APPLICATIONS OF DIFFERENTIATIONS PAST PAPERS QUESTIONS EDEXCEL A LEVEL YEAR 1

1.

The curve C has equation $y = 4x^2 + \dfrac{5-x}{x}$, $x \neq 0$. The point P on C has x-coordinate 1.

(a) Show that the value of $\dfrac{dy}{dx}$ at P is 3.

(5)

(b) Find an equation of the tangent to C at P.

(3)

This tangent meets the x-axis at the point $(k, 0)$.

(c) Find the value of k.

(2)

2.

Figure 2

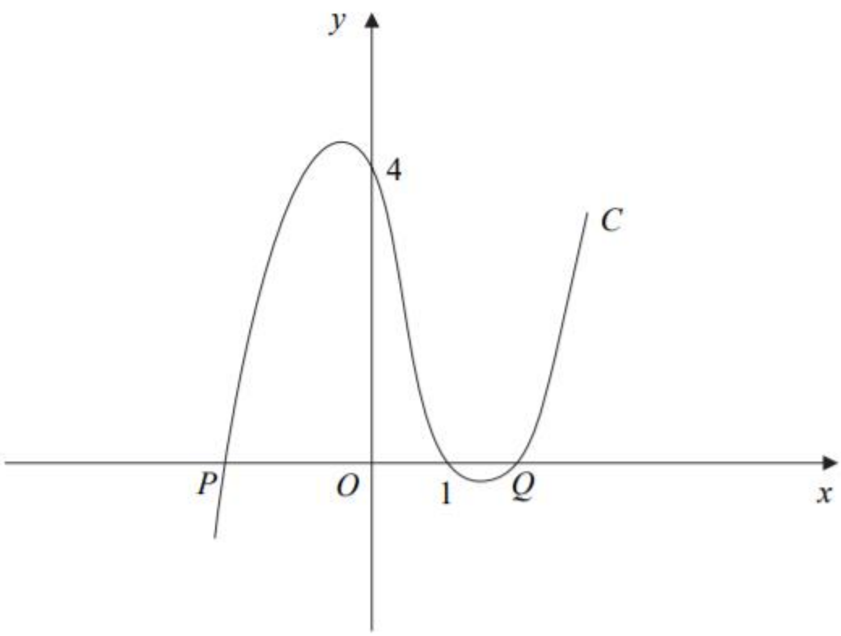

Figure 2 shows part of the curve C with equation

$$y = (x - 1)(x^2 - 4).$$

The curve cuts the x-axis at the points P, $(1, 0)$ and Q, as shown in Figure 2.

(a) Write down the x-coordinate of P, and the x-coordinate of Q.

(2)

(b) Show that $\frac{dy}{dx} = 3x^2 - 2x - 4$.

(3)

(c) Show that $y = x + 7$ is an equation of the tangent to C at the point $(-1, 6)$.

(2)

The tangent to C at the point R is parallel to the tangent at the point $(-1, 6)$.

(d) Find the exact coordinates of R.

(5)

3.

The curve C has equation $y = 4x + 3x^{\frac{3}{2}} - 2x^2, \quad x > 0$.

(a) Find an expression for $\frac{dy}{dx}$.
(3)

(b) Show that the point P (4, 8) lies on C.
(1)

(c) Show that an equation of the normal to C at the point P is

$$3y = x + 20.$$

(4)

The normal to C at P cuts the x-axis at the point Q.

(d) Find the length PQ, giving your answer in a simplified surd form.
(3)

4.

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)

5.

The curve C has equation

$$y = 9 - 4x - \frac{8}{x}, \qquad x > 0 .$$

The point P on C has x-coordinate equal to 2.

(a) Show that the equation of the tangent to C at the point P is $y = 1 - 2x$.
(6)

(b) Find an equation of the normal to C at the point P.
(3)

The tangent at P meets the x-axis at A and the normal at P meets the x-axis at B.

(c) Find the area of triangle APB.
(4)

6.

The curve C has equation

$$y = \frac{(x+3)(x-8)}{x}, \quad x > 0$$

(a) Find $\frac{dy}{dx}$ in its simplest form.
(4)

(b) Find an equation of the tangent to C at the point where $x = 2$
(4)

7.

The curve C has equation

$$y = \frac{1}{2}x^3 - 9x^{\frac{3}{2}} + \frac{8}{x} + 30, \qquad x > 0$$

(a) Find $\frac{dy}{dx}$.
(4)

(b) Show that the point $P(4, -8)$ lies on C.
(2)

(c) Find an equation of the normal to C at the point P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers.
(6)

8.

The curve C_1 has equation

$$y = x^2(x+2)$$

(a) Find $\frac{dy}{dx}$

(2)

(b) Sketch C_1, showing the coordinates of the points where C_1 meets the x-axis.

(3)

(c) Find the gradient of C_1 at each point where C_1 meets the x-axis.

(2)

The curve C_2 has equation

$$y = (x-k)^2(x-k+2)$$

where k is a constant and $k > 2$

(d) Sketch C_2, showing the coordinates of the points where C_2 meets the x and y axes.

(3)

9.

The curve C has equation

$$y = 2x - 8\sqrt{x} + 5, \quad x \geqslant 0$$

(a) Find $\frac{dy}{dx}$, giving each term in its simplest form.

(3)

The point P on C has x-coordinate equal to $\frac{1}{4}$

(b) Find the equation of the tangent to C at the point P, giving your answer in the form $y = ax + b$, where a and b are constants.

(4)

The tangent to C at the point Q is parallel to the line with equation $2x - 3y + 18 = 0$

(c) Find the coordinates of Q.

(5)