

Question 7 (12 marks) Use a SEPARATE writing booklet.

(a) Consider the geometric series

$$1 + (\sqrt{5} - 2) + (\sqrt{5} - 2)^2 + \dots$$

- (i) Explain why the geometric series has a limiting sum. **1**
- (ii) Find the exact value of the limiting sum. Write your answer with a rational denominator. **2**

(b) A cooler, which is initially full, is drained so that at time t seconds the volume of water V , in litres, is given by

$$V = 25 \left(1 - \frac{t}{60}\right)^2 \quad \text{for } 0 \leq t \leq 60.$$

- (i) How much water was initially in the cooler? **1**
- (ii) After how many seconds was the cooler one-quarter full? **2**
- (iii) At what rate was the water draining out when the cooler was one-quarter full? **2**

(c) Chris has four pairs of socks in a drawer, each pair a different colour.

He selects socks one at a time and at random from the drawer.

- (i) The probability that he does NOT have a matching pair after selecting the second sock is $\frac{6}{7}$. Explain why this is so. **1**
- (ii) Find the probability that he does NOT have a matching pair after selecting the third sock. **2**
- (iii) What is the probability that the first three socks include a matching pair? **1**