1. March/2023/Paper_9709/22/No.1

Find the exact value of $\int_0^{\frac{1}{2}\pi} 2\tan^2\left(\frac{1}{2}x\right) \mathrm{d}x$. [4]

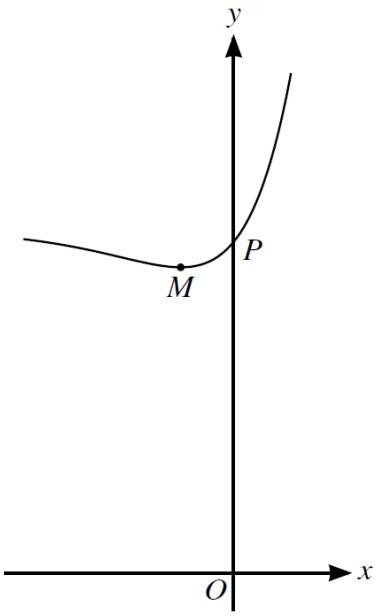
2. March/2023/Paper_9709/22/No.5

It is given that $\int_1^a \left(\frac{4}{1+2x} + \frac{3}{x}\right) \mathrm{d}x = \ln 10$, where a is a constant greater than 1.

(a) Show that $a = \sqrt[3]{90(1+2a)^{-2}}$. [5]

(b) Use an iterative formula, based on the equation in **(a)**, to find the value of a correct to 3 significant figures. Use an initial value of 1.7 and give the result of each iteration to 5 significant figures. [3]

3. March/2023/Paper_9709/22/No.6

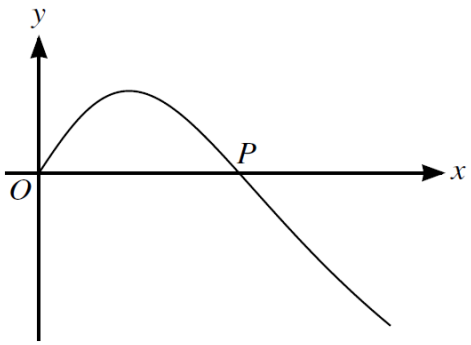


The diagram shows the curve with equation $y = \dfrac{4e^{2x} + 9}{e^{x} + 2}$. The curve has a minimum point M and crosses the y-axis at the point P.

(a) Find the exact value of the gradient of the curve at P. [4]

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

4. March/2023/Paper_9709/22/No.7



The diagram shows the curve with parametric equations

$$x = k \tan t, \qquad y = 3 \sin 2t - 4 \sin t,$$

for $0 < t < \frac{1}{2}\pi$. It is given that k is a positive constant. The curve crosses the x-axis at the point P.

(a) Find the value of $\cos t$ at P, giving your answer as an exact fraction. [3]

(b) Express $\frac{dy}{dx}$ in terms of k and $\cos t$. [4]

(c) Given that the normal to the curve at P has gradient $\frac{9}{10}$, find the value of k, giving your answer as an exact fraction. [3]