FOUNDATION & HIGHER

HIGHER EXTENDS

Name ..... Class .....

A24: Special sequences

Reason with triangular, square, cube, Fibonacci-type, quadratic and geometric sequences

20 marks · 25 minutes · Non-calculator

1) Explain why 1, 1, 2, 3, 5, 8, . . . is a Fibonacci sequence.

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[Question 1: 1 marks]

2) The nth triangular number is $\frac{n(n+1)}{2}$. Show that the 10th triangular number is 55

[Question 2: 2 marks]

3) Explain why the next square number after 16 is 25

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[Question 3: 1 marks]

4) Sam says the next term of $3, 6, 12, \ldots$ is 18. Explain why this is not a geometric sequence answer.

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[Question 4: 2 marks]

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5) Show that $2,\ 2\sqrt{2},\ 4,\ 4\sqrt{2}, \ldots$ is geometric with ratio $\sqrt{2}$, and that its 7th term is 16

[Question 5: 3 marks]

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6) The 4th and 5th terms of a Fibonacci-type sequence are 13 and 21. Show that the first two terms are 3 and 5

[Question 6: 3 marks]

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7) Explain why 2, 6, 18, 54 is geometric and not arithmetic.

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[Question 7: 2 marks]

8) Prove that the sum of two consecutive triangular numbers is a square number.

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[Question 8: 3 marks]

9) Show that 5, 9, 15, 23, . . . is a quadratic sequence.

[Question 9: 2 marks]

10) Explain why cube numbers grow faster than square numbers.

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[Question 10: 1 marks]

End of paper – 20 marks in total

Answers and brief mark scheme

Q	Answer	Method / notes
1	Explanation	Each term is the sum of the two before (C1).
2	Shown	$\frac{10 \times 11}{2}$ (M1); C1.
3	Explanation	$4^2 = 16$, $5^2 = 25$ (C1).
4	24	Common ratio is 2, so multiply (C1); 24 (B1).
5	Shown	Ratio $\sqrt{2}$ each time (B1); $2 \times (\sqrt{2})^6$ (M1); $2 \times 8 = 16$ (C1).
6	Shown	3rd term $21 - 13 = 8$ (M1); 2nd term $13 - 8 = 5$ (M1); 1st term 3 (C1).
7	Explanation	Constant ratio 3 (C1); differences 4, 12, 36 not constant (C1).
8	Proof	$\frac{n(n+1)}{2} + \frac{(n+1)(n+2)}{2}$ (M1); $\frac{(n+1)(2n+2)}{2}$ (M1); $(n+1)^2$ (C1).
9	Shown	Differences 4, 6, 8 (M1); second differences constant (C1).
10	Explanation	Multiplying by n three times rather than twice (C1).