1.5 Sets and Venn diagrams

Name: _____ Class: _____ Date: _____ **Total: 20 marks**

KEY WORDS set • complement

Sets and Venn diagrams

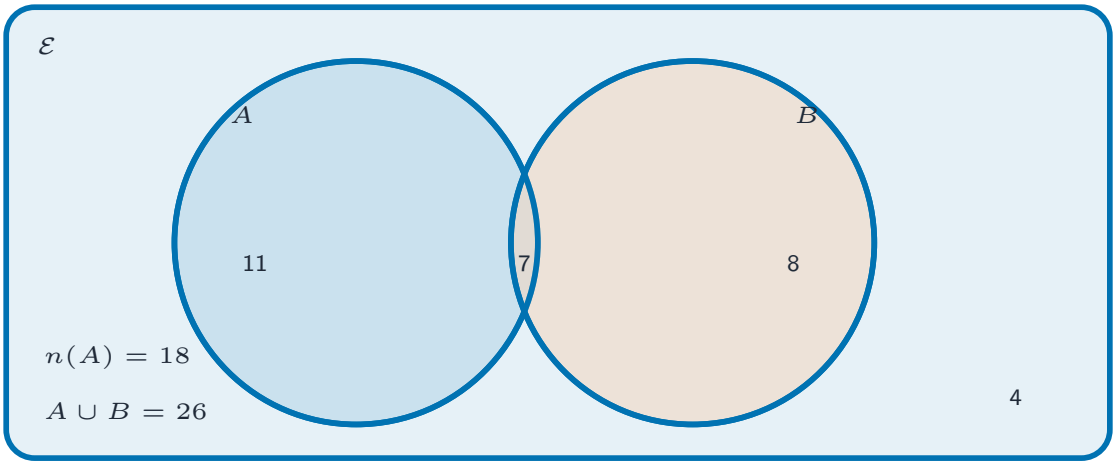
Objective

Use set notation and Venn diagrams: union, intersection, membership, universal and empty sets, complements; at Higher, subsets, element counts and practical sets (objectives Foundation 1.5 A–E and Higher 1.5 A–D).

1 Key knowledge and worked examples

Notation. $A = \{2, 4, 6, 8\}$ is a set; $\cup$ union (either), $\cap$ intersection (both), $\in$ / $\notin$ membership; $\mathcal{E}$ the universal set, $\emptyset$ the empty set, A' the complement. A Venn diagram draws the regions.

Counting. $n(A)$ counts elements. 30 students: 18 cricket, 15 tennis, 7 both – regions 11, 7, 8, 4 with $n(A) = 18$, $A \cup B$ covering 26 and 4 in B' and A'. Subset: $B \subset A$ when every element of B is in A.



HCF reads the overlap's product; LCM everything's product (prime-factor Venns)

2 Practice

2.1 For $A = \{1, 2, 3, 4, 5\}$ and $B = \{4, 5, 6, 7\}$, find $A \cap B$ [1]

2.2 Find $A \cup B$ [2]

2.3 Write whether $3 \in B$ is true or false [1]

2.4 $\mathcal{E} = \{1, \ldots, 10\}$, $A = \{2, 4, 6, 8\}$: list A' [2]

3 Exam-style questions

3.1 *(Original.)* 30 students: 18 play cricket (C), 15 tennis (T), 7 both. (a) Fill a Venn diagram. (b) Find $n(C \cup T)$ and the number in neither region. (c) A student who plays cricket is chosen at random: find the probability they also play tennis. [5]

3.2 *(Original.)* $P =$ multiples of 3 between 1 and 20; $Q = \{x\colon x \text{ is odd}\}$. (a) List P and $P \cap Q$. (b) Is $P \subset Q$? Justify. [4]

3.3 *(Edexcel 4MA1 1HR June 2024 Q11 family, adapted.)* The prime factors of A fill a two-set Venn with those of B; the overlap holds 2^2 and 3, the rest of A holds 2^2 and 5, and the rest of B holds 7. (a) Find A and B. (b) Write down the HCF. [5]

Solutions

2.1 $\{4, 5\}$.

2.2 $\{1, 2, 3, 4, 5, 6, 7\}$.

2.3 False.

2.4 $\{1, 3, 5, 7, 9, 10\}$.

3.1 (a) Regions: cricket only 11, both 7, tennis only 8, neither 4. (b) $n(C \cup T) = 11 + 7 + 8 = 26$; neither 4. (c) $P(T \mid C) = \frac{7}{18}$ – 7 of the 18 cricketers.

3.2 (a) $P = \{3, 6, 9, 12, 15, 18\}$; $P \cap Q = \{3, 9, 15\}$. (b) No: 6 is a multiple of 3 but even, so not every element of P is in Q.

3.3 (a) $A = 2^2 \cdot 3 \cdot 2^2 \cdot 5 = 2^4 \cdot 3 \cdot 5 = 240$; $B = 2^2 \cdot 3 \cdot 7 = 84$. (b) The overlap's product: $2^2 \cdot 3 = 12$.

Local review guidance: regions filled before any counting; set notation correct ($\cap$ vs $\cup$); subset verdicts justified by an element. This is authored classroom guidance.