

Lesson 13

A-Level Pure Mathematics : Year 2 Differentiation III

13.1 Later Date Revision

Marks Available : 40

Table of Standard Derivatives

$f(x)$	$f'(x)$	In Formula Book ?
x^n	$n x^{n-1}$	No
e^x	e^x	No
$\ln x$	$\frac{1}{x}$	No
$\sin x$	$\cos x$	No
$\cos x$	$-\sin x$	No
$\tan x$	$\sec^2 x$	Yes
$\csc x$	$-\csc x \cot x$	Yes
$\sec x$	$\sec x \tan x$	Yes
$\cot x$	$-\csc^2 x$	Yes
$\arcsin x$	$\frac{1}{\sqrt{1-x^2}}$	Yes
$\arccos x$	$-\frac{1}{\sqrt{1-x^2}}$	Yes
$\arctan x$	$\frac{1}{1+x^2}$	Yes

Question 1

Show that the derivative with respect to x of

$$y = \sec x \tan x$$

is

$$\frac{dy}{dx} = \sec x (2 \sec^2 x - 1)$$

[4 marks]

Question 2

Show that the derivative with respect to x of;

$$y = \csc x \cot x$$

is

$$\frac{dy}{dx} = \csc x (1 - 2 \csc^2 x)$$

[4 marks]

Question 3

Consider the function;

$$f(x) = \frac{8}{(1 - 3x)^3}$$

Show that;

$$f'(1) = \frac{9}{2}$$

[4 marks]

Question 4

A-Level Examination Question from January 2009, Paper C3 (Edexcel)

Find the equation of the tangent to the curve

$$x = \cos(2y + \pi) \quad \text{at} \quad \left(0, \frac{\pi}{4}\right)$$

Give your answer in the form $y = ax + b$, where a and b are constants to be found.

[6 marks]

Question 5

The curve

$$y = \ln(x^2 - 3)$$

crosses the x -axis at A and B .

- (i) Find the coordinates of A and B

[3 marks]

- (ii) The normals at A and B meet at P .
Find the coordinates of P .

[5 marks]

Question 6

Show that the derivative of the inverse cotangent function

$$y = \operatorname{arccot} x$$

is

$$\frac{dy}{dx} = -\frac{1}{1+x^2}$$

The following trigonometry identity will be useful;

$$\cot^2 y + 1 = \csc^2 y$$

[6 marks]

Question 7

The curve

$$y = \frac{2x + 1}{2x - 1}$$

crosses the x -axis at A and the y -axis at B .

Find the point of intersection of the tangents to the curve at A and B .

[8 marks]

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Teachers may obtain detailed worked solutions to the exercises by email from mhh@shrewsbury.org.uk