

7 The sum of the first  $n$  terms of an arithmetic series is  $A_n$  where

$$A_n = \sum_{r=1}^n (4r + 5)$$

(a) For this arithmetic series, find

- (i) the first term,
- (ii) the common difference.

(2)

The sum of the first  $n$  terms of a geometric series is  $G_n$  where

$$G_n = \sum_{r=1}^n 4(3)^{r-1}$$

(b) For this geometric series, find

- (i) the first term,
- (ii) the common ratio.

(2)

(c) Find the value of  $n$  for which  $A_{14} - 6 = G_n$

(5)

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**Question 7 continued**

Handwritten solution for Question 7 continued:

Let  $u = \frac{1}{x}$ . Then  $\frac{du}{dx} = -\frac{1}{x^2}$ .

The integral becomes  $\int \frac{1}{x^2} \ln x \, dx = \int u \ln u \, du$ .

Let  $v = \ln u$ . Then  $\frac{dv}{du} = \frac{1}{u}$ .

Using integration by parts,  $\int u \ln u \, du = \frac{1}{2} u^2 \ln u - \frac{1}{4} u^2 + C$ .

Substituting back,  $\frac{1}{x} \ln x - \frac{1}{4} + C$ .



**Question 7 continued**

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**Question 7 continued**

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**(Total for Question 7 is 9 marks)**

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