6: **In this question you must show all stages of your working.**
Solutions relying entirely on calculator technology are not acceptable.

A curve C has parametric equations

$$x = 8\cos t + 2 \qquad y = 6\sin t - 3 \qquad 0 < t \leqslant 2\pi$$

The point P lies on C where $t = \frac{\pi}{3}$

(a) Use parametric differentiation to find the exact gradient of the **tangent** to C at P.

(3)

The **normal** to C at P intersects the x-axis at the point R.

(b) Find, using algebra, the exact coordinates of R.

(6)

(c) Find a Cartesian equation of C. The equation must not involve trigonometric expressions.

(2)

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Question 6 continued

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Question 6 continued

(Total for Question 6 is 11 marks)

7: **In this question you must show all stages of your working.**
Solutions relying on calculator technology are not acceptable.

(a) Show that the substitution $u = e^x - \frac{1}{2}$ transforms

$$\int_{\ln 3}^{\ln 8} \frac{24e^x - 2}{(2e^x - 1)^2}\,dx$$

to

$$\int_a^b \frac{12u + 5}{u^2(2u + 1)}\,du$$

where a and b are constants to be found.

(4)

(b) Find an expression for $\frac{12u + 5}{u^2(2u + 1)}$ in the form

$$\frac{A}{u^2} + \frac{B}{u} + \frac{C}{(2u + 1)}$$

where A, B and C are integers.

(3)

(c) Hence show that

$$\int_{\ln 3}^{\ln 8} \frac{24e^x - 2}{(2e^x - 1)^2}\,dx = p + \ln q$$

where p and q are constants to be found.

(4)

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