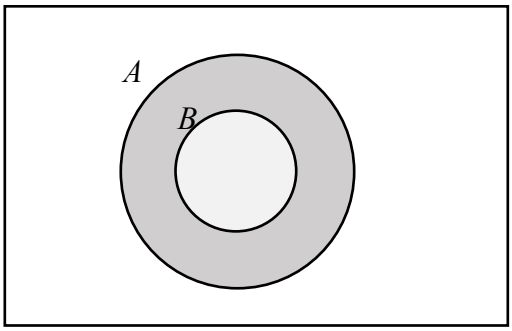
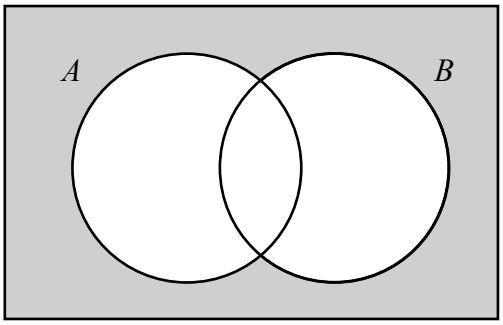
Worksheet 1 – Sets

1. Answer

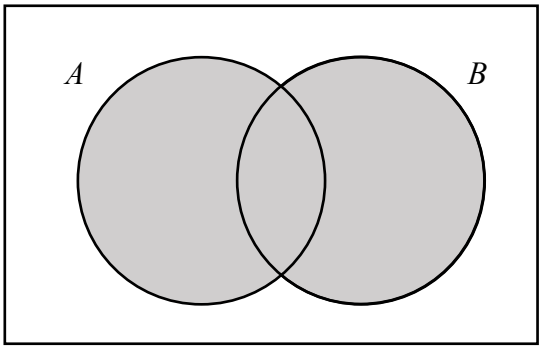
(a) $B' \cap A$



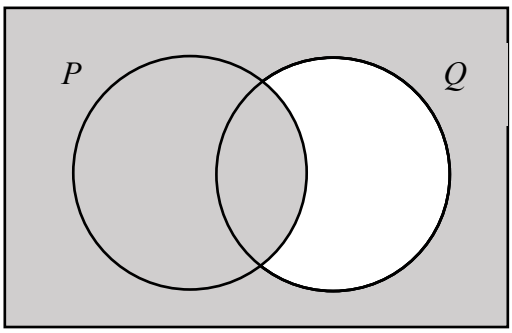
(b) $B' \cap A'$



(c) $(A' \cap B')'$

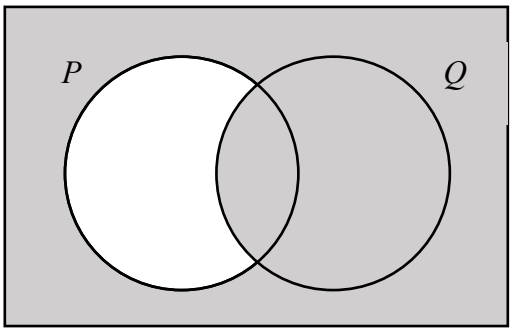


(d) $P \cup Q'$

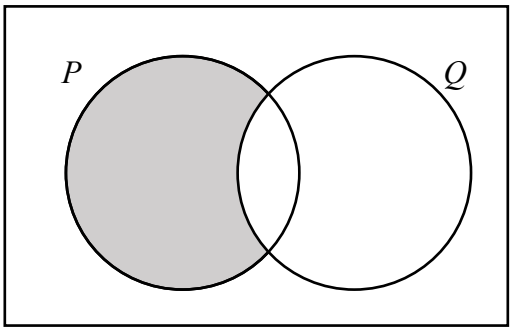


(e) $(P' \cup Q)'$

$P' \cup Q$ is shown below



Thus $(P' \cup Q)'$ will be the inverse of above.



2. Answer

(a) List all the elements in $A \cup B$ in set notation.

$A = \{2, 4, 6, 8, 10, 12, 14\}$

$B = \{3, 6, 9, 12, 15\}$

$A \cup B = \{1, 2, 3, 4, 6, 8, 9, 10, 12, 14, 15\}$

(b) List all the elements in $A' \cup B$ in set notation.

$A' = \{1, 3, 5, 7, 9, 11, 13, 15\}$

$A' \cup B = \{1, 3, 5, 6, 7, 9, 11, 12, 13, 15\}$

(c) List all the elements in $A \cap B$ in set notation.

$A \cap B = \{6, 12\}$

(d) List all the elements in $A' \cap B'$ in set notation.

$A' = \{1, 3, 5, 7, 9, 11, 13, 15\}$

$B' = \{1, 2, 4, 5, 7, 8, 10, 11, 13, 14\}$

$A' \cap B' = \{1, 5, 7, 11, 13\}$

3. **Answer**

(a) $A = \{1, 3, 5, 7, 9, 11, 13, 15\}$

$B = \{3, 6, 9, 12, 15\}$

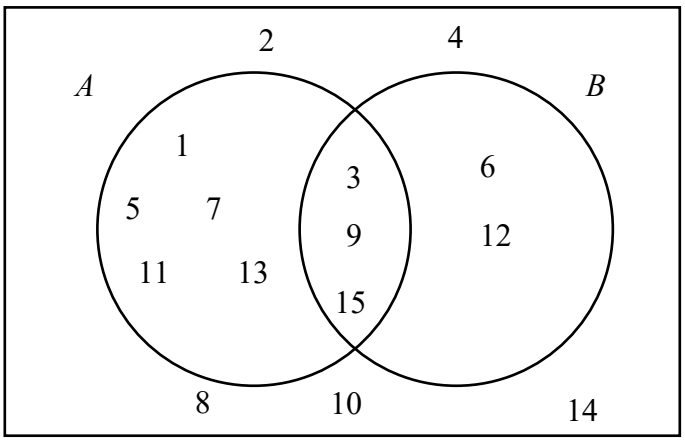
$A \cap B = \{3, 9, 15\}$

(b) $A' = \{2, 4, 6, 8, 10, 12, 14\}$

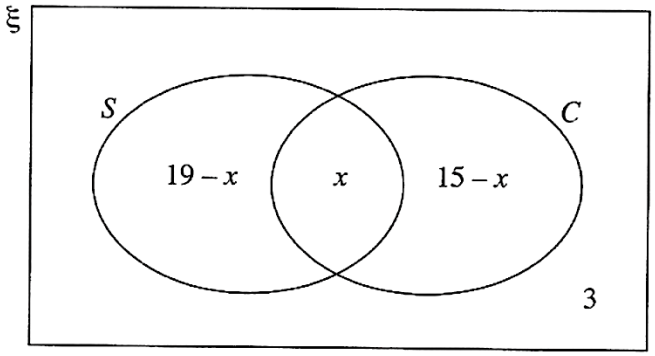
$B' = \{1, 2, 4, 5, 7, 8, 10, 11, 13, 14\}$

$A' \cap B' = \{2, 4, 8, 10, 14\}$

(c) Answer



4. Answer



$19 - x + x + 15 - x + 3 = 27$

$37 - x = 27$

$x = 10$

∴ No. of children who own a smartphone but not a computer $= 19 - x$

$= 19 - 10$

$= 9$

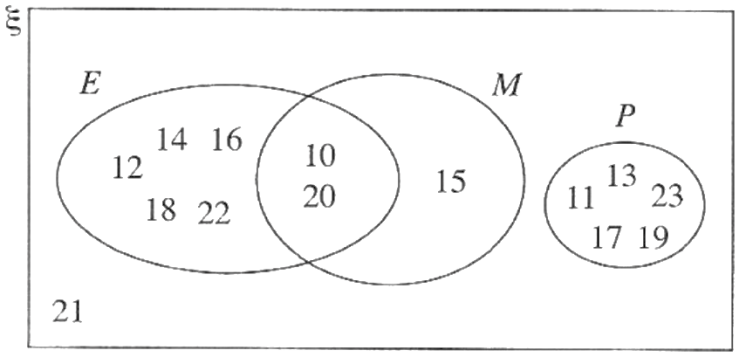
5. Answer

(a)

$\xi = \{10, 11, 12, \ldots, 21, 22, 23\}$

$E = \{10, 12, 14, 16, 18, 20, 22\}$

$P = \{11, 13, 17, 19, 23\}, M = \{10, 15, 20\}$



(b) $E' = \{11, 13, 15, 17, 19, 21, 23\}$

$P' = \{10, 12, 14, 15, 16, 18, 20, 21, 22\}$

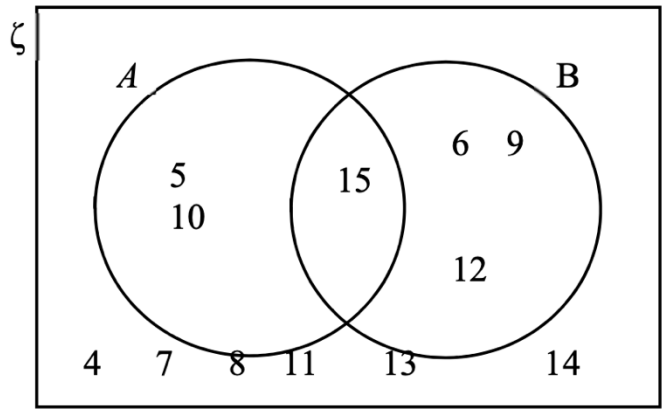
$E' \cup M = \{10, 11, 13, 15, 17, 19, 20, 21, 23\}$

$(E' \cup M) \cap P' = \{10, 15, 21\}$

6. Answer

(a) 5, 10, 15

(b)



(c) {5}, {5, 10}, {5, 15}, {10, 15}, {5, 10, 15} { }

7. Answer

(a) Is $(-1,6) \in A$? Explain clearly.

Answer

Substitute $(-1,6)$, LHS $= 2(-1)+6=4$, RHS $= 8$.

LHS $\neq$ RHS. $(-1,6)$ does not satisfy the equation so $(-1,6) \notin A$. [1]

(b) Find the element p such that $p \in (A \cap B)$.

$2x + y = 8$ .....(1)

$3x - 4y = 12$ .....(2)

From (1): $y = -2x + 8$ into (2)

$3x - 4(8 - 2x) = 12$

$3x - 32 + 8x = 12$

$11x = 44$

$x = 4$

$y = 0$

Answer $p =$ (4, 0) [2]

(c) Write down a possible value of m and of c such that $B \cap C = \varnothing$.

$y = \frac{3}{4}x - 3$ and $y = \frac{mx}{4} - \frac{c}{4}$

Since $B \cap C = \varnothing$

$\frac{m}{4} = \frac{3}{4}$

$m = 3$

$-\frac{c}{4} = -3$

$c = 12$

Answer $m =$ 3 [1]

$c =$ Any real value $\neq 12$ [1]

8. Answer

(a) $\{4, 5\} \subset B$

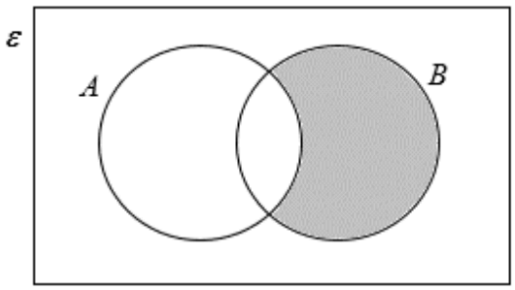
(b) $2 \in (A \cup B)$

(c) $B \cap C = \emptyset$

Worksheet 2 – Sets

1. Answer

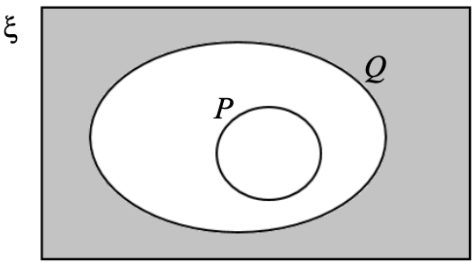
(a) On the Venn diagram, shade the region which represents $A' \cap B$.



[1]

(b) Given that P is a subset of Q, simplify $(P \cup Q)'$.

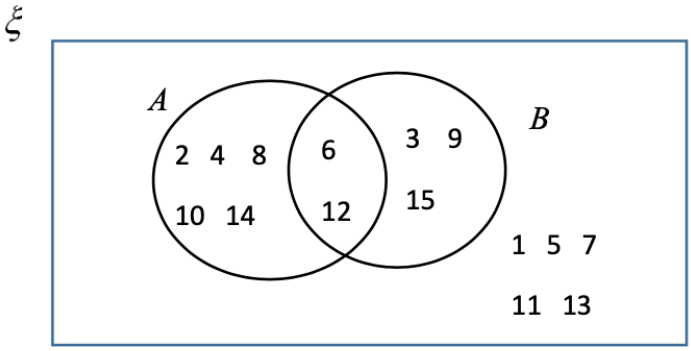
You may use the space below to help in your investigation.



Answer $(P \cup Q)' =$ ..... Q' ..... [1]

2. Answer

(a) Draw a Venn Diagram to illustrate this information. [2]



(b) List the elements contained in the set $(A \cup B)'$.

$(A \cup B)' = \{1, 5, 7, 11, 13\}$ *Answer* $\{1, 5, 7, 11, 13\}$ [1]

(c) Describe, as simply as possible, in words, the elements contained in the set $A \cap B$.

Answer

Elements in set $A \cap B$ are positive integers that are less than or equal to 15 and is divisible by 6. [1]

3. Answer

(a) $3 \notin C$

(b) $\{1\} \subset (A \cap B)$

(c) $(A \cup B \cup C)' = \emptyset$

4. Answer

Given that $\varepsilon = \{x : x \text{ is a positive integer and } x \leq 12\}$, = { 1, 2, 3, ….. , 12 }
$A = \{x : x \text{ is an odd integer and } 3x + 5 > 11\}$, = { 3, 5, 7, 9, 11 }
$B = \{x : x \text{ is a factor of } 28\}$, = { 1, 2, 4, 7 }
$C = \{x : x \text{ is a composite number}\}$. = { 4, 6, 8, 9, 10, 12 }

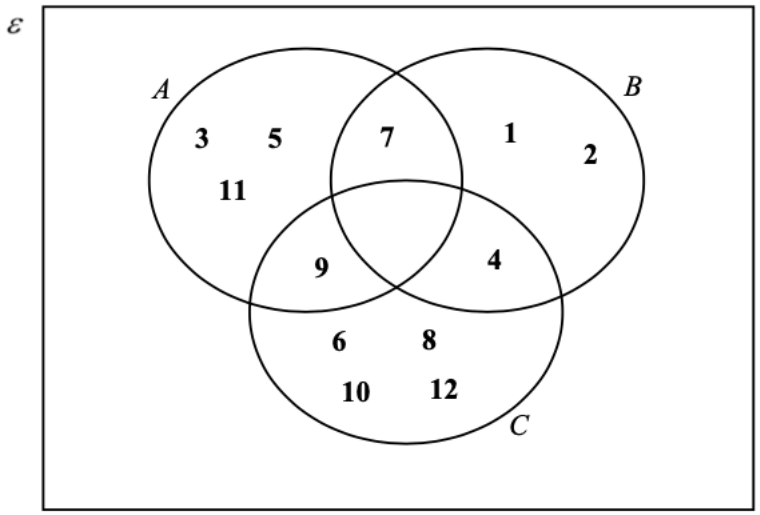
x > 2

(a) List the elements of
(i) $A \cup B$,
(ii) $B \cap C$,

Answer : **(a)(i)** $A \cup B$ = { 1, 2, 3, 4, 5, 7, 9, 11 } [B1] [1]

(ii) $B \cap C$ = { 4 } [B1] [1]

(b) Represent the elements of ε and sets A, B and C in the Venn Diagram below. [1]



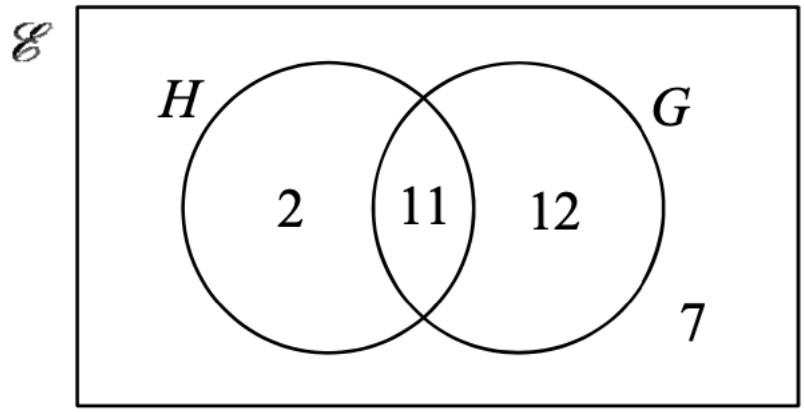
[B1 – All must be correct]

**Composite number is a positive integer that can be formed by multiplying two smaller positive integers.

5. Answer

(a) Answer

(i)



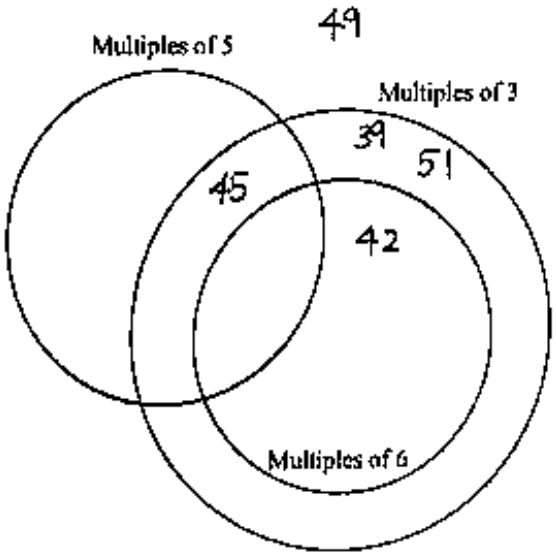
(ii) Only History or Geography = 2 + 12 = 14

(b) Answer

(i) $D \subset P$

(ii) There are (some) students who play the drums and the piano.

6. Answer

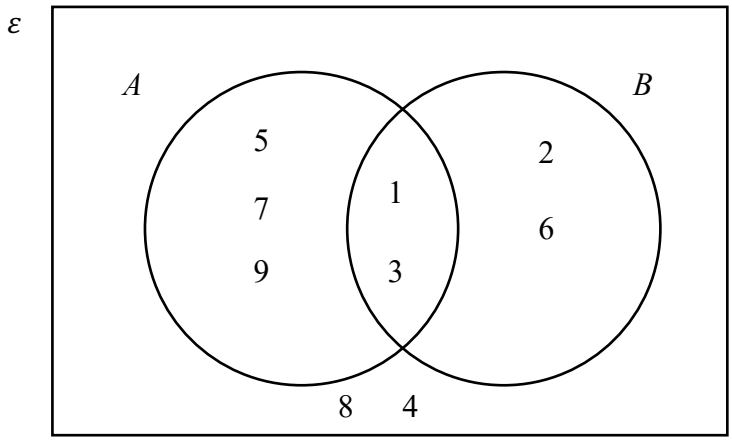


7. Answer

(a) $X \cap Y'$

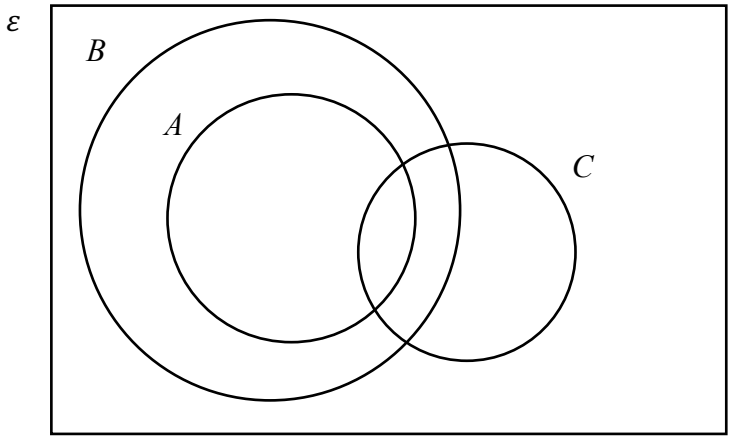
(b) Answer

(i) Answer



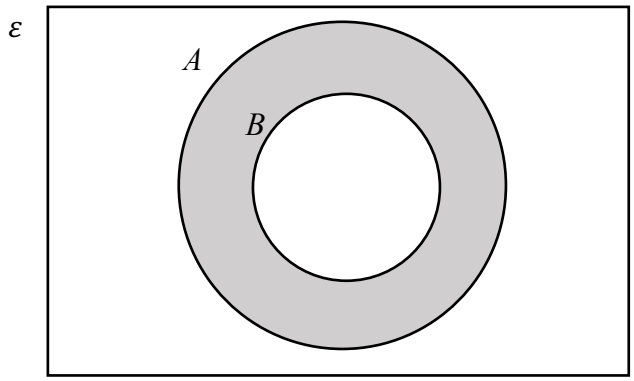
(ii) 4, 8

8. Answer



9. Answer

(a)



(b) $M = \{1, 8, 27\}$

Test for $k \rightarrow x = 2k + 1$

If $x = 1$, $k = 0$ (is an integer), $x = 1$ accepted

If $x = 8$, $k = \frac{7}{2}$ (not an integer), $x = 8$ rejected

If $x = 27$, $k = 13$ (is an integer), $x = 27$ accepted

So $N = \{1, 27, \ldots, \ldots\}$ Or just check all values of x then find $(M \cap N)$.

$(M \cap N) = \{1, 27\}$

Worksheet 3 – Sets

1. Answer

   (a) Answer

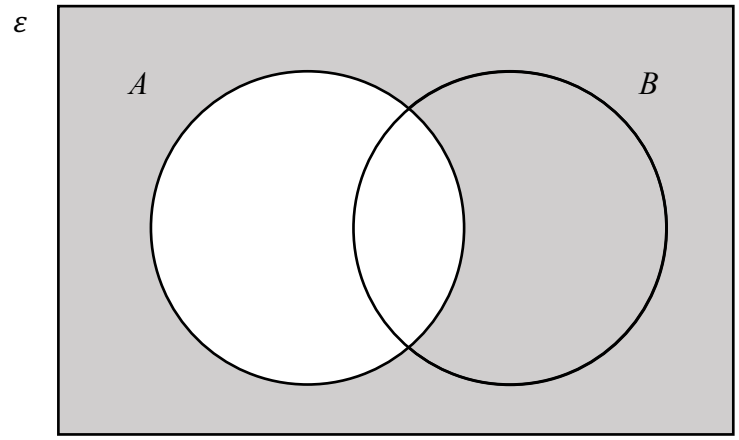
   $A = \{1, 4, 9, 16\}$

   $B = \{1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23\}$

   $(A \cap B) = \{1, 9\}$

   $n\,(A \cap B) = 2$

   (b) Answer



2. Answer

   (a) $(P' \cap Q') \cup (P \cap Q)$

   (b) $A = \{2, 3, 5, 7\}$

   $B = \{1, 2, 3, 4, 6\}$

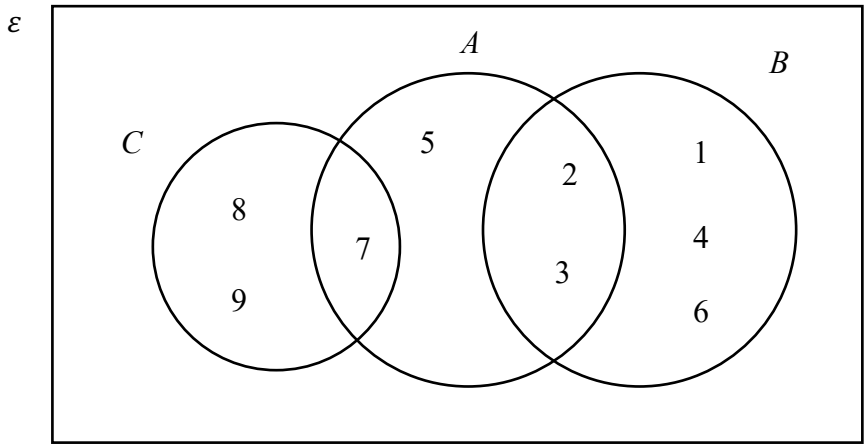
   $C = \left\{x: \frac{25}{4} < x\right\} = \{x: x > 6.25\} = \{7, 8, 9\}$

   (i) $B \cap C = \emptyset$

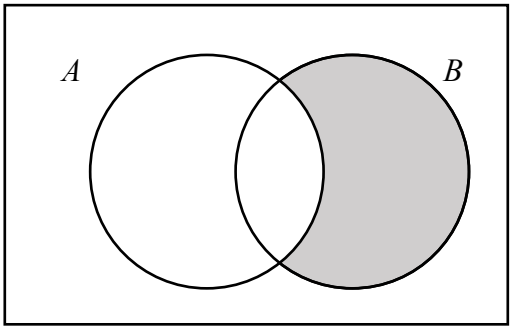
   (ii) $(A \cup B) = \{1, 2, 3, 4, 5, 6, 7\}$

   $(A \cup B)' = \{8, 9\}$

(iii)

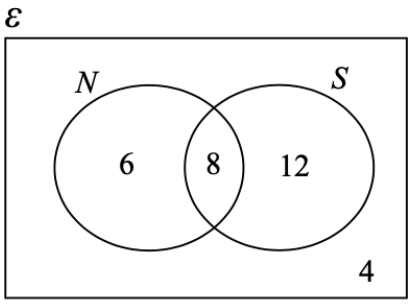


3. Answer



4. Answer

(a)



Deduct 1 mark each for two overlapping circles *N* & *S* missing/wrong, [B1]
Deduct 1 mark each for missing/wrong label of ε, *N* & *S*, [B1]
Deduct 1 mark each for any numbers (6, 8, 12, 4) missing/wrong. [B1]

(b) (i) $M \cap S \neq \{\ \}$ means there are Malay students in the soccer team. [B1]

(ii) Since I is a proper subset of N, therefore all Indian students are members of the NCC [B1]

(iii) $C \cap (N \cup S)'$ OR $C \cap (N' \cap S')$ [B1]

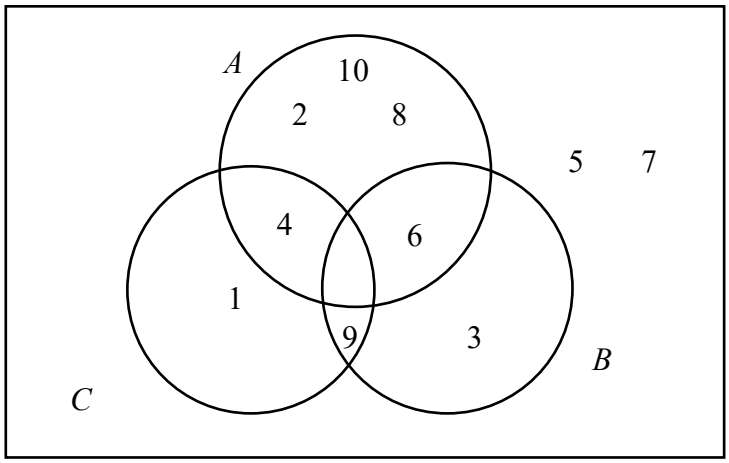
5. Answer

$A = \{2, 4, 6, 8, 10\}$

$B = \{3, 6, 9\}$

$C = \{1, 4, 9\}$

ε



$n(A \cup B \cup C)' = 3$

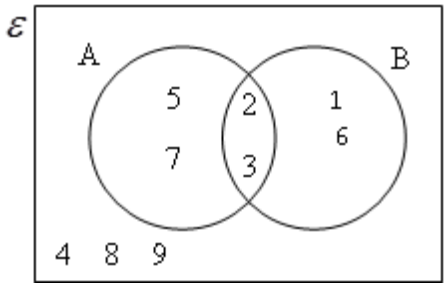
6. Answer

(a) $A \cap B' = \{5, 7\}$

(b) $(A \cup B)' = \{4, 8, 9\}$

(c) No. $\{2, 3\}$ is a set. It should be subset of set A.

(d) Draw a Venn diagram to represent the sets ε, A and B.

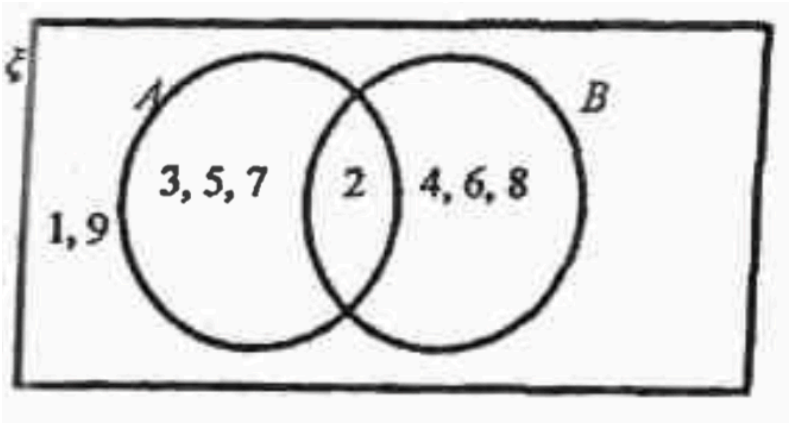


7. Answer

   (a) $E \cap F$ (Irrational numbers are numbers like pi, surds as they cannot be expressed in fractions)

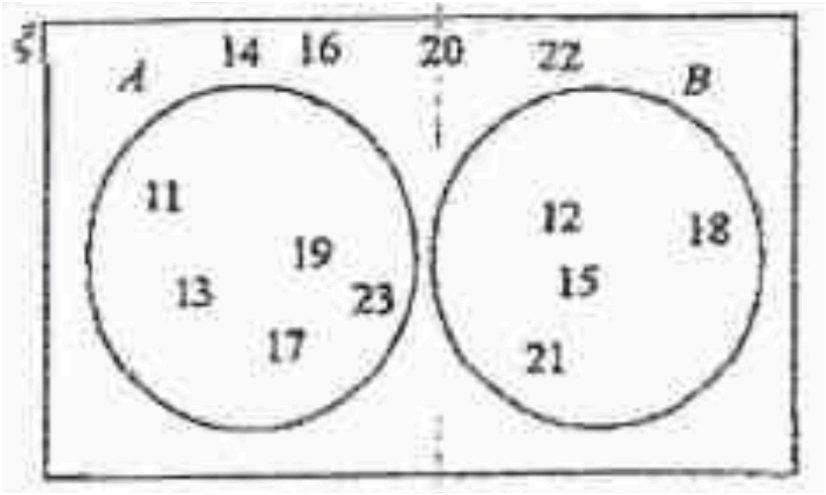
   (b) 3

8. Answer



9. Answer

   (a)



   (b) 14, 16, 20 and 22