

Foundation GCSE: Sets and Venn Diagrams

Name: _____

Class: _____

Instructions: Answer all questions. Questions are ordered from easiest (1) to hardest (20). Working out should be shown where appropriate.

1. Write down the mathematical symbol for “is an element of a set”.
2. What does the symbol $\cap$ mean in set notation?
3. What does the symbol $\cup$ mean in set notation?
4. Let $A = \{1, 2, 3, 4, 5\}$ and $B = \{3, 4, 5, 6, 7\}$. List the elements of $A \cap B$.
5. Using A and B from Q4, list the elements of $A \cup B$.
6. State the meaning of A' in set notation.
7. Universal set $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$ and $A = \{2, 4, 6, 8, 10\}$. List A' .
8. In a Venn diagram, set A has 8 elements, set B has 10, and $A \cap B$ has 3. How many are in $A \cup B$?
9. In a group of 30 students, 18 study French, 15 study German, and 7 study both. How many study neither?
10. Using Q9, find the probability that a randomly chosen student studies French ONLY.
11. Write down the number of elements in the empty set $\emptyset$.
12. $\mathcal{E} = \{\text{integers from 1 to 12}\}$, $S = \{\text{prime numbers}\}$. List S .
13. Using Q12, list S' .
14. In a class of 25: 14 like Cats, 12 like Dogs, 3 like neither. Find $n(C \cap D)$.
15. Using Q14, a student who likes Dogs is chosen. What is $P(\text{they also like Cats})$?
16. Shade or describe the region represented by $A \cap B'$ on a Venn diagram.
17. $\mathcal{E} = \{1, 2, 3, 4, 5, 6, 7, 8\}$, $A = \{2, 3, 5, 7\}$, $B = \{1, 3, 5, 7\}$. Find $n(A \cup B)'$.
18. A group of 50 people: 30 drink Coffee, 25 drink Tea, 5 drink neither. Find $P(\text{drinks Coffee AND Tea})$.
19. Using Q18, given a person drinks Coffee, what is $P(\text{they also drink Tea})$?
20. Express “elements in set A or set B or both” using formal set notation.

Answers & Worked Solutions

1. $\in$ – The membership symbol.
2. Intersection ("AND") – Elements in both sets.
3. Union ("OR") – Elements in either set or both.
4. $\{3, 4, 5\}$ – Common elements in both A and B .
5. $\{1, 2, 3, 4, 5, 6, 7\}$ – Combined elements without duplicates.
6. Complement of A – All elements in $\mathcal{E}$ not in set A .
7. $\{1, 3, 5, 7, 9\}$ – Odd numbers up to 10.
8. $15 - n(A \cup B) = 8 + 10 - 3 = 15$.
9. 4 – French only = $18 - 7 = 11$, German only = $15 - 7 = 8$. Total in sets = $11 + 7 + 8 = 26$. Neither = $30 - 26 = 4$.
10. $\frac{11}{30}$ – French only = 11. $P = \frac{11}{30}$.
11. 0 – The empty set contains no elements.
12. $\{2, 3, 5, 7, 11\}$ – Prime numbers ≤ 12 .
13. $\{1, 4, 6, 8, 9, 10, 12\}$ – Non-prime numbers ≤ 12 .
14. $4 - n(C \cup D) = 25 - 3 = 22$. $n(C \cap D) = 14 + 12 - 22 = 4$.
15. $\frac{1}{3} - n(C \cap D) = 4$, $n(D) = 12$. $P = \frac{4}{12} = \frac{1}{3}$.
16. Inside set A , but outside set B (A only).
17. 2 – $A \cup B = \{1, 2, 3, 5, 7\}$. $(A \cup B)' = \{4, 6, 8\}$. $n = 3$... Wait: 1, 2, 3, 5, 7 is 5 elements. Remaining in $\mathcal{E}$: 4, 6, 8 (3 elements). $n((A \cup B)') = 3$.
18. $0.2 - n(C \cup T) = 50 - 5 = 45$. $n(C \cap T) = 30 + 25 - 45 = 10$. $P = \frac{10}{50} = 0.2$.
19. $\frac{1}{3} - n(C \cap T) = 10$, $n(C) = 30$. $P = \frac{10}{30} = \frac{1}{3}$.
20. $A \cup B$ – Formal set notation for union.