

Differentiation: Tangents & Normals

Question Paper 1

Level	A Level
Subject	Maths
Exam Board	OCR - MEI
Module	Core 2
Topic	Calculus
Sub Topic	Differentiation: Tangents & Normals
Booklet	Question Paper 1

Time Allowed: 54 minutes

Score: /45

Percentage: /100

Grade Boundaries:

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

- 1 The gradient of a curve is given by $\frac{dy}{dx} = 4x + 3$. The curve passes through the point (2, 9).
- (i) Find the equation of the tangent to the curve at the point (2, 9). [3]
 - (ii) Find the equation of the curve and the coordinates of its points of intersection with the x -axis. Find also the coordinates of the minimum point of this curve. [7]
 - (iii) Find the equation of the curve after it has been stretched parallel to the x -axis with scale factor $\frac{1}{2}$. Write down the coordinates of the minimum point of the transformed curve. [3]
- 2 Find the equation of the normal to the curve $y = 8x^4 + 4$ at the point where $x = \frac{1}{2}$. [5]
- 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 In Fig. 5, A and B are the points on the curve $y = 2^x$ with x -coordinates 3 and 3.1 respectively.

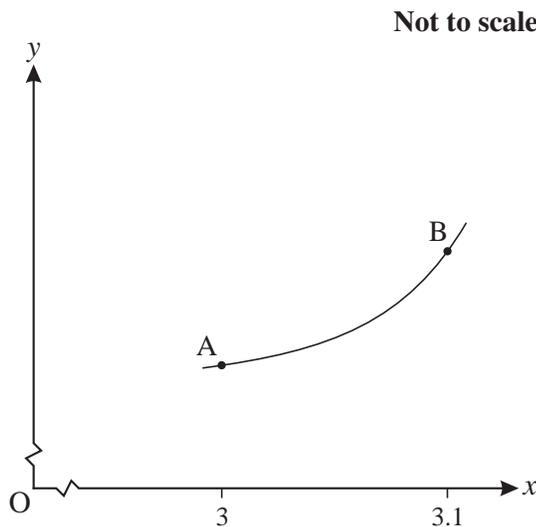


Fig. 5

- (i) Find the gradient of the chord AB. Give your answer correct to 2 decimal places. [2]
- (ii) Stating the points you use, find the gradient of another chord which will give a closer approximation to the gradient of the tangent to $y = 2^x$ at A. [2]