C1 – Differentiation QUESTIONS

(EASY + HARD)

MAY 2007

3. Given that $y = 3x^2 + 4\sqrt{x}, \quad x > 0$, find

(a) $\dfrac{dy}{dx}$, **(2)**

(b) $\dfrac{d^2y}{dx^2}$, **(2)**

(c) $\int y \, dx$. **(3)**

MAY 2008

4. $$f(x) = 3x + x^3, \qquad x > 0.$$

(a) Differentiate to find $f'(x)$. **(2)**

Given that $f'(x) = 15$,

(b) find the value of x. **(3)**

JAN 2008

5. (a) Write $\dfrac{2\sqrt{x}+3}{x}$ in the form $2x^p + 3x^q$ where p and q are constants. **(2)**

Given that $y = 5x - 7 + \dfrac{2\sqrt{x}+3}{x}, \qquad x > 0,$

(b) find $\dfrac{dy}{dx}$, simplifying the coefficient of each term. **(4)**

MAY 2008

9. The curve C has equation $y = kx^3 - x^2 + x - 5$, where k is a constant.

(a) Find $\dfrac{dy}{dx}$. **(2)**

The point A with x-coordinate $-\frac{1}{2}$ lies on C. The tangent to C at A is parallel to the line with equation $2y - 7x + 1 = 0$.

Find

(b) the value of k, **(4)**

(c) the value of the y-coordinate of A. **(2)**

MAY 2007

10. The curve C has equation $y = x^2(x-6) + \dfrac{4}{x}, \quad x > 0$.

The points P and Q lie on C and have x-coordinates 1 and 2 respectively.

(a) Show that the length of PQ is $\sqrt{170}$. **(4)**

(b) Show that the tangents to C at P and Q are parallel. **(5)**

(c) Find an equation for the normal to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. **(4)**

JANUARY 2008

10. The curve C has equation

$$y = (x+3)(x-1)^2.$$

(a) Sketch C showing clearly the coordinates of the points where the curve meets the coordinate axes. **(4)**

(b) Show that the equation of C can be written in the form

$$y = x^3 + x^2 - 5x + k,$$

where k is a positive integer, and state the value of k. **(2)**

There are two points on C where the gradient of the tangent to C is equal to 3.

(c) Find the x-coordinates of these two points. **(6)**