5. $$4x^2 + 4x + 17 \equiv (2x + p)^2 + q$$

where p and q are integers.

(a) Determine the value of p and the value of q

(2)

Given that

$$\frac{8x + 5}{\sqrt{4x^2 + 4x + 17}} \equiv \frac{1}{\sqrt{4x^2 + 4x + 17}} + \frac{Ax + B}{\sqrt{4x^2 + 4x + 17}}$$

where A and B are integers,

(b) write down the value of A and the value of B

(1)

(c) Hence use algebraic integration to show that

$$\int_{\frac{1}{3}}^{1} \frac{8x + 5}{\sqrt{4x^2 + 4x + 17}} \, \mathrm{d}x = k + \frac{1}{2} \ln k$$

where k is a rational number to be determined.

(5)

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(Total for Question 5 is 8 marks)

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