Differentiation – 2021 A2

1. June/2021/Paper_9709/31/No.6

The parametric equations of a curve are

$$x = \ln(2 + 3t), \qquad y = \frac{t}{2 + 3t}.$$

(a) Show that the gradient of the curve is always positive. [5]

(b) Find the equation of the tangent to the curve at the point where it intersects the y-axis. [3]

2. June/2021/Paper_9709/31/No.9a

The equation of a curve is $y = x^{-\frac{2}{3}} \ln x$ for $x > 0$. The curve has one stationary point.

(a) Find the exact coordinates of the stationary point. [5]

3. June/2021/Paper_9709/32/No.8

The equation of a curve is $y = e^{-5x} \tan^2 x$ for $-\frac{1}{2}\pi < x < \frac{1}{2}\pi$.

Find the x-coordinates of the stationary points of the curve. Give your answers correct to 3 decimal places where appropriate. [8]

4. June/2021/Paper_9709/33/No.3

The parametric equations of a curve are

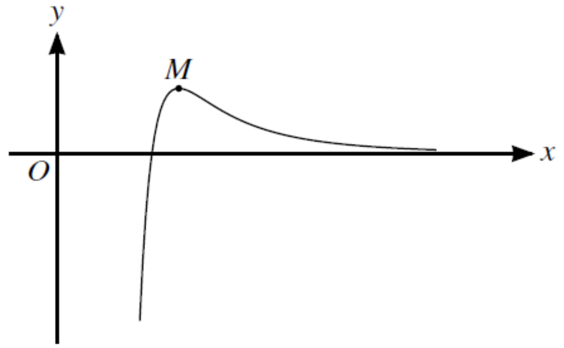
$$x = t + \ln(t + 2), \qquad y = (t - 1)e^{-2t},$$

where $t > -2$.

(a) Express $\dfrac{dy}{dx}$ in terms of t, simplifying your answer. [5]

(b) Find the exact y-coordinate of the stationary point of the curve. [2]

5. June/2021/Paper_9709/33/No.8a



The diagram shows the curve $y = \dfrac{\ln x}{x^4}$ and its maximum point M.

(a) Find the exact coordinates of M. [4]

6. March/2021/Paper_9709/32/No.4

The variables x and y satisfy the differential equation

$$(1 - \cos x)\frac{dy}{dx} = y \sin x.$$

It is given that $y = 4$ when $x = \pi$.

(a) Solve the differential equation, obtaining an expression for y in terms of x. [6]

(b) Sketch the graph of y against x for $0 < x < 2\pi$. [1]