# Sets

Standard difficulty · 20 questions · 40 marks · Time: 36 minutes

Name: _____ Date: _____ Score: ____ / 40

Show your working for Sections B and C. Answers are on the last page — try every question first!

## Section A — Choose the correct answer — 8 × 1 = 8 marks

**1.** A set has 4 elements. How many subsets does it have?

**(a)** 8 **(b)** 15 **(c)** 17 **(d)** 16

**2.** If A = {1, 4, 5, 7, 8, 10} and B = {2, 5, 8}, then A ∩ B is:

**(a)** {5, 8} **(b)** {1, 2, 4, 5, 7, 8, 10}

**(c)** {1, 4, 7, 10} **(d)** {2}

**3.** If n(A) = 17, n(B) = 13 and n(A ∩ B) = 4, then n(A ∪ B) is:

**(a)** 26 **(b)** 22 **(c)** 30 **(d)** 34

**4.** If U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10} and A = {2, 3, 5, 6, 7, 9, 10}, then A′ is:

**(a)** {1, 4} **(b)** {2, 3, 5, 6, 7, 9, 10}

**(c)** {1, 4, 8} **(d)** {4, 8}

**5.** The empty set is written as:

**(a)** 0 **(b)** {0} **(c)** {φ} **(d)** φ or { }

**6.** In roster form, {x : x ∈ N and $x^2$ < 69} is:

**(a)** {2, 3, 4, 5, 6, 7, 8} **(b)** {1, 2, 3, 4, 5, 6, 7}

**(c)** {1, 2, 3, 4, 5, 6, 7, 8} **(d)** {1, 2, 3, 4, 5, 6, 7, 8, 9}

**7.** How many integers are there in the interval (1, 11)?

**(a)** 11 **(b)** 8 **(c)** 10 **(d)** 9

**8.** Assertion (A): If n(A) = 26, n(B) = 18 and n(A ∩ B) = 8, then n(A ∪ B) = 44.
Reason (R): n(A ∪ B) = n(A) + n(B) − n(A ∩ B), so that the common elements are not counted twice.

**(a)** Both A and R are true, and R is the correct explanation of A.

**(b)** Both A and R are true, but R is not the correct explanation of A.

**(c)** A is true, but R is false.

**(d)** A is false, but R is true.

## Section B — Short answer — 8 × 2 = 16 marks

**9.** If A = {1, 2, 5, 6, 9, 10} and B = {2, 7, 9}, find A ∪ B, A ∩ B and A − B.

**10.** In a group of 98 people, 49 like tea, 70 like coffee and 35 like both. How many like neither? How many like tea only?

**11.** Write down all the subsets of {2, 6, 8}. How many elements does its power set have?

**12.** Let U = {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}, A = {3, 5, 6, 7, 9, 10} and B = {1, 3, 4, 7, 9, 10}. Find $(A \cup B)'$ and $A' \cap B'$. What do you notice?

**13.** (a) Write $\{x : x \in R, -9 < x \leq -5\}$ as an interval. (b) Write $[1, 10)$ in set-builder form.

**14.** Write {x : x is a positive multiple of 6 and $x \leq 31$} in roster form. How many elements does it have?

**15.** $n(A) = 29$, $n(B) = 35$, $n(C) = 32$, $n(A \cap B) = 15$, $n(A \cap C) = 16$, $n(B \cap C) = 15$ and $n(A \cap B \cap C) = 7$. Find $n(A \cup B \cup C)$.

**16.** If $n(A) = 41$, $n(B) = 49$ and $n(A \cap B) = 19$, find $n(A - B)$, $n(B - A)$ and $n(A \cup B)$.

## Section C — Word problems — 4 × 4 = 16 marks

**17.** In a survey of 118 students, 36 read Hindi newspapers, 72 read English, 59 read Punjabi; 17 read Hindi and English, 21 read Hindi and Punjabi, 32 read English and Punjabi, and 5 read all three. How many read (a) none of them, (b) exactly one, (c) Hindi only?

**18.** In a class of 93, 60 play cricket, 44 play football and 14 play neither. Find how many play (a) both, (b) cricket only, (c) football only. Draw a Venn diagram.

**19.** Let A = {2, 6, 7, 8}, B = {2, 6, 8, 9, 10} and C = {1, 3, 4, 7, 8, 9}. Verify that A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C).

**20.** Set A has 2 more elements than set B, and A has 96 more subsets than B. How many elements does each set have?

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# Answer key

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| Q | Answer | Working |
|---|---|---|
| 1 | **(d) 16** | $2^4$ |
| 2 | **(a) {5, 8}** | — |
| 3 | **(a) 26** | n(A) + n(B) − n(A ∩ B) |
| 4 | **(c) {1, 4, 8}** | the elements of U not in A |
| 5 | **(d) φ or { }** | {0} has one element, 0 |
| 6 | **(c) {1, 2, 3, 4, 5, 6, 7, 8}** | — |
| 7 | **(d) 9** | excludes 1; excludes 11 |
| 8 | **(d) A is false, but R is true.** | A is false: 26 + 18 − 8 = 36. R is true. |
| 9 | **A ∪ B = {1, 2, 5, 6, 7, 9, 10}; A ∩ B = {2, 9}; A − B = {1, 5, 6, 10}** | — |
| 10 | **Neither: 14; tea only: 14** | n(T ∪ C) = 49 + 70 − 35 = 84 |
| 11 | **φ, {2}, {6}, {8}, {2, 6}, {2, 8}, {6, 8}, {2, 6, 8}; 8 elements** | $2^3 = 8$ |
| 12 | **Both are {2, 8}: (A ∪ B)′ = A′ ∩ B′ (De Morgan's law)** | A ∪ B = {1, 3, 4, 5, 6, 7, 9, 10} |
| 13 | **(a) (−9, −5]; (b) {x : x ∈ R, 1 ≤ x < 10}** | — |
| 14 | **{6, 12, 18, 24, 30}; 5 elements** | — |
| 15 | **57** | 29 + 35 + 32 − 15 − 16 − 15 + 7 |
| 16 | **n(A − B) = 22; n(B − A) = 30; n(A ∪ B) = 71** | n(A − B) = n(A) − n(A ∩ B) |
| 17 | **(a) 16; (b) 42; (c) 3** | fill the Venn diagram from the centre outwards |
| 18 | **(a) 25; (b) 35; (c) 19** | n(C ∪ F) = 93 − 14 = 79; both = 60 + 44 − 79 |
| 19 | **B ∩ C = {8, 9}, so A ∪ (B ∩ C) = {2, 6, 7, 8, 9}. A ∪ B = {2, 6, 7, 8, 9, 10}, A ∪ C = {1, 2, 3, 4, 6, 7, 8, 9}, and their intersection is {2, 6, 7, 8, 9}. Both sides are equal.** | — |
| 20 | **A has 7, B has 5** | $2^m - 2^k = 96 = 2^k(2^2 - 1) = 2^5 \times 3$ |



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