7. Given that

$$\sin\theta = \frac{1}{2\mathrm{i}}\left(\mathrm{e}^{\mathrm{i}\theta} - \mathrm{e}^{-\mathrm{i}\theta}\right)$$

(a) show that

$$\sin^4\theta = \frac{1}{8}(A\cos 4\theta + B\cos 2\theta + C)$$

where A, B and C are integers to be determined.

(4)

Using $\cos\theta \equiv \sin\left(\frac{1}{2}\pi - \theta\right)$ and the result from part (a),

(b) determine an expression for $\cos^4\theta$ in terms of $\cos 4\theta$ and $\cos 2\theta$

(2)

(c) Hence determine

$$\int\left(\sin^4\theta + \cos^4\theta\right)\mathrm{d}\theta$$

(2)

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Question 7 continued

(Total for Question 7 is 8 marks)