Basic Differentiation

Question Paper 3

Level	A Level
Subject	Maths
Exam Board	OCR - MEI
Module	Core 2
Topic	Calculus
Sub Topic	Basic Differentiation
Booklet	Question Paper 3

Time Allowed: **61 minutes**

Score: **/51**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	77.5%	70%	62.5%	57.5%	45%	<45%

1

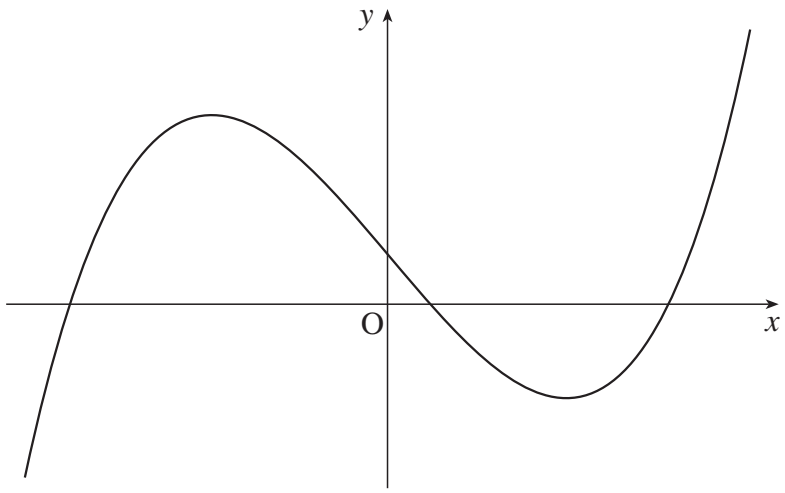

Fig. 11

The equation of the curve shown in Fig. 11 is $y = x^3 - 6x + 2$.

(i) Find $\frac{dy}{dx}$. [2]

(ii) Find, in exact form, the range of values of x for which $x^3 - 6x + 2$ is a decreasing function. [3]

(iii) Find the equation of the tangent to the curve at the point $(-1, 7)$.

Find also the coordinates of the point where this tangent crosses the curve again. [6]

2 Find $\frac{dy}{dx}$ when $y = x^6 + \sqrt{x}$. [3]

3 **(i)** Find the equation of the tangent to the curve $y = x^4$ at the point where $x = 2$. Give your answer in the form $y = mx + c$. **[4]**

(ii) Calculate the gradient of the chord joining the points on the curve $y = x^4$ where $x = 2$ and $x = 2.1$. **[2]**

(iii) (*A*) Expand $(2 + h)^4$. **[3]**

(*B*) Simplify $\frac{(2+h)^4 - 2^4}{h}$. **[2]**

(*C*) Show how your result in part **(iii)** (*B*) can be used to find the gradient of $y = x^4$ at the point where $x = 2$. **[2]**

4 **(i)** Calculate the gradient of the chord joining the points on the curve $y = x^2 - 7$ for which $x = 3$ and $x = 3.1$. **[2]**

(ii) Given that $f(x) = x^2 - 7$, find and simplify $\frac{f(3+h) - f(3)}{h}$. **[3]**

(iii) Use your result in part **(ii)** to find the gradient of $y = x^2 - 7$ at the point where $x = 3$, showing your reasoning. **[2]**

(iv) Find the equation of the tangent to the curve $y = x^2 - 7$ at the point where $x = 3$. **[2]**

(v) This tangent crosses the x-axis at the point P. The curve crosses the positive x-axis at the point Q. Find the distance PQ, giving your answer correct to 3 decimal places. **[3]**

5 **(i)**

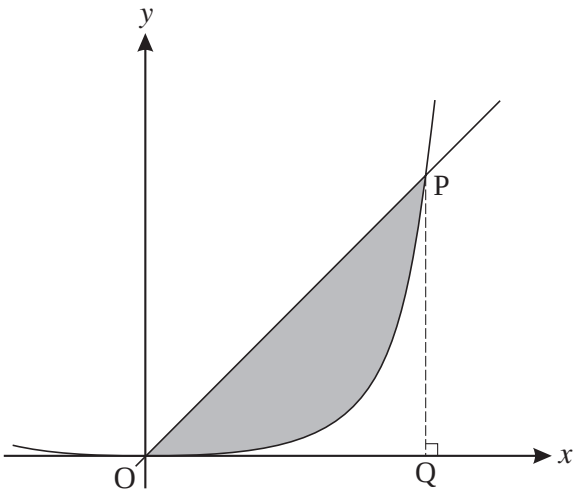

Fig. 12

Fig. 12 shows part of the curve $y = x^4$ and the line $y = 8x$, which intersect at the origin and the point P.

(*A*) Find the coordinates of P, and show that the area of triangle OPQ is 16 square units. [3]

(*B*) Find the area of the region bounded by the line and the curve. [3]

(ii) You are given that $f(x) = x^4$.

(*A*) Complete this identity for $f(x + h)$.

$$f(x + h) = (x + h)^4 = x^4 + 4x^3h + \ldots$$ [2]

(*B*) Simplify $\dfrac{f(x + h) - f(x)}{h}$. [2]

(*C*) Find $\lim\limits_{h \to 0} \dfrac{f(x + h) - f(x)}{h}$. [1]

(*D*) State what this limit represents. [1]