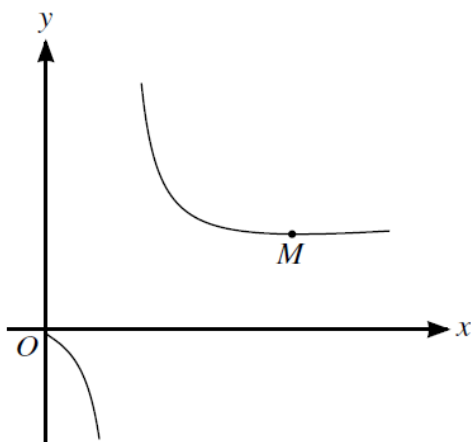1. June/2021/Paper_9709/21/No.5
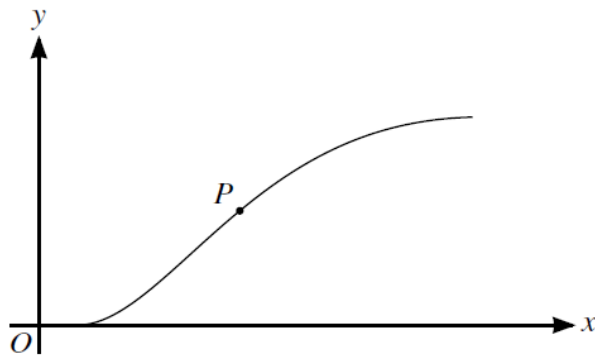

The diagram shows the curve with equation $y = \dfrac{3x+2}{\ln x}$. The curve has a minimum point M.

(a) Find an expression for $\dfrac{dy}{dx}$ and show that the x-coordinate of M satisfies the equation $x = \dfrac{3x+2}{3\ln x}$.

[3]

(b) Use the equation in part **(a)** to show by calculation that the x-coordinate of M lies between 3 and 4.

[2]

(c) Use an iterative formula, based on the equation in part **(a)**, to find the x-coordinate of M correct to 5 significant figures. Give the result of each iteration to 7 significant figures.

[3]

The diagram shows the curve with parametric equations

$$x = 4t + e^{2t}, \qquad y = 6t \sin 2t,$$

for $0 \leqslant t \leqslant 1$. The point P on the curve has parameter p and y-coordinate 3.

(a) Show that $p = \dfrac{1}{2 \sin 2p}$.   [1]

(b) Show by calculation that the value of p lies between 0.5 and 0.6.   [2]

(c) Use an iterative formula, based on the equation in part **(a)**, to find the value of p correct to 3 significant figures. Use an initial value of 0.55 and give the result of each iteration to 5 significant figures.   [3]

(d) Find the gradient of the curve at P.   [5]

(a) Given that $2\ln(x+1) + \ln x = \ln(x+9)$, show that $x = \sqrt{\dfrac{9}{x+2}}$. [3]

(b) It is given that the equation $x = \sqrt{\dfrac{9}{x+2}}$ has a single root.

Show by calculation that this root lies between 1.5 and 2.0. [2]

(c) Use an iterative formula, based on the equation in part **(b)**, to find the root correct to 3 significant figures. Give the result of each iteration to 5 significant figures. [3]