$\int k\frac{f'}{f} \, dx$	$\ln \lvert f \rvert$

Some integrals are given in the formula book. These include many common trig-based integrals, as well as some fractions. Check the formula book before spending ages on a tricky integral.

Many integrals benefit from transforming their insides using trig identities. Integrating a trig function to a power is very hard. Try to apply identities to reduce it.

Large algebraic fractions are very awkward. Simplify them into partial fractions. These should then become natural logs and/or and inverse trig functions when integrated.

Integrals can often be simplified by using an appropriate substitution. Always remember to find $\mathrm{d}x$ in terms of $\mathrm{d}u$ and exchange the bounds of the integral.

Integrating by parts is the most complicated method, and should be avoided wherever possible. Use the following formula:

$$\int u\frac{\mathrm{d}v}{\mathrm{d}x}\,\mathrm{d}x = uv - \int v\frac{\mathrm{d}u}{\mathrm{d}x}\,\mathrm{d}x$$

Since the second integral involves $\dfrac{\mathrm{d}u}{\mathrm{d}x}$, we should choose u to be the function in the original integral that reduces the fastest. To find the function that reduces fastest, follow the acronym **LATE** - **L**ogs, **A**lgebra, **T**rig, **E**xponentials. Pick the function that comes first in the acronym.