Differentiation, Tangents & Normal 2 - Edexcel Past Exam Questions

1. The curve C_1 has equation

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

(*a*) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$. **(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)**

Jan 12 Q8

2.

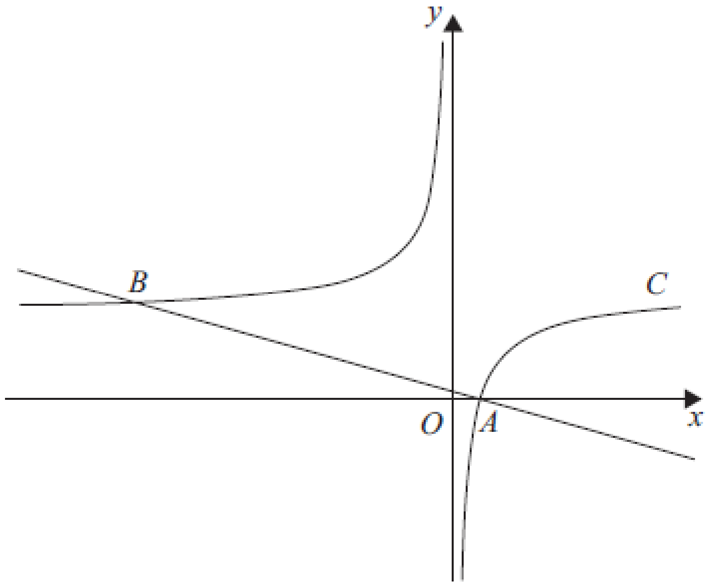

Figure 2

Figure 2 shows a sketch of the curve C with equation

$$y = 2 - \frac{1}{x}, \qquad x \neq 0.$$

The curve crosses the x-axis at the point A.

(a) Find the coordinates of A. **(1)**

(b) Show that the equation of the normal to C at A can be written as

$$2x + 8y - 1 = 0.$$ **(6)**

The normal to C at A meets C again at the point B, as shown in Figure 2.

(c) Find the coordinates of B. **(4)**

Jan 12 Q10

3. $$y = 5x^3 - 6x^{\frac{4}{3}} + 2x - 3.$$

(*a*) Find $\frac{dy}{dx}$, giving each term in its simplest form. **(4)**

(*b*) Find $\frac{d^2y}{dx^2}$. **(2)**

June 12 Q4

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4. The curve C has equation

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

(*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)**

Jan 13 Q11

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5. $$f'(x) = \frac{(3 - x^2)^2}{x^2}, \quad x \neq 0.$$

(*a*) Show that $f'(x) = 9x^{-2} + A + Bx^2$, where A and B are constants to be found. **(3)**

(*b*) Find $f''(x)$. **(2)**

Given that the point $(-3, 10)$ lies on the curve with equation $y = f(x)$,

(*c*) find $f(x)$. **(5)**

June 13 Q9 *(edited)*

6.

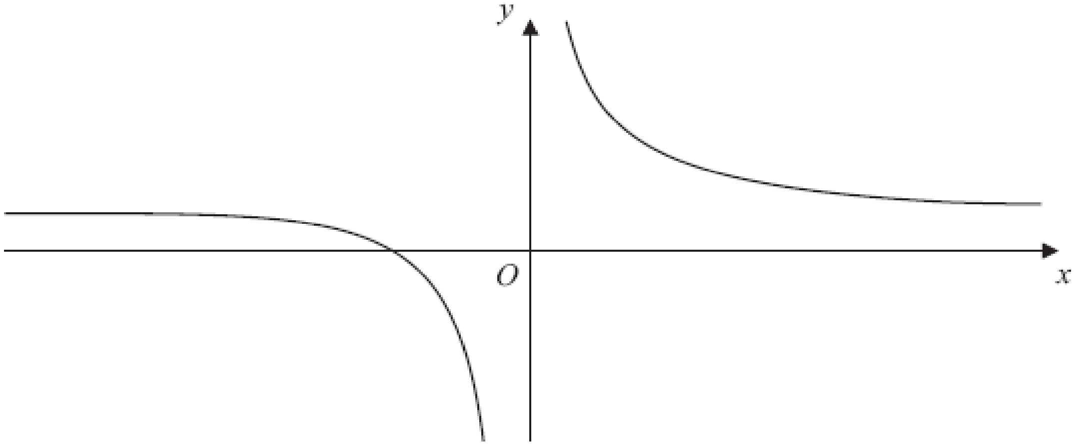

Figure 2

Figure 2 shows a sketch of the curve H with equation $y = \frac{3}{x} + 4$, $x \neq 0$.

(a) Give the coordinates of the point where H crosses the x-axis. **(1)**

(b) Give the equations of the asymptotes to H. **(2)**

(c) Find an equation for the normal to H at the point $P(-3, 3)$. **(5)**

This normal crosses the x-axis at A and the y-axis at B.

(d) Find the length of the line segment AB. Give your answer as a surd. **(3)**

June 13 Q11

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7. Given $y = x^3 + 4x + 1$, find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 3$. **(4)**

June 13(R) Q1

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8. Differentiate with respect to x, giving each answer in its simplest form,

(a) $(1 - 2x)^2$, **(3)**

(b) $\dfrac{x^5 + 6\sqrt{x}}{2x^2}$. **(4)**

June 14 Q7

9.

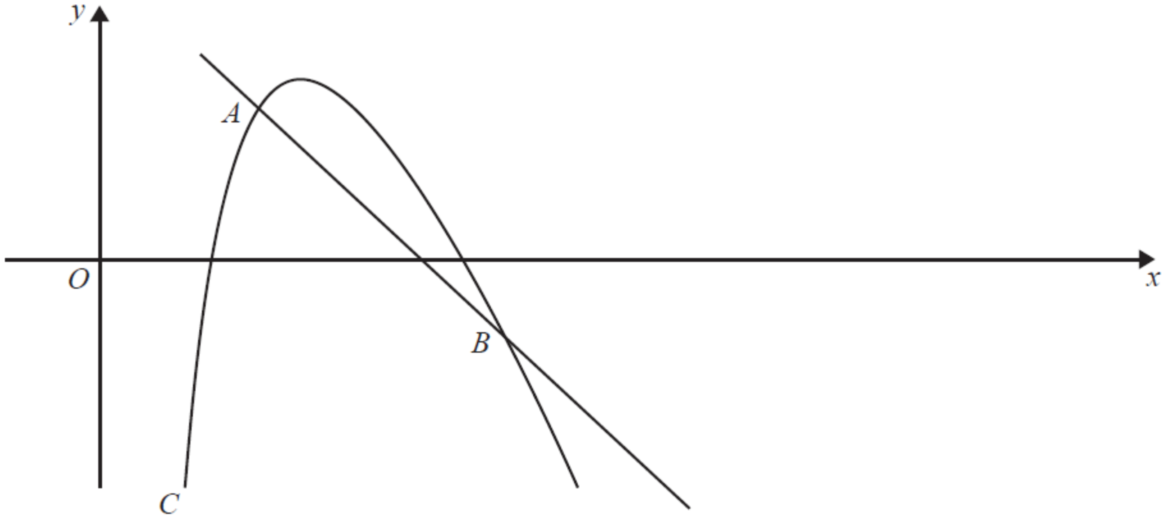

Figure 3

A sketch of part of the curve C with equation

$$y = 20 - 4x - \frac{18}{x}, \qquad x > 0$$

is shown in Figure 3.

Point A lies on C and has an x coordinate equal to 2.

(a) Show that the equation of the normal to C at A is $y = -2x + 7$. **(6)**

The normal to C at A meets C again at the point B, as shown in Figure 3.

(b) Use algebra to find the coordinates of B. **(5)**

June 14(R) Q11

10. The curve C has equation

$$y = \frac{(x^2+4)(x-3)}{2x}, \quad x \neq 0.$$

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ in its simplest form. **(5)**

(b) Find an equation of the tangent to C at the point where $x = -1$.

Give your answer in the form $ax + by + c = 0$, where a, b and c are integers. **(5)**

June 15 Q6

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11. The curve C has equation $y = 2x^3 + kx^2 + 5x + 6$, where k is a constant.

(a) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$. **(2)**

The point P, where $x = -2$, lies on C.

The tangent to C at the point P is parallel to the line with equation $2y - 17x - 1 = 0$.

Find

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

(c) the value of the y coordinate of P, **(2)**

(d) the equation of the tangent to C at P, giving your answer in the form $ax + by + c = 0$, where a, b and c are integers. **(2)**

June 16 Q11

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12. Given

$$y = \sqrt{x} + \frac{4}{\sqrt{x}} + 4, \qquad x > 0$$

find the value of $\frac{\mathrm{d}y}{\mathrm{d}x}$ when $x = 8$, writing your answer in the form $a\sqrt{2}$, where a is a rational number. **(5)**

June 17 Q2

13.

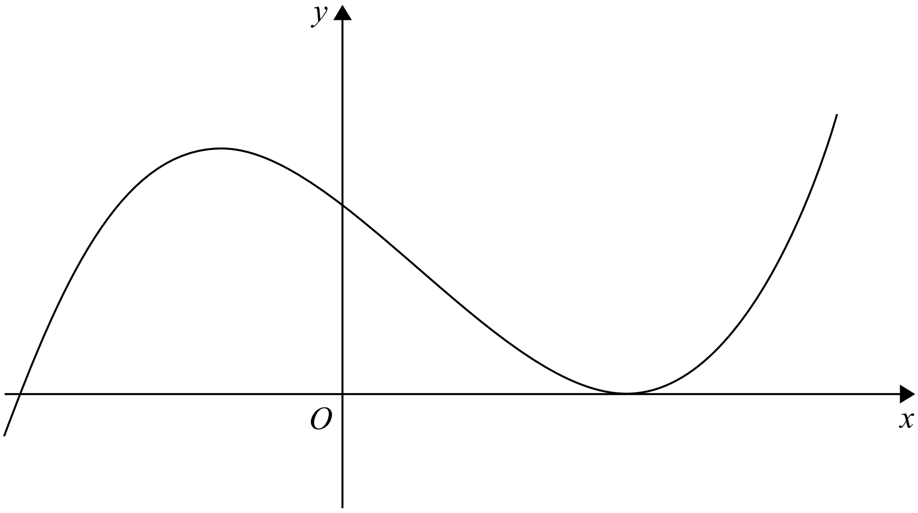

Figure 2

Figure 2 shows a sketch of part of the curve $y = \mathrm{f}(x)$, $x \in \mathbb{R}$, where

$$\mathrm{f}(x) = (2x - 5)^2 (x + 3)$$

(*a*) Given that

(i) the curve with equation $y = \mathrm{f}(x) - k$, $x \in \mathbb{R}$, passes through the origin, find the value of the constant k,

(ii) the curve with equation $y = \mathrm{f}(x + c)$, $x \in \mathbb{R}$, has a minimum point at the origin, find the value of the constant c. **(3)**

(*b*) Show that $\mathrm{f}'(x) = 12x^2 - 16x - 35$ **(3)**

Points A and B are distinct points that lie on the curve $y = \mathrm{f}(x)$.

The gradient of the curve at A is equal to the gradient of the curve at B.

Given that point A has x coordinate 3

(*c*) find the x coordinate of point B. **(5)**

June 17 Q10