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]**

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]

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]**

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)
