4.1 Sequences

- Sequences are lists of numbers (and sometimes letters) which have a pattern to them. An important part of any mathematician's job is to search for and explain hidden patterns or structures.

- 2, 9, 4, 7, 6, 41, ... is a list. There is no underlying pattern to the numbers – and so we have no real way of predicting what comes next.

- These are sequences. Their underlying patterns are shown.

Sequence	Structure
3, 5, 7, 9, ...	3 $\;$ 5 $\;$ 7 $\;$ 9 (+2) (+2) (+2) (+2)
20, 17, 14, 11, ...	20 $\;$ 17 $\;$ 14 $\;$ 11 (−3) (−3) (−3) (−3)
5, 8, 12, 17, ...	5 $\;$ 8 $\;$ 12 $\;$ 17 (+3) (+4) (+5) (+6)
2, 2, 4, 12, 48, ...	2 $\;$ 2 $\;$ 4 $\;$ 12 $\;$ 48 (×1) (×2) (×3) (×4) (×5)
1, 1, 2, 3, 5, 8, ...	1 $\;$ 1 $\;$ 2 $\;$ 3 $\;$ 5 (1 + 1) (1 + 2) (2 + 3)

This is a *Fibonacci* sequence

1. The numbers in boxes form a sequence. Find the next number.

(a) $\boxed{10}$ $\;\;\;$ $\boxed{12}$ $\;\;\;$ $\boxed{14}$ $\;\;\;$ $\boxed{16}$ $\;\;\;$ $\boxed{}$

(b) $\boxed{3}$ $\;\;\;$ $\boxed{8}$ $\;\;\;$ $\boxed{13}$ $\;\;\;$ $\boxed{18}$ $\;\;\;$ $\boxed{}$

(c) $\boxed{11}$ $\;\;\;$ $\boxed{9}$ $\;\;\;$ $\boxed{7}$ $\;\;\;$ $\boxed{5}$ $\;\;\;$ $\boxed{}$

Winter

In Questions **2** to **17** write down the sequence and find the next number

2. 4, 8, 12, 16,

3. 2, 5, 8, 11,

4. 21, 17, 13, 9,

5. 2, 4, 8, 16,

6. 1, 2, 4, 7, 11,

7. 3, 5, 9, 17,

8. 2, 4, 6, 8,

9. 1, 4, 8, 13,

10. 80, 40, 20, 10,

11. 5, 8, 12, 17,

12. $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2,

13. 2, 20, 200, 2000,

14. 45, 36, 28, 21,

15. 1, 3, 9, 27,

16. 56, 28, 14, 7,

17. 1, 1, 2, 3, 5, 8, [Hint see page 93]

18. Write down the sequence and find the missing number.

(a) | 2 | 6 | ☐ | 14 | 18 |

(b) | 3 | ☐ | 12 | 24 | 48 |

(c) | $\frac{1}{2}$ | 2 | $3\frac{1}{2}$ | 5 | ☐ |

(d) | ☐ | 8 | 4 | 0 | −4 |
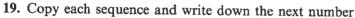
19. Copy each sequence and write down the next number
(a) 3·2, 3·4, 3·6, 3·8, ...
(b) 1·76, 1·77, 1·78, 1·79, ...
(c) 0·402, 0·403, 0·404, 0·405, ...
(d) 4·192, 4·194, 4·196, 4·198, ...

20. The rule for the sequences below is '*double and take away 1*'. Find the missing numbers

(a) 3 → 5 → 9 → 17 → ☐

(b) ☐ → 7 → 13 → 25 → 49

(c) ☐ → 19 → ☐ → 73

21. The rule for the sequences here is '*multiply by 3 and add 1*'. Find the missing numbers

(a) 1 → 4 → 13 → ☐

(b) ☐ → 7 → 22 → 67

(c) ☐ → 2 → ☐ → 22