3. (a) Factorise $x^2 - 4y^2$

(1)

(b) Use proof by contradiction to prove that there are no positive integers x and y such that

$$x^2 - 4y^2 = 27$$

(4)

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Question 3 continued

(Total for Question 3 is 5 marks)

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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