Paper 1-type *Instructions to candidates:*

You are not permitted access to any calculator for these problems. Unless otherwise stated in the question, all numerical answers must be given exactly or correct to three significant figures. Show all working, etc. Please do all of your working on separate pieces of paper.

1.1	The n^{th} term of an arithmetic sequence	$u_n = u_1 + (n-1)d$
	The sum of n terms of an arithmetic sequence	$S_n = \frac{n}{2}(2u_1 + (n-1)d) = \frac{n}{2}(u_1 + u_n)$
	The n^{th} term of a geometric sequence	$u_n = u_1 r^{n-1}$
	The sum of n terms of a finite geometric sequence	$S_n = \frac{u_1(r^n - 1)}{r-1} = \frac{u_1(1-r^n)}{1-r}$, $r \neq 1$
	The sum of an infinite geometric sequence	$S = \frac{u_1}{1-r}$, $\lvert r \rvert < 1$

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1. **(6 points)** You are given an arithmetic sequence $u_1, u_2, \ldots$ with $u_4 = 15$ and $u_8 = 7$. Determine

   (a) u_1,

   (b) d (the common difference), and

   (c) the sum $S_{22} = \sum_{k=1}^{22} u_k$.

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(6 points) The sum of an infinite geometric sequence is $13\frac{1}{2}$, and the sum of the first three terms is 13. Find the first term.

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An arithmetic sequence is defined in such a way that the 15th term, $u_{15} = 92$, and the 3rd term, $u_3 = 56$.

(a) Determine
  (i) the common difference.
  (ii) the first term.

(b) Calculate S_{12}.

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The nth term of a sequence is given by

$$u_n = \frac{2}{3} \times 3^n, n = 1, 2, 3, \ldots .$$

If $\sum_{n=1}^{20} \left(\frac{2}{3} \times 3^n \right) = a(3^{20} - b)$, determine the values of a and b.

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Non-calculator

a) An arithmetic series has a fourth term is 42, and the sum of the first four terms is 96.
Find the first term and the common difference of the series.

b) The first and fifth terms of the arithmetic series in a) are the first and third terms of a geometric series.
Find the sum of the first five terms of the geometric series given that the common ratio is positive.

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Non-calculator

$\ln x + 2(\ln x)^2 + 4(\ln x)^3 + 8(\ln x)^4 + \ldots..$ where $x > 0$.

a) Find the set of values of x such that the series converges.

b) If the sum of the sequence is 4, find x, leaving your answer in terms of e.