M.K. HOME TUITION

Mathematics Revision Guides

Level: A-Level Year 2

SUMMARY OF DIFFERENTIATION RESULTS

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(General rules)	
$f(x) \pm g(x)$	$f'(x) \pm g'(x)$
$kf(x)$	$kf'(x)$
(Polynomial)	
x^n	nx^{n-1}
$(ax+b)^n$	$an(ax+b)^{n-1}$
$(f(x))^n$	$nf'(x)(f(x))^{n-1}$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Inverse Trig) (radians !)	
$\sin^{-1}x$	$\frac{1}{\sqrt{(1-x^2)}}$
$\sin^{-1}(ax/b)$	$\frac{a}{\sqrt{b^2-a^2x^2}}$
$\cos^{-1}x$	$\frac{-1}{\sqrt{(1-x^2)}}$
$\cos^{-1}(ax/b)$	$\frac{-a}{\sqrt{b^2-a^2x^2}}$
$\tan^{-1}x$	$\frac{1}{1+x^2}$
$\tan^{-1}(ax/b)$	$\frac{ab}{b^2+a^2x^2}$
$\text{cosec}^{-1}x$	$\frac{-1}{x\sqrt{(x^2-1)}}$
$\sec^{-1}x$	$\frac{1}{x\sqrt{(x^2-1)}}$
$\cot^{-1}x$	$\frac{-1}{1+x^2}$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Trigonometric) (radians !)	
$\sin x$	$\cos x$
$\sin(ax+b)$	$a\cos(ax+b)$
$\sin^n x$	$n\sin^{n-1}x\cos x$
$\cos x$	$-\sin x$
$\cos(ax+b)$	$-a\sin(ax+b)$
$\cos^n x$	$-n\cos^{n-1}x\sin x$
$\tan x$	$\sec^2 x$
$\tan(ax+b)$	$a\sec^2(ax+b)$
$\tan^n x$	$n\tan^{n-1}x\sec^2 x$
$\text{cosec}\,x$	$-\text{cosec}\,x\cot x$
$\sec x$	$\sec x\tan x$
$\cot x$	$-\text{cosec}^2 x$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Exponential & Logarithmic)	
e^x	e^x
e^{ax+b}	ae^{ax+b}
$e^{f(x)}$	$f'(x)e^{f(x)}$
a^x	$a^x\ln a$
$\ln x$	$\frac{1}{x}$
$\ln(x^n)$	$\frac{n}{x}$
$\ln(f(x))$	$\frac{f'(x)}{f(x)}$

Version : 1.1 Date: 29-03-2013

SUMMARY OF STANDARD DERIVATIVES.

The list of derivatives below includes both the 'standard' ones plus some results obtained by easier application of the chain rule (highlighted). The list is not exhaustive – add some more of your own if it helps your revision !

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(General rules)	
$f(x) \pm g(x)$	$f'(x) \pm g'(x)$
$kf(x)$	$kf'(x)$
(Polynomial)	
x^n	nx^{n-1}
$(ax + b)^n$	$an(ax + b)^{n-1}$
$(f(x))^n$	$nf'(x)(f(x))^{n-1}$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Trigonometric) (radians !)	
$\sin x$	$\cos x$
$\sin (ax + b)$	$a \cos (ax + b)$
$\sin^n x$	$n \sin^{n-1} x \cos x$
$\cos x$	$-\sin x$
$\cos (ax + b)$	$-a \sin (ax + b)$
$\cos^n x$	$-n \cos^{n-1} x \sin x$
$\tan x$	$\sec^2 x$
$\tan (ax + b)$	$a \sec^2 (ax + b)$
$\tan^n x$	$n \tan^{n-1} x \sec^2 x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\sec x$	$\sec x \tan x$
$\cot x$	$-\operatorname{cosec}^2 x$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Exponential & Logarithmic)	
e^x	e^x
e^{ax+b}	ae^{ax+b}
$e^{f(x)}$	$f'(x)e^{f(x)}$
a^x	$a^x \ln a$
$\ln x$	$\frac{1}{x}$
$\ln (x^n)$	$\frac{n}{x}$
$\ln (f(x))$	$\frac{f'(x)}{f(x)}$

$y = f(x)$	$y' = \frac{dy}{dx} = f'(x)$
(Inverse Trigonometric) (radians !)	
$\sin^{-1}x$	$\frac{1}{\sqrt{(1-x^2)}}$
$\sin^{-1}(ax/b)$	$\frac{a}{\sqrt{b^2-a^2x^2}}$
$\cos^{-1}x$	$\frac{-1}{\sqrt{(1-x^2)}}$
$\cos^{-1}(ax/b)$	$\frac{-a}{\sqrt{b^2-a^2x^2}}$
$\tan^{-1}x$	$\frac{1}{1+x^2}$
$\tan^{-1}(ax/b)$	$\frac{ab}{b^2+a^2x^2}$
$\text{cosec}^{-1}x$	$\frac{-1}{x\sqrt{(x^2-1)}}$
$\sec^{-1}x$	$\frac{1}{x\sqrt{(x^2-1)}}$
$\cot^{-1}x$	$\frac{-1}{1+x^2}$

Note: The functions $\text{cosec}^{-1}\,x$ and $\sec^{-1}\,x$ come up very rarely at A-level. Also, the derivative of $\cos^{-1}(ax/b)$ is the same as that of $\sin^{-1}(ax/b)$ multiplied by –1. Similarly the derivative of $\cot^{-1}(ax/b)$ is the same as that of $\tan^{-1}(ax/b)$ multiplied by –1.