# Functions & calculus - Notes

## Exponential Rules

*am* *x* *an* = *am* + *n* *a*-*m* = 1/*am*

= *am* – *n* (*am*)*n* = *amn*

(*ab*)*m* = *am* *bm* *a*0 = 1

## Rules for Logarithms

log (*ab*) = log(*a*) + log(*b*) log (*a*/*b*) = log(*a*) – log(*b*)

log (*an*) = *n* log(*a*) log*a* *a* = 1

log*a*1 = 0

## Rules for the summation and product functions

(*x*1 . *x*2 . *x*3 . … . *xn* ) (i.e. the product of *x*1, *x*2 until *xn*)

(*x*1 + *x*2 + *x*3 +….+ *xn* ) (i.e. the sum of x1, x2 until *xn*)

## Some rules for differentiation

*a* = 0 *ax* = *a*

*xn* = *n* *xn* – 1 loge(*x*) =

e*x* = e*x* e*F*(*x*)  = e*F*(*x*) = *F*’(*x*) e*F*(*x*)

(*F*(*x*)+*L*(*x*)) = *F*’(*x*) + *L*’(*x*)

(*F*(*x*) . *L*(*x*)) = *L*(*x*).*F*’(*x*) + *F*(*x*).*L*’(*x*)

(*F*(*x*)/*L*(*x*)) = - or

‘Chain rule’:

## Some important integrals

∫ *a* *dx* = *ax* ∫ *a* *f*(*x*) *dx* = *a* ∫ *f*(*x*) *dx*

∫ *xn* *dx* = ∫ *F*’(*x*) [*F*(*x*)]*n* *dx* =

∫ e*x**dx* = e*x* ∫ *F*’(*x*) e*F*(*x*)  *dx* = e*F*(*x*)

∫ *dx* = loge (*x*) ∫ *dx* = loge (*F*(*x*))

∫ (*F*(*x*) + *L*(*x*)) *dx* = ∫*F*(*x*) *dx* + ∫*L*(*x*) *dx*

Integrating by parts:

## Further material

Potentially useful websites:

1) <http://www.mathsrevision.net/alevel/>

Quite nice explanations of differentiation and integration.

2) <http://www.univie.ac.at/future.media/moe/tests.html>

Has some exercises on differentiation and other topics which may be useful.

3) <http://www.tech.plym.ac.uk/maths/resources/PDFLaTex/logs.pdf>

Useful material on logarithms. It’s part of the following website which contains other helpful stuff:

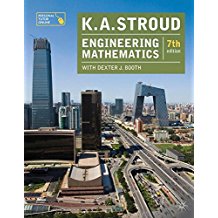
<http://www.tech.plym.ac.uk/maths/resources/PDFLaTex/mathaid.html>

Books:

*Quick Calculus 2nd Edition: A self-teaching guide* by Kleppner & Ramsey; published by Wiley.

Quite a few students have used the above book successfully in the past. It contains introductory chapters on basic algebra etc., so it covers most relevant material (but it has no material on matrices).

The following book is a bit more expensive (approx £35), but very good and covers everything you’ll need:



Engineering Mathematics

By K.A.Stroud and Dexter J. Booth

Published by Palgrave

7th Edition.