

Lesson 11

A-Level Pure Mathematics : Year 2 Differentiation III

11.1 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

Differentiate each of the following with respect to x ,

(i) $y = 7x^4$

(ii) $y = 11\sqrt{x}$

[2 marks]

Question 2

By first expanding the brackets, differentiate each of the following with respect to x ,

(i) $y = (x + 6)(2x - 5)$

(ii) $y = \sqrt{x} \left(\frac{1}{\sqrt{x}} + 3\sqrt{x} \right)$

[4 marks]

Question 3

Use The Chain Rule to differentiate each of the following with respect to x ,

(i) $y = 4(x^3 + 3)^5$

(ii) $y = 4 \cos(2x)$

(iii) $y = \sec^3 x$

(iv) $y = e^{\sin x} + e^{\cos x}$

[8 marks]

Question 4

(i) Use The Product Rule to find $\frac{dy}{dx}$ if $y = x \ln x$

[2 marks]

(ii) Find also $\frac{d^2y}{dx^2}$

[1 mark]

Question 5

Consider the function

$$f(x) = \tan(3x)$$

Determine the value of

$$f'\left(\frac{\pi}{18}\right)$$

[4 marks]

Question 6

Use The Quotient Rule to show that if $y = \frac{x^3 - 1}{x^3 + 1}$

$$\text{then } \frac{dy}{dx} = \frac{6x^2}{(x^3 + 1)^2}$$

[4 marks]

Question 7

Find the equation of the tangent to the curve $y = \frac{11}{x^2 - 3}$ when $x = 5$

Give the answer in the form $ax + by + c = 0$
where a , b and c are integers to be found.

[6 marks]

Question 8

The function $f(x)$ is given below

$$f(x) = \frac{x^2 \sin(2x)}{9\pi}$$

- (i) Find $f'(x)$
- (ii) Show that $f' \left(\frac{\pi}{4} \right) = \frac{1}{18}$

[5 marks]

Question 9

If

$$\frac{d}{dx} \left(\ln \sqrt{ax + b} \right) = \frac{4}{ax + 1}$$

Find the values of a and b .

[4 marks]

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