



Differentiation From First Principles Exam Questions (From OCR MEI 4752 unless otherwise stated)

Q1, (Jun 2009, Q12)

- (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]
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Q2, (Jan 2007, Q5)

A is the point (2, 1) on the curve $y = \frac{4}{x^2}$.

B is the point on the same curve with x -coordinate 2.1.

- (i) Calculate the gradient of the chord AB of the curve. Give your answer correct to 2 decimal places. [2]
- (ii) Give the x -coordinate of a point C on the curve for which the gradient of chord AC is a better approximation to the gradient of the curve at A. [1]
- (iii) Use calculus to find the gradient of the curve at A. [2]
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Q3, (Jun 2010, Q10)

- (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]
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Q4, (OCR H230/02, Sample Question Paper, Q7)

Differentiate $f(x) = x^4$ from first principles.

[5]

Q5, (Jun 2016, Q10)

- (i) Calculate the gradient of the chord of the curve $y = x^2 - 2x$ joining the points at which the values of x are 5 and 5.1. [2]
- (ii) Given that $f(x) = x^2 - 2x$, find and simplify $\frac{f(5+h) - f(5)}{h}$. [4]
- (iii) Use your result in part (ii) to find the gradient of the curve $y = x^2 - 2x$ at the point where $x = 5$, showing your reasoning. [2]
- (iv) Find the equation of the tangent to the curve $y = x^2 - 2x$ at the point where $x = 5$.
Find the area of the triangle formed by this tangent and the coordinate axes. [5]

Q6, (OCR 4721, Jun 2016, Q8)

A curve has equation $y = 2x^2$. The points A and B lie on the curve and have x -coordinates 5 and $5+h$ respectively, where $h > 0$.

- (i) Show that the gradient of the line AB is $20 + 2h$. [3]
- (ii) Explain how the answer to part (i) relates to the gradient of the curve at A . [1]
- (iii) The normal to the curve at A meets the y -axis at the point C . Find the y -coordinate of C . [3]

Q7, (Edexcel 8MA0/01, Sample Assessment 1, Q6)

Prove, from first principles, that the derivative of $3x^2$ is $6x$.

(4)