

NAME:

# Patterns Sequences and Series Worksheet

68 min  
68 marks

1. Find the sum of the arithmetic series

$$17 + 27 + 37 + \dots + 417.$$

<p><i>Working:</i></p>	<p><i>Answer:</i></p> <p>.....</p>
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(Total 4 marks)

2. (a) Write down the first three terms of the sequence  $u_n = 3n$ , for  $n \geq 1$ .

(1)

- (b) Find

(i)  $\sum_{n=1}^{20} 3n$ ;

(ii)  $\sum_{n=21}^{100} 3n$ .

.....

.....

.....

.....

.....

.....

(5)

(Total 6 marks)

3. Find the sum of the infinite geometric series

$$\frac{2}{3} - \frac{4}{9} + \frac{8}{27} - \frac{16}{81} + \dots$$

*Working:*

*Answer:*  
.....

**(Total 4 marks)**

4. In an arithmetic sequence, the first term is  $-2$ , the fourth term is  $16$ , and the  $n^{\text{th}}$  term is  $11\,998$ .
- (a) Find the common difference  $d$ .
- (b) Find the value of  $n$ .

*Working:*

*Answers:*

(a) .....

(b) .....

**(Total 6 marks)**

5. The diagrams below show the first four squares in a sequence of squares which are subdivided in half. The area of the shaded square A is  $\frac{1}{4}$ .

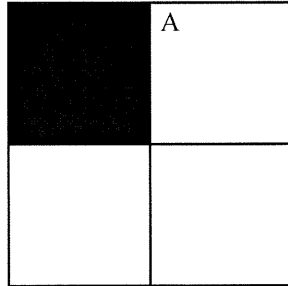


Diagram 1

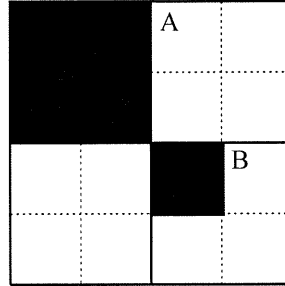


Diagram 2

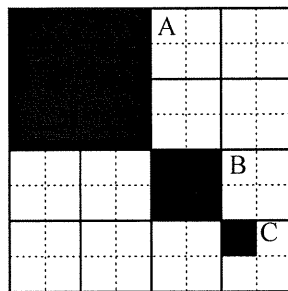


Diagram 3

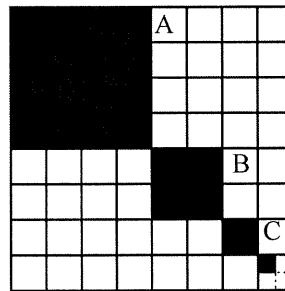


Diagram 4

- (a) (i) Find the area of square B and of square C.  
(ii) Show that the areas of squares A, B and C are in geometric progression.  
(iii) Write down the common ratio of the progression.
- (b) (i) Find the **total** area shaded in diagram 2.  
(ii) Find the **total** area shaded in the 8<sup>th</sup> diagram of this sequence.  
Give your answer correct to six significant figures.
- (c) The dividing and shading process illustrated is continued indefinitely.  
Find the total area shaded.

(5)

(4)

(2)

(Total 11 marks)



8. When the expression  $(2 + ax)^{10}$  is expanded, the coefficient of the term in  $x^3$  is 414 720. Find the value of  $a$ .

*Working:*

*Answer:*

.....

**(Total 6 marks)**

9. Determine the constant term in the expansion of  $\left(x - \frac{2}{x^2}\right)^9$ .

*Working:*

*Answer:*

.....

**(Total 4 marks)**

10. Find the coefficient of  $x^5$  in the expansion of  $(3x - 2)^8$ .

*Working:*

*Answer:*

.....

**(Total 4 marks)**

11. Ashley and Billie are swimmers training for a competition.

- (a) Ashley trains for 12 hours in the first week. She decides to increase the amount of time she spends training by 2 hours each week. Find the total number of hours she spends training during the first 15 weeks.

(3)

- (b) Billie also trains for 12 hours in the first week. She decides to train for 10% longer each week than the previous week.

(i) Show that in the third week she trains for 14.52 hours.

(ii) Find the total number of hours she spends training during the first 15 weeks.

(4)

- (c) In which week will the time Billie spends training first exceed 50 hours?

(4)

**(Total 11 marks)**