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

Using algebraic integration, find the exact value of

$$\int_{2}^{2e^2} x^3 \ln\left(\frac{1}{2}x\right) \mathrm{d}x$$

giving the answer in simplest form.

(5)

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Question 2 continued

(Total for Question 2 is 5 marks)

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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