

Lesson 13

A-Level Pure Mathematics : Year 2 Differentiation IV

13.1 Differentiation : Later Date Revision

*Any solution based entirely on graphical
or numerical methods is not acceptable*

Marks Available : 40

Question 1

Without looking up the formulae booklet, differentiate each of the following with respect to x . If you can remember a formulae book formula you can use it !

(i) $y = e^{5x}$

(ii) $y = 4 \sin 6x$

(iii) $y = \cos^2 3x$

(iv) $y = \tan x$

(v) $y = \frac{1}{\cos x}$

(vi) $y = \ln(5x^3)$

(vii) $y = (\ln(5x))^3$

[14 marks]

Question 2

Use the product rule to find the derivative with respect to x of $y = 3x e^{5x}$ giving the answer in the form $\frac{dy}{dx} = A e^{5x} (Bx + C)$ where A , B and C are integers to be found.

[3 marks]

Question 3

Use the quotient rule to find the derivative with respect to x of $y = \frac{\sin 3x}{2x^2}$ and simplify your answer.

[4 marks]

Question 4

Use the chain rule to find the derivative with respect to x of $y = (1 + \cos^2 3x)^5$
Write your answer in the form $\frac{dy}{dx} = A (1 + \cos^2 3x)^B \sin Cx$ where A , B , and C are integers to be found.

[3 marks]

Question 5

A curve is described parametrically by the equations

$$x = t - \cos^2 t \qquad y = \sin^2 t$$

(i) Show that, $\frac{dy}{dx} = \frac{\sin 2t}{1 + \sin 2t}$

[4 marks]

(ii) Show that when $t = \frac{\pi}{6}$, $\frac{dy}{dx} = m\sqrt{3} + n$
for some integer values of m and n that you should determine.

[4 marks]

Question 6

Find the tangent to the curve $y = \sin x$ when $x = \frac{\pi}{3}$

Give your answer in the form $y = mx + c$ and give the exact value for c .

[4 marks]

Question 7

Differentiate implicitly to find $\frac{dy}{dx}$ for the curve $4x^3 + 5y^4 + 7xy = 0$

[4 marks]

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