**5.** (i) Find the value of

$$\sum_{r=1}^{\infty} 6 \times (0.25)^r$$

**(3)**

(ii) A sequence $u_1, u_2, u_3, \ldots$ is defined by

$$u_1 = 3$$
$$u_{n+1} = \frac{u_n - 3}{u_n - 2} \qquad n \in \mathbb{N}$$

(a) Show that this sequence is periodic.

**(2)**

(b) State the order of this sequence.

**(1)**

(c) Hence find

$$\sum_{n=1}^{70} u_n$$

**(2)**

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**Question 5 continued**

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**Question 5 continued**

**(Total for Question 5 is 8 marks)**

**6.** (a) Given that

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

show that

$$x^3 + 6x^2 + x - 4 = 0$$

**(4)**

(b) Given also that –1 is a root of the equation

$$x^3 + 6x^2 + x - 4 = 0$$

(i) use algebra to find the other two roots of the equation.

**(3)**

(ii) Hence solve

$$2\log_4(x+3) + \log_4 x = \log_4(4x+2) + \frac{1}{2}$$

**(1)**

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