OLEVEL P2
A80 PATTERNS AND SEQUENCES

1   **Read** these instructions.

A   Choose two **different** digits from 1, 2, 3, 4, 5, 6, 7, 8 and 9.
B   Write down the larger two-digit number which can be formed from the chosen digits.
C   Write down the smaller two-digit number which can be formed from the chosen digits.
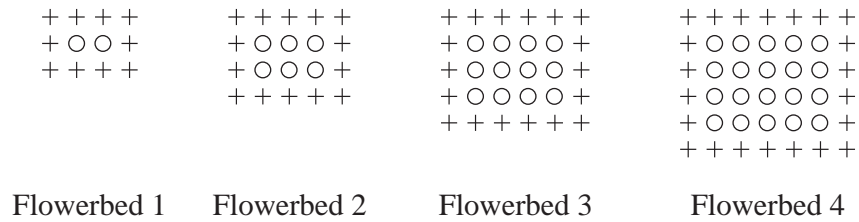D   Subtract the smaller number from the larger and note the result.

Example: A   Choose 2 and 8.
            B   Larger number is eighty-two (82).
            C   Smaller number is twenty-eight (28).
            D   Subtract: 82
                             −28
                             ‾‾‾
                              54
                Result = 54

(a) The digits 3 and 7 are chosen.
      Follow the instructions to find the result.   [1]

(b) Choose three other different pairs of digits.
      Follow the instructions to find the result in each case.   [1]

(c) What do you notice about all these results?   [1]

(d) The digits x and y, where $x > y$, are chosen.

      Find expressions, in terms of x and y, for the value of

      (i)   the larger number,   [1]

      (ii) the result.   [2]

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+ + + +        + + + + +        + + + + + +        + + + + + + +
+ ○ ○ +        + ○ ○ ○ +        + ○ ○ ○ ○ +        + ○ ○ ○ ○ ○ +
+ + + +        + ○ ○ ○ +        + ○ ○ ○ ○ +        + ○ ○ ○ ○ ○ +
               + + + + +        + ○ ○ ○ ○ +        + ○ ○ ○ ○ ○ +
                               + + + + + +        + ○ ○ ○ ○ ○ +
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                                                  + + + + + + +

 Flowerbed 1    Flowerbed 2       Flowerbed 3        Flowerbed 4
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The diagrams above show the first four flowerbeds in a sequence.
Each flowerbed contains two types of plant, pansies (+) and primroses (○).

The table shows the number of plants in the first three flowerbeds.

Flowerbed number (n)	1	2	3	4	5
Number of pansies	10	14	18		
Number of primroses	2	6	12		
Total number of plants	12	20	30		

(a) Copy and complete the columns for flowerbeds 4 and 5. [2]

(b) Find an expression, in terms of n, for

    (i) the number of pansies in flowerbed n, [1]

    (ii) the number of primroses in flowerbed n. [1]

(c) **Hence** show that the total number of plants in flowerbed n can be expressed in the form

$$(n + 2)(n + 3).$$ [2]

(d) Calculate the total number of plants in flowerbed 10. [1]

(e) There are 306 plants in flowerbed k.

    (i) Show that k satisfies the equation

$$k^2 + 5k - 300 = 0.$$ [2]

    (ii) Solve the equation $\quad k^2 + 5k - 300 = 0.$ [2]

    (iii) Hence find the number of pansies in flowerbed k. [1]

3 **(a)** 1, 7, 13, 19, 25, …

      (i) Find an expression, in terms of n, for the nth term of this sequence.

Answer .... [2]

      (ii) Explain why 251 is not a term in this sequence.

Answer ....

.... [1]

(b) Here is another sequence.

5, 8, 13, 20, 29, …

The pth term of this sequence is $p^2 + 4$.

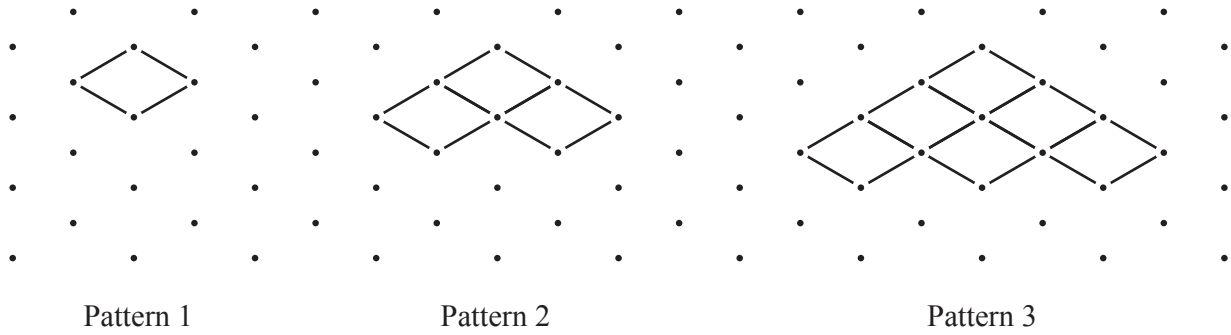Write down an expression, in terms of p, for the pth term of these sequences.

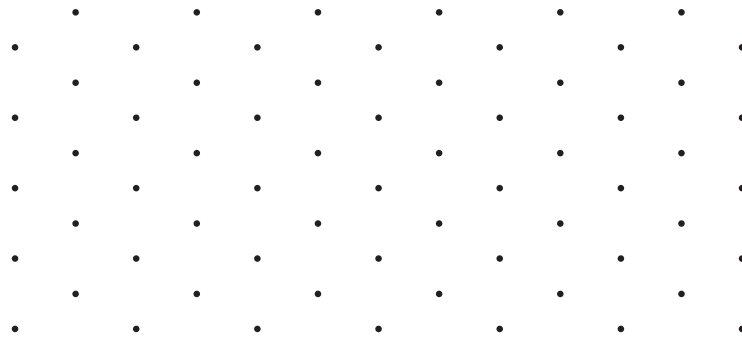   **(i)** −2, 1, 6, 13, 22, …

Answer .... [1]

      (ii) 7, 12, 19, 28, 39, …

Answer .... [1]

(c) The diagrams below show the first three patterns in a sequence.
The patterns are made from short diagonal lines.

Pattern 1   Pattern 2   Pattern 3

(i) Draw Pattern 4 on the dotty grid below.

[1]

(ii) Complete the table below for the number of short lines in Patterns 4 and 5.

Pattern	1	2	3	4	5
Number of short lines	4	10	18		

[2]

(iii) Find an expression, in terms of t, for the number of short lines in Pattern t.

Answer .... [2]