1)C   In an arithmetic sequence, the first term is -2, the fourth term is 16, and the nth term is $11\,998$.

(a) Find the common difference d.

(b) Find the value of n.

2)C   Consider the expansion of $\left(3x^2 - \dfrac{1}{x}\right)^9$.

(a) How many terms are there in this expansion?

(b) Find the constant term in this expansion.

3)C   Gwendolyn added the multiples of 3, from 3 to 3750 and found that

$$3+6+9+\ldots+3750 = s.$$

4)NC   Let $\ln a = p$, $\ln b = q$. Write the following expressions in terms of p and q.

(a) $\ln a^3 b$

(b) $\ln\left(\dfrac{\sqrt{a}}{b}\right)$
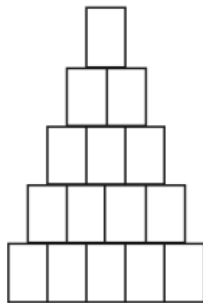
5)   Find the **exact** value of x in each of the following equations.

     (a) $5^{x+1} = 625$

     (b) $\log_a (3x+5) = 2$

6)   Clara organizes cans in triangular piles, where each row has one less can than the row below. For example, the pile of 15 cans shown has 5 cans in the bottom row and 4 cans in the row above it.

     (a)   A pile has 20 cans in the bottom row. Show that the pile contains 210 cans.   *[4 marks]*

     (b)   There are 3240 cans in a pile. How many cans are in the bottom row?   *[4 marks]*

     (c)   (i)   There are S cans and they are organized in a triangular pile with n cans in the bottom row. Show that $n^2 + n - 2S = 0$.

            (ii)   Clara has 2100 cans. Explain why she cannot organize them in a triangular pile.   *[6 marks]*

7) (a) Write down the first three terms of the sequence $u_n = 3n$, for $n \geq 1$. *[1 mark]*

 (b) Find

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

  (ii) $\displaystyle\sum_{n=21}^{100} 3n$. *[5 marks]*

8) *[Maximum mark: 6]*

 (a) Expand $\left(e + \dfrac{1}{e}\right)^4$ in terms of e. *[4 marks]*

 (b) Express $\left(e + \dfrac{1}{e}\right)^4 + \left(e - \dfrac{1}{e}\right)^4$ as the sum of three terms. *[2 marks]*

9) The first term of an infinite geometric sequence is 18, while the third term is 8. There are two possible sequences. Find the sum of each sequence.