4. (a) Use the substitution $u = e^x + 4$ to show that

$$\int_0^{\ln 6} \frac{2e^x + 3}{e^x + 4}\,dx = \int_a^b \frac{cu + d}{u(u-4)}\,du$$

where a, b, c and d are constants to be found.

(3)

(b) Hence, using algebraic integration, show that

$$\int_0^{\ln 6} \frac{2e^x + 3}{e^x + 4}\,dx = P\ln 2 + Q\ln 3$$

where P and Q are constants to be found.

(6)

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Question 4 continued

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Question 4 continued

(Total for Question 4 is 9 marks)

5.

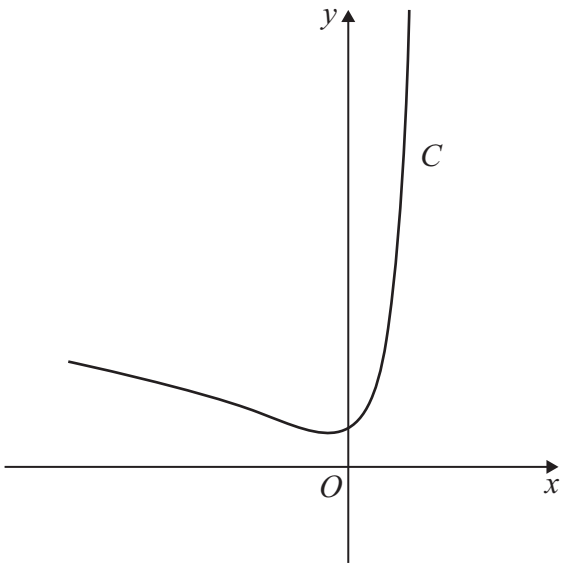


Figure 1

The curve C, shown in Figure 1, has parametric equations

$$x = \frac{4t - 5}{2t + 1} \qquad y = 2t^2 - 4t + 4 \qquad t \geqslant 0$$

The point P lies on C and has parameter $t = 3$

(a) Find the coordinates of P.

(2)

(b) Find $\dfrac{\mathrm{d}y}{\mathrm{d}x}$ in terms of t, writing the answer in simplest form.

(4)

(c) Hence find the equation of the tangent to C at P. Write the answer in the form $y = mx + c$, where m and c are constants.

(2)

Given that

- the Cartesian equation of C is $y = \mathrm{f}(x)$
- the function f is defined for all values of x on C

(d) (i) find the domain of f

(ii) find the range of f

(3)

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