Differentiation and integration– 2023 March Cambridge AS & A Level Mathematics

1. March/2023/Paper_9709/32/No.5

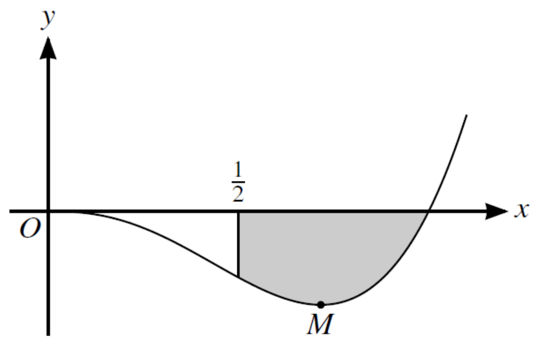
The parametric equations of a curve are

$$x = te^{2t}, \qquad y = t^2 + t + 3.$$

(a) Show that $\frac{dy}{dx} = e^{-2t}$. [3]

(b) Hence show that the normal to the curve, where $t = -1$, passes through the point $\left(0,\ 3 - \frac{1}{e^4}\right)$. [3]

2. March/2023/Paper_9709/32/No.8



The diagram shows the curve $y = x^3 \ln x$, for $x > 0$, and its minimum point M.

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

(b) Find the exact area of the shaded region bounded by the curve, the x-axis and the line $x = \frac{1}{2}$. [5]

3. March/2023/Paper_9709/32/No.11

Let $f(x) = \dfrac{5x^2 + x + 11}{(4 + x^2)(1 + x)}$.

(a) Express $f(x)$ in partial fractions. [5]

(b) Hence show that $\displaystyle\int_0^2 f(x)\,dx = \ln 54 - \tfrac{1}{8}\pi$. [5]