1. The table shows some rows of a number pattern.

Row 1	1^2	–	(0×2)
Row 2	2^2	–	(1×3)
Row 3	3^2	–	(2×4)
Row 4	4^2	–	(3×5)
Row *n*	…………………………………		

(a) In the table, write down an expression, in terms of n, for Row n.

(1)

(b) Simplify fully your expression for Row n.
You must show your working.

....

(2)
(Total 3 marks)

2. Here are the first 4 lines of a number pattern.

$1 + 2 + 3 + 4$	$=$	$(4 \times 3) - (2 \times 1)$
$2 + 3 + 4 + 5$	$=$	$(5 \times 4) - (3 \times 2)$
$3 + 4 + 5 + 6$	$=$	$(6 \times 5) - (4 \times 3)$
$4 + 5 + 6 + 7$	$=$	$(7 \times 6) - (5 \times 4)$

n is the first number in the nth line of the number pattern.

Show that the above number pattern is true for the four consecutive integers

n, $(n + 1)$, $(n + 2)$ and $(n + 3)$

(Total 4 marks)

3. Here are the first five terms of an arithmetic sequence.

$-1 \quad 3 \quad 7 \quad 11 \quad 15$

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

………………………………..

(2)

In another arithmetic sequence the nth term is $8n - 16$

John says that there is a number that is in both sequences.

(b) Explain why John is wrong.

……………………………………………………………………………………………

……………………………………………………………………………………………

……………………………………………………………………………………………

(2)
(Total 4 marks)

4. Here are the first five terms of an arithmetic sequence.

3 7 11 15 19

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

....

(2)

Laura says that 412 is a term in this arithmetic sequence.
Laura is wrong.

(b) Explain why.

....

(1)
(Total 3 marks)

5. Here are the first five terms of an arithmetic sequence.

3 5 7 9 11

Find, in terms of n, an expression for the nth term of the sequence.

....

(Total 2 marks)

1. (a) n^{th} row $= n^2 - (n - 1)(n + 1)$ 1

$= n^2 - (n + 1)(n - 1)$

B1 for $n^2 - (n - 1)(n + 1)$oe
(condone n^2 $(n + 1)(n - 1)$)

(b) $n^2 - (n - 1)(n + 1) = n^2 - (n^2 - 1) = 1$ 2
$= 1$

M1 for $(n - 1)(n + 1) = n^2 - 1$
A1 cao
(SC: B1 for 1 on answer line without working)

[3]

2. $n + (n + 1) + (n + 2) + (n + 3) = 4n + 6$

$(n + 3)(n + 2) - (n + 1)n = n^2 + 5n + 6 - n^2 - n = 4n + 6$ 4

M1 for adding $n + (n + 1) + (n + 2) + (n + 3)$
M1 for writing $(n + 3)(n + 2) - (n + 1)n$
M1 for 4 correct terms from $n^2+5n+6-n^2 - n$ ignoring signs
A1 for establishing equality between LHS and RHS

[4]

3. (a) $4n - 5$ 2

B2
(B1 for $4n + k$, k any integer including 0)

(b) All terms in 1st sequence are odd since $4n$ is always even, so $4n - 5$ is always odd.
All terms in 2nd sequence are even since $8n - 16 = 2(4n - 8)$
so John is wrong 2

B1 for all terms of first sequence are odd
B1 for all terms of second sequence are even

[4]

4. $4n - 1$ oe 2

B2 for $4n - 1$ oe
(B1 for $4n + k$ (k could be zero))

Not an odd number 1

B1 e.g. All terms in sequence are odd numbers or $4n = 413$ and 413 is not divisible by 4 oe

[3]

5. $2n + 1$ 2

B2 for $2n + 1$ oe [for example: $3 + (n - 1)2$]
[Accept: nth = $2n + 1$, nth term = $2n + 1$, $T_n = 2n + 1$,
$x = 2n + 1$, $n = 2x + 1$ oe]
(B1 for $2n + k$ ($k \neq 1$) or $n = 2n + 1$ or $x = 2x + 1$)

[2]

1. In part (a), the vast majority of candidates were able to write down an expression for the nth term of the sequence, but a significant number of these did not use brackets. Although these candidates were not penalised for poor notation at this stage, many went on to simplify their expression inaccurately. A common error here was $n^2 - n^2 - 1 = -1$
A small minority of candidates noticed that every row in the table resulted in 1, and concluded that the nth term should also equal 1.

2. Only the best candidates were able to score full marks for this question, but many were able to add the four consecutive integers algebraically on the RHS to get $4n + 6$ and/or write down a suitable expression for the LHS, such as $(n + 3)(n + 2) - (n + 1)n$ with or without brackets. Expanding and simplifying the LHS proved an obstacle for some, with errors frequently occurring in signs, e.g. $n^2 + 2n + 3n + 6 - n^2 + n$. A significant number of candidates thought that a few numerical examples were sufficient to show the result for all integers.

3. **Paper 9**

The correct answer to part (a) was rarely (13%) seen, however 22% did gain 1 mark for an answer of $4n$ + a constant. $n + 4$ or 19 (the next term) were the usual errors in part (a).
In part (b) candidates often got confused in their explanations which were often unclear and often contradictory. It was sufficient to say that the first sequence contained only odd numbers whilst the numbers in the second sequence were all even. 8 and 16 being even was insufficient.

Paper 10

Part (a) was very well answered. Many candidates gained 2 marks for $4n - 5$ in some form and a further good proportion gained 1 mark for $4n$. The usual incorrect answes of $n + 4$ was seen. It was pleasing to see so many good answers to part (b), mainly using the fact that one of the sequences produced odd numbers and the other even. One or two used the fact that John's sequence consisted of multiples of 4 or 8. Common incorrect answers for (b) included “5 is not a multiple of 16”, something to do with one sequence having negative numbers, or the fact that $8n - 16$ is not double $4n - 5$.

4. This question was well understood with about 60% obtaining the fully correct nth term of the sequence. There were some interesting answers and reasons in part (b) why 412 was not a member of the sequence with 55% obtaining a correct reason. Many more candidates probably did understand the reason but ‘because it is even’ is not enough.

5. $2n - 1$, $2n + 3$, $2n$ and $3n + 2$ were the most common incorrect answers given by candidates who showed partial understanding of what was required. Weaker candidates often wrote $n + 2$ as their general expression.