

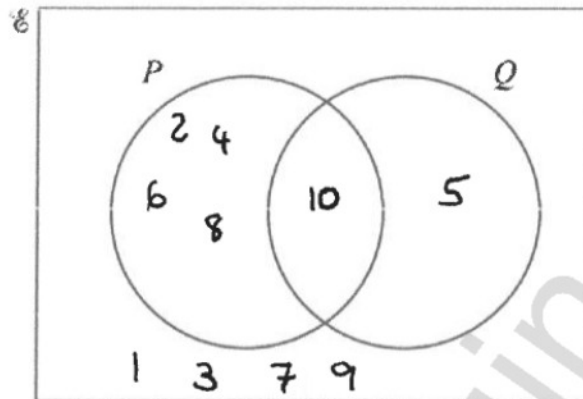
A Sets and Venn Diagrams

16 x is an integer.

$$\mathcal{E} = \{x : 1 \leq x \leq 10\}$$

$$P = \{x : x \text{ is an even number}\}$$

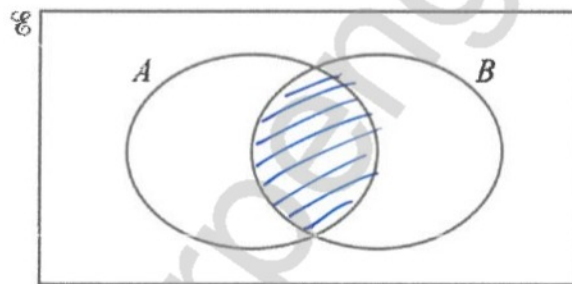
$$Q = \{x : x \text{ is a multiple of 5}\}$$



Complete the Venn diagram.

[2]

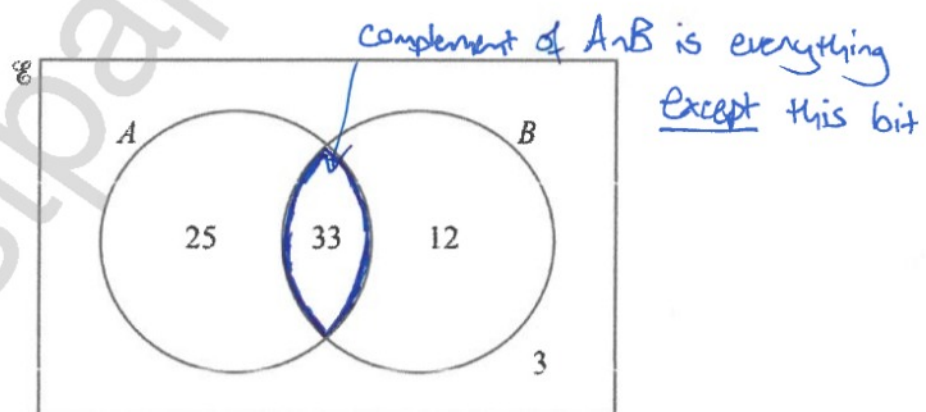
3



On the Venn diagram, shade the region $A \cap B$.

[1]

10



Find $n(A \cap B)$.

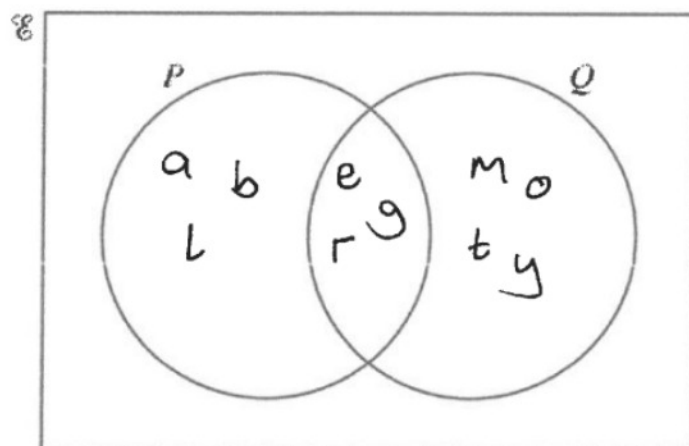
↑
"number of elements"
← complement of $A \cap B$

$$25 + 12 + 3 = 40$$

40

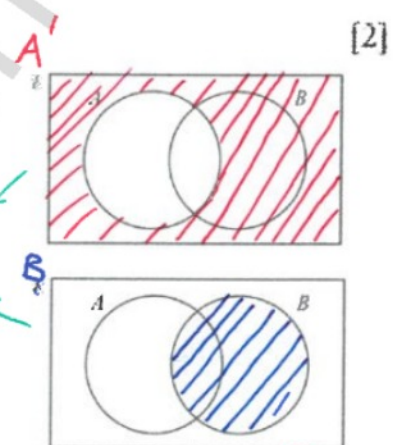
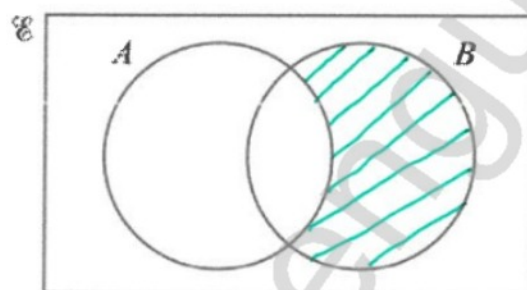
[1]

- 11 (a) $\mathcal{E} = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z\}$
 $P = \{a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z\}$
 $Q = \{c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z\}$



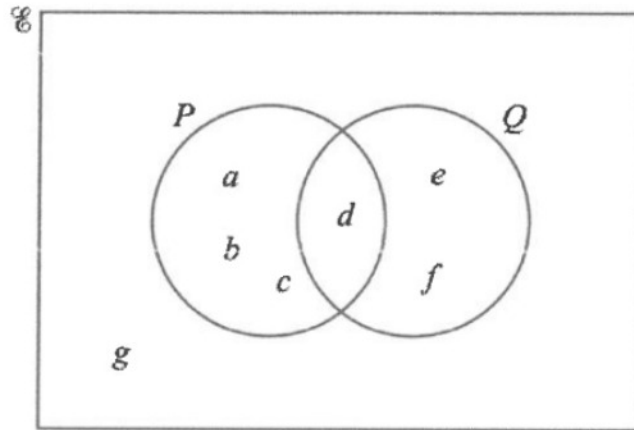
Complete the Venn diagram.

(b)



Shade the region $A' \cap B$.

$\nwarrow \cap$ means we want what gets shaded both times $\nearrow$ [1]



The Venn diagram shows the elements of the sets E , P and Q .

Complete the statements.

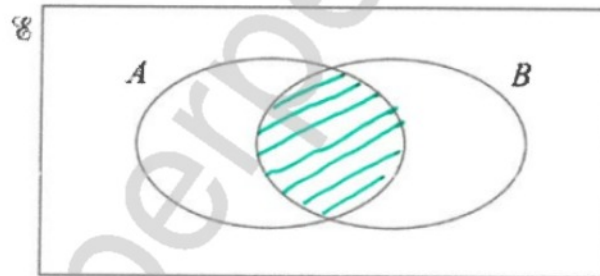
(a) $P = \{ \dots a, b, c, d \dots \}$

[1]

(b) $n(P \cup Q) = \dots 6 \dots$

[1]

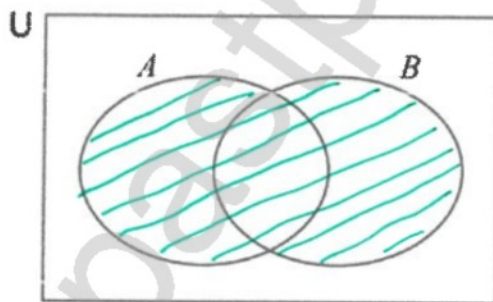
↑
"or"



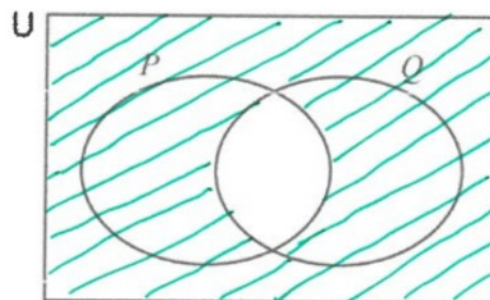
On the Venn diagram, shade the region $A \cap B$.

[1]

9 In each Venn diagram, shade the given set.



$A \cup B$

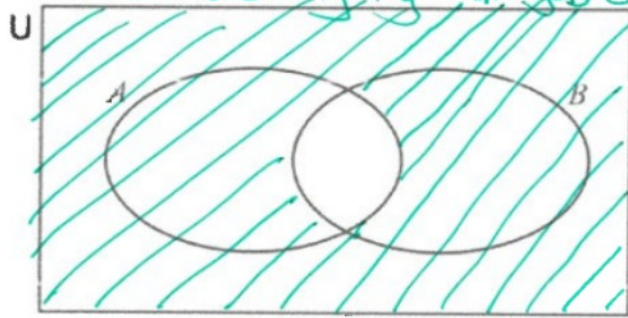


$(P \cap Q)'$

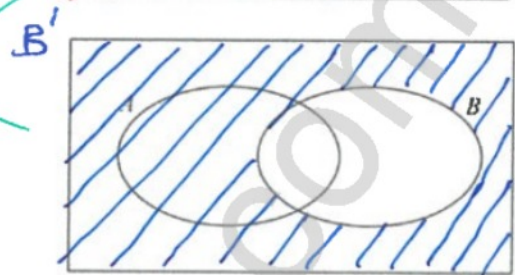
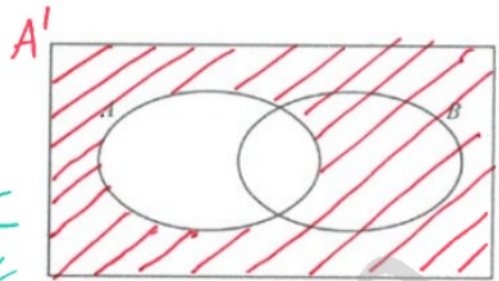
[2]

13 Shade the given sets in each of these Venn diagrams.

(a) $A' \cup B'$

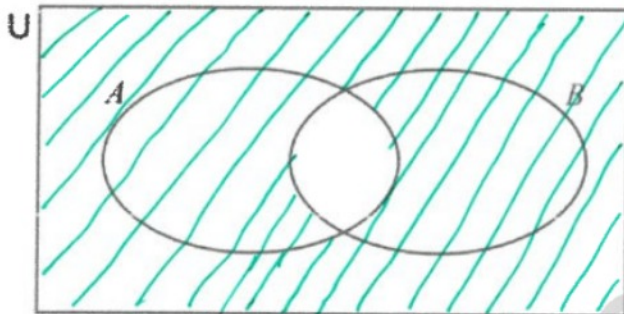


$\cup$ means anything that gets shaded either time



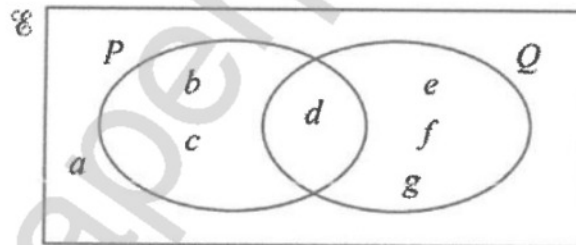
[1]

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



[1]

14



(a) Complete the statement.

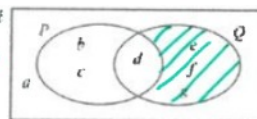
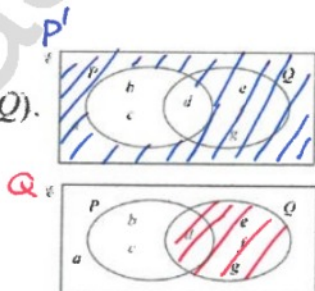
$$P \cup Q = \{ \dots b, c, d, e, f, g \dots \} \quad [1]$$

(b) Find $n(Q)$.

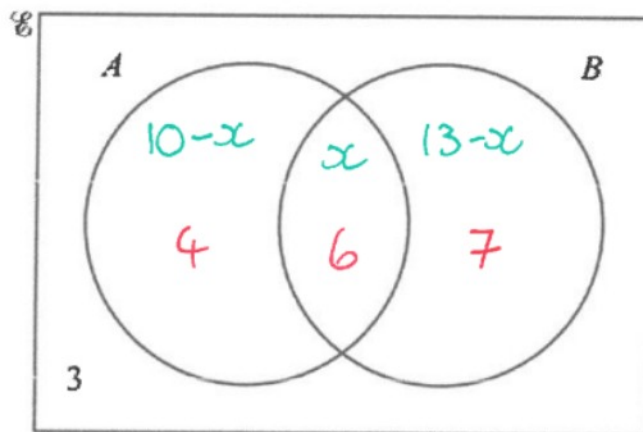
$$\dots 4 \dots \quad [1]$$

(c) Find $n(P' \cap Q)$.

$\cap$: "and"



$$\dots 3 \dots \quad [1]$$



$n(E) = 20$, $n(A \cup B)' = 3$, $n(A) = 10$ and $n(B) = 13$.
The Venn diagram shows some of this information.

$$10 - x + x + 13 - x + 3 = 20$$

$$26 - x = 20$$

$$-x = -6$$

$$x = 6$$

Find

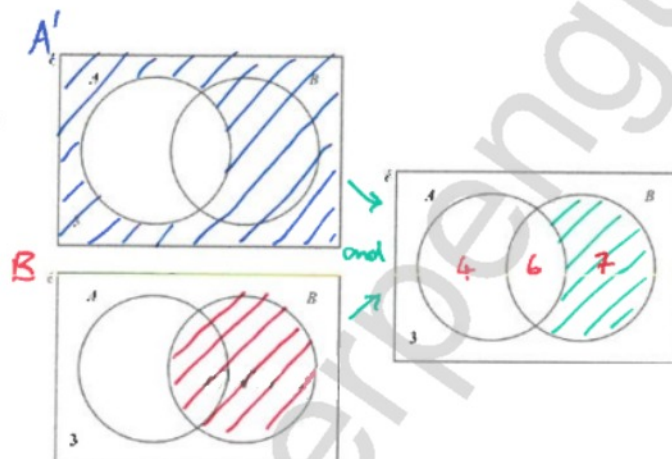
(a) $n(A \cap B)$

6

[2]

(b) $n(A' \cap B)$

↑
and

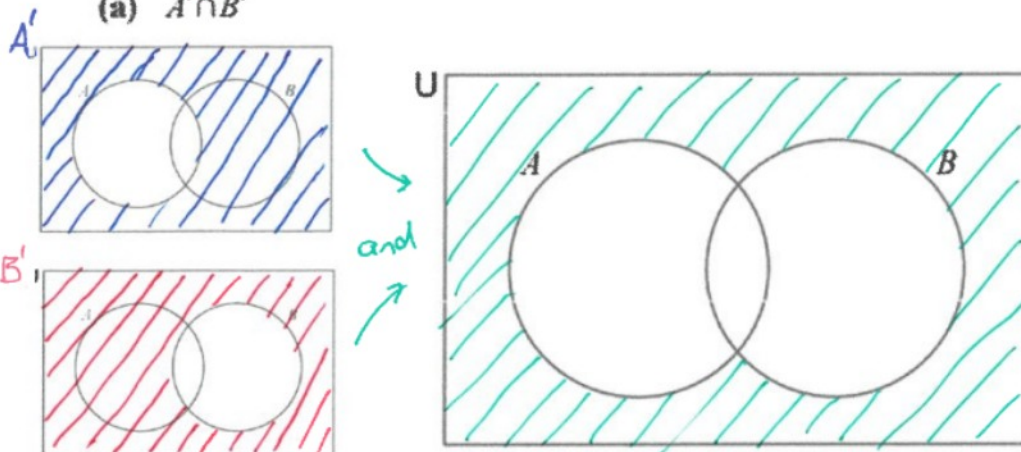


7

[1]

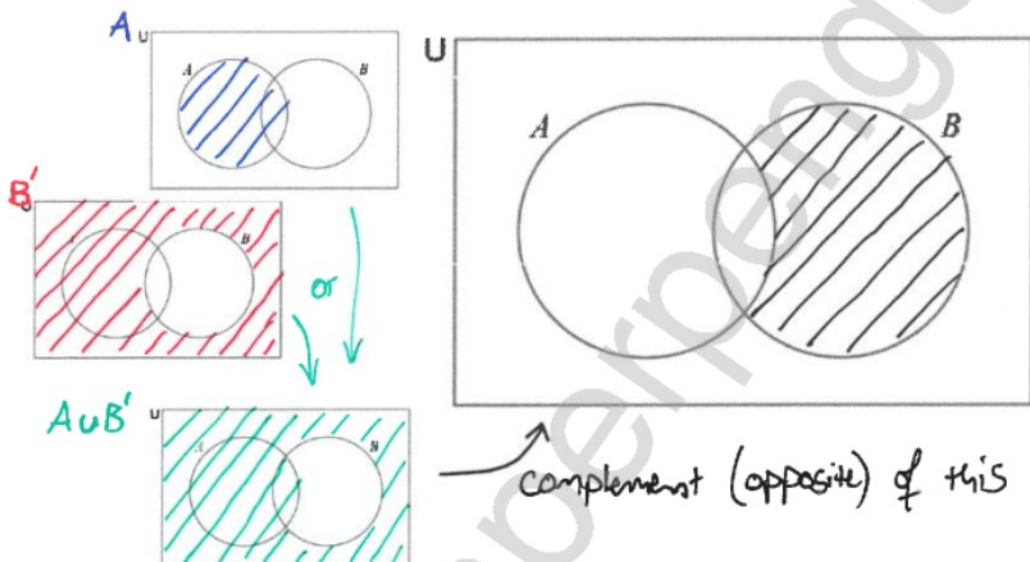
13 Shade the given region on the Venn diagram.

(a) $A' \cap B'$

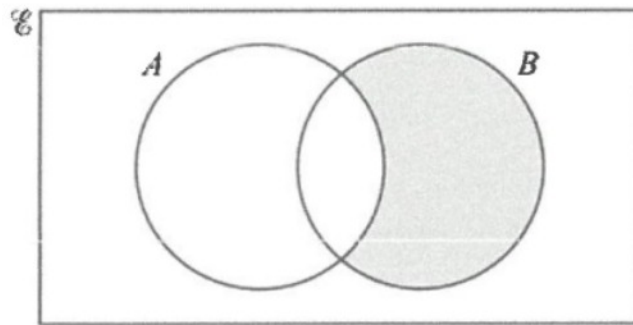


[1]

(b) $(A \cup B)'$



[1]



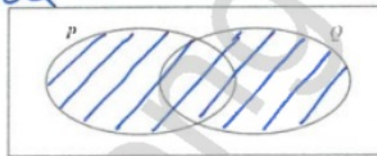
Use set notation to describe the shaded region.

$$A' \cap B$$

[1]

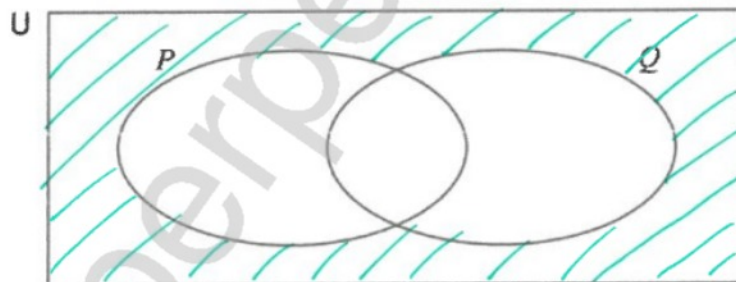
(others are possible,
e.g. $(A \cup B)'$)

$P \cup Q$



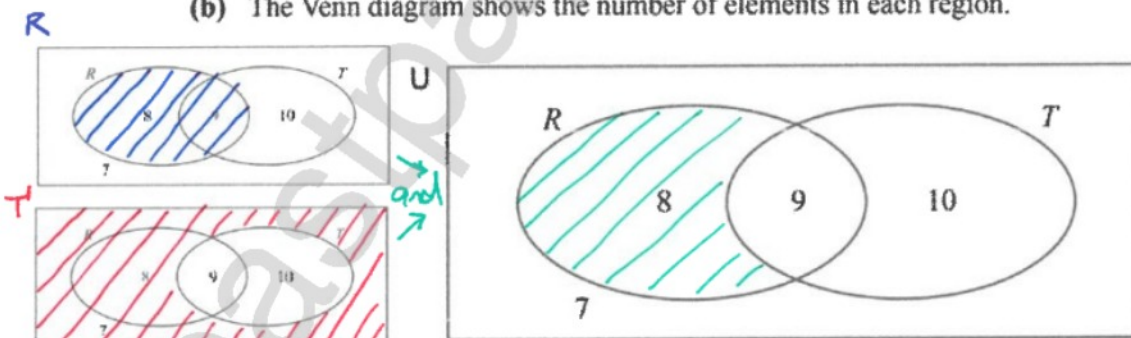
10 (a) Shade the region $(P \cup Q)'$.

↓ complement



[1]

(b) The Venn diagram shows the number of elements in each region.



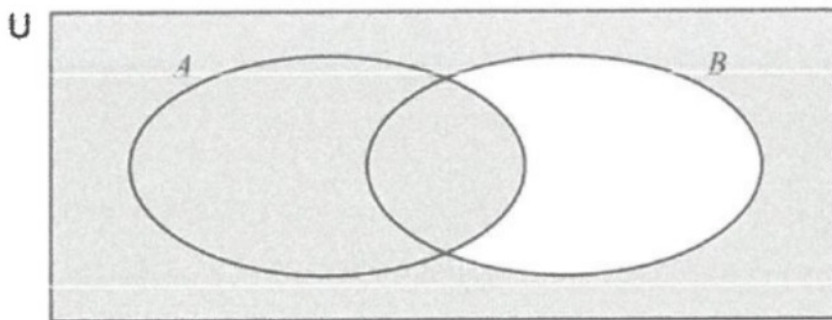
Find $n(R \cap T')$.

↑ and

8

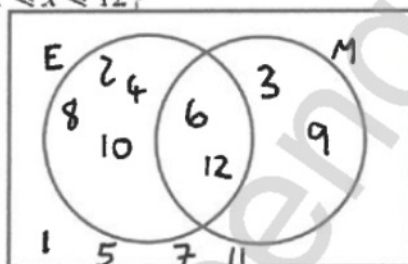
[1]

(c) Use set notation to describe the shaded region.



$A \cup B'$ [1]
(others possible)

- 7 $\mathcal{E} = \{x: x \text{ is an integer and } 1 \leq x \leq 12\}$
 $E = \{\text{even numbers}\}$
 $M = \{\text{multiples of 3}\}$



(a) Find $n(M)$.

4 [1]

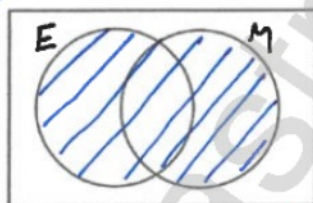
(b) Write down the set $E \cap M$.

{ 6, 12 } [1]

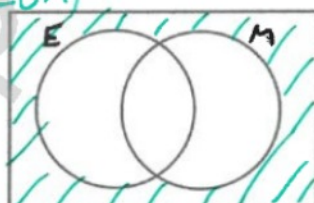
(c) $y \in (E \cup M)'$

Write down a possible value of y .

$E \cup M$

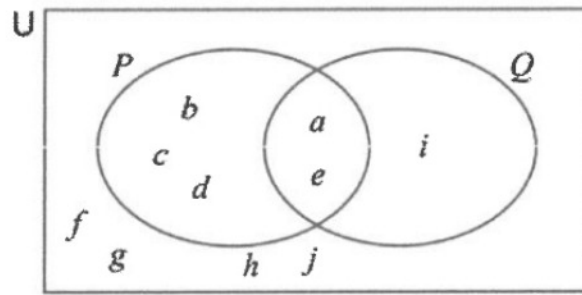


$(E \cup M)'$



complement

1 [1]
(or 5 or 7 or 11)



$$U = \{a, b, c, d, e, f, g, h, i, j\}$$

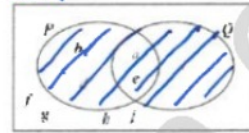
Complete each statement.

(a) $(P \cup Q)' = \{ \dots f, g, h, j \dots \}$

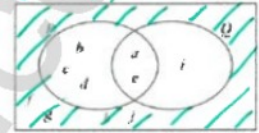
(b) $\{a, e\} = P \cap Q$

(c) $n(P' \cup Q) = \dots 7 \dots$

$P \cup Q$



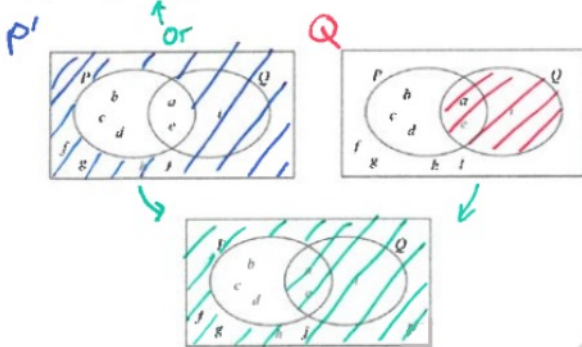
$(P \cup Q)'$



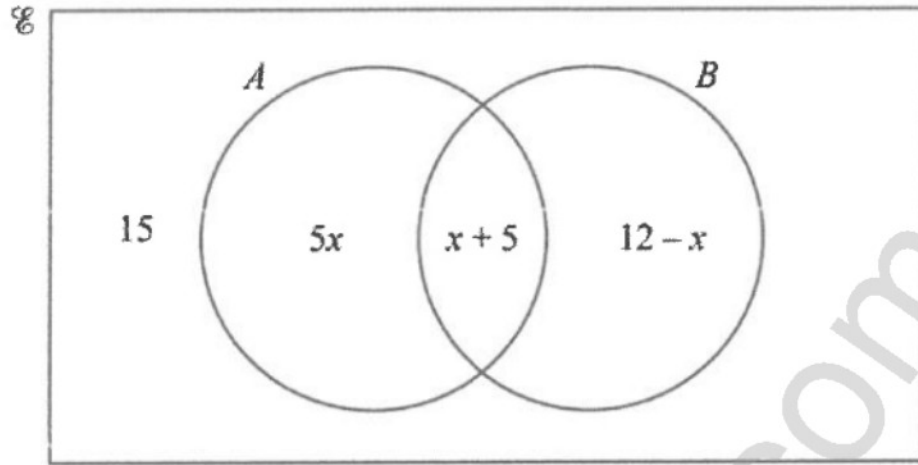
[1]

[1]

[1]



14 (a)



The Venn diagram shows information about the number of elements in sets A , B and $\mathcal{U}$.
 $n(\mathcal{U}) = 52$.

Find $n(A \cap B)$.

$$x + 5 + 5x + 12 - x + 15 = 52$$

$$5x + 32 = 52$$

$$- 32 \quad - 32$$

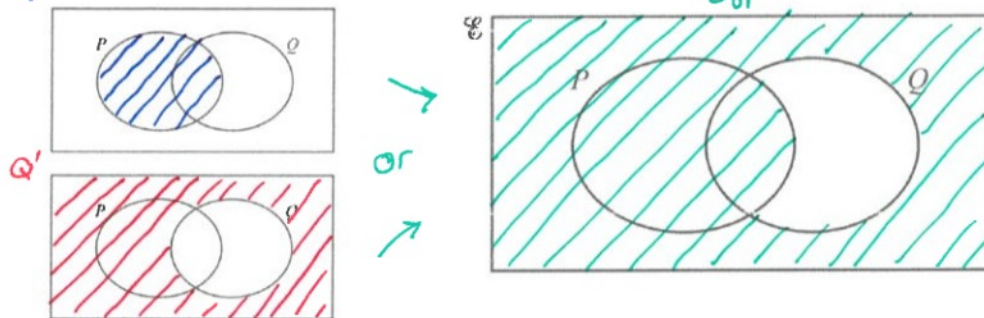
$$5x = 20$$

$$\div 5 \quad \div 5$$

$$x = 4$$

$$n(A \cap B) = \underline{\underline{9}}$$

15 (a) On the Venn diagram, shade the region $P \cup Q'$.



[1]

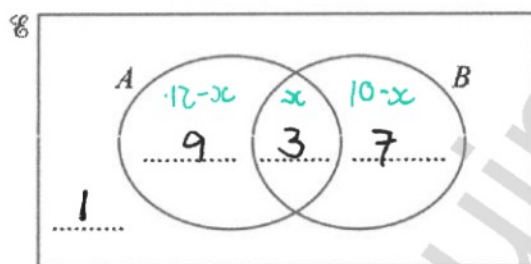
(b) $n(E) = 20$

$n(A \cup B)' = 1$

$n(A) = 12$

$n(B) = 10$

Complete the Venn diagram.



$12 - x + x + 10 - x + 1 = 20$

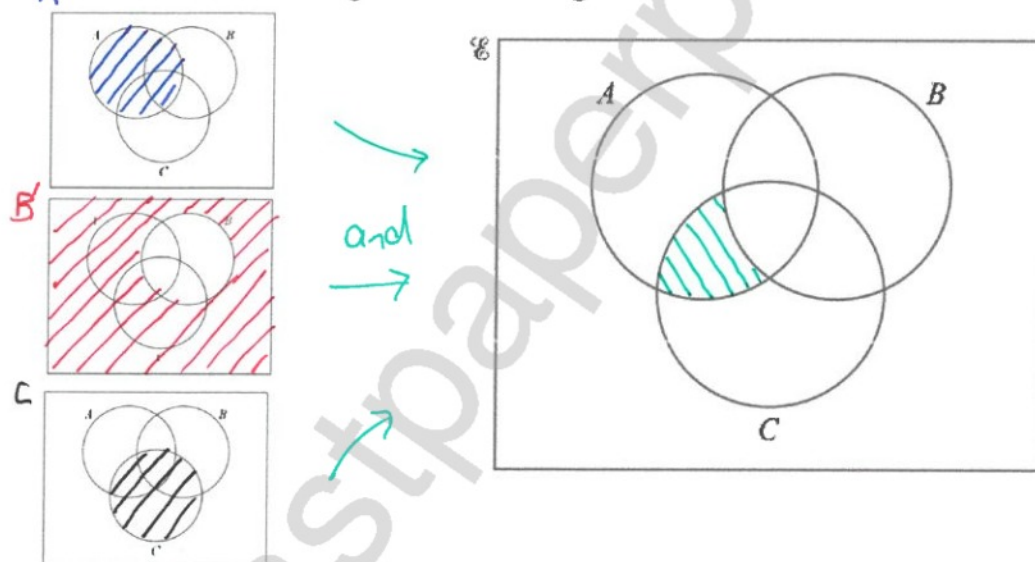
$23 - x = 20$

$-x = -3$

$x = 3$

[2]

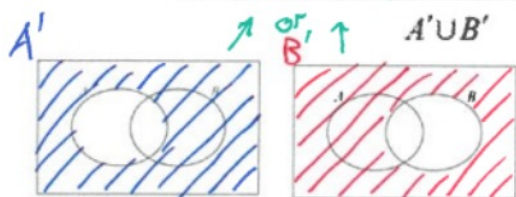
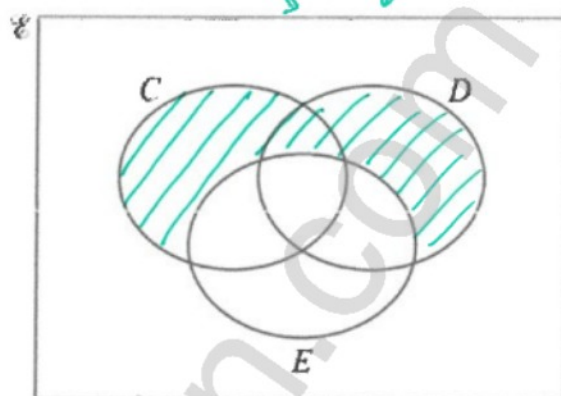
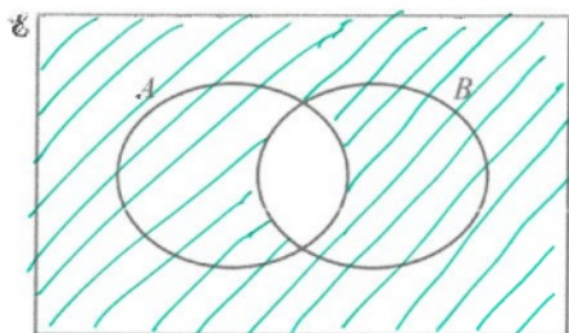
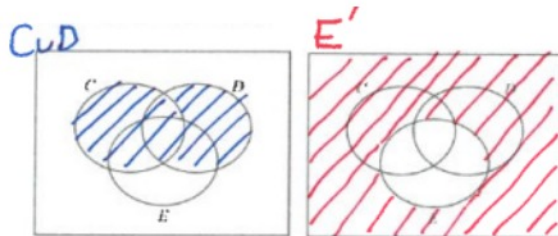
20 In the Venn diagram, shade the region $A \cap B' \cap C$.



(Only the area
Shaded all three
times)

[1]

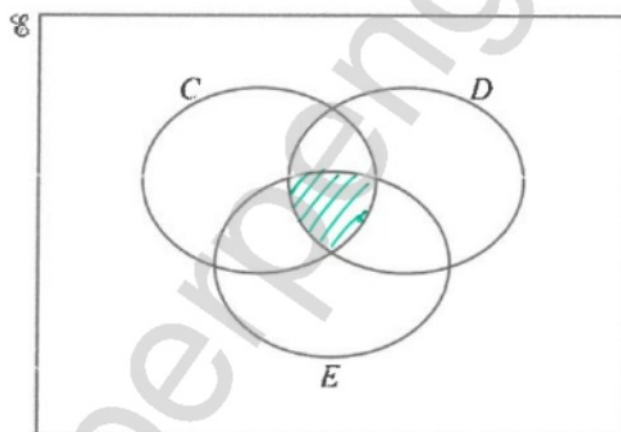
19 In these Venn diagrams, shade the given regions.



$(C \cup D) \cap E'$
↑
and

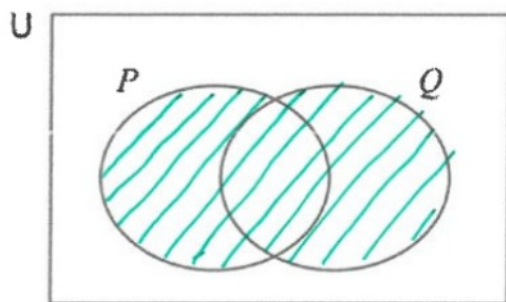
[2]

(b) In this Venn diagram, shade the region $C \cap D \cap E$.



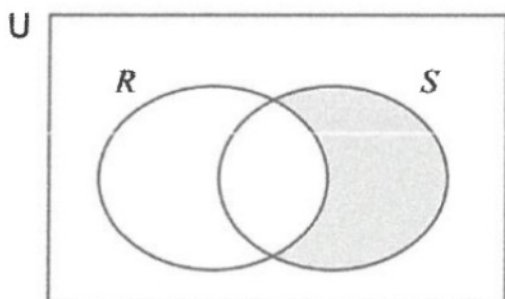
[1]

11 (a) Shade $P \cup Q$.



[1]

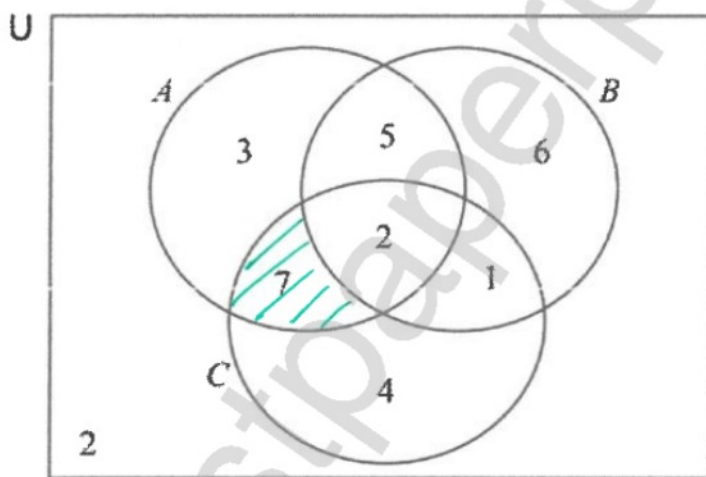
(b) Describe the shaded area using set notation.



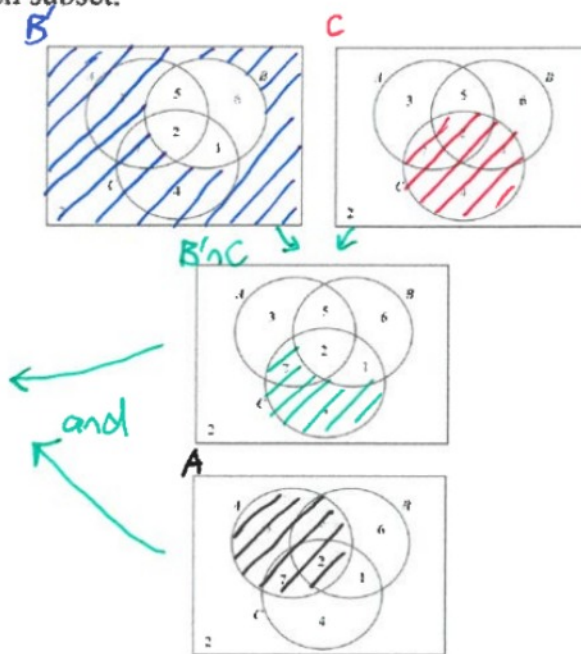
$$S \cap R'$$

[1]

(c) The Venn diagram shows the number of elements in each subset.



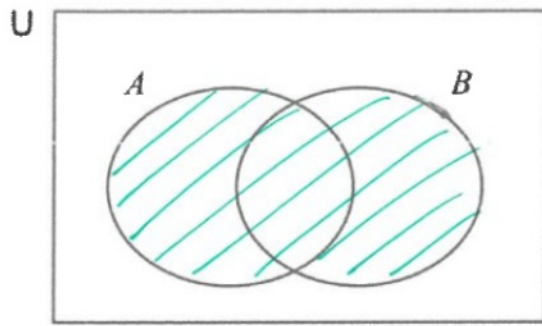
Find $n((B' \cap C) \cap A)$.



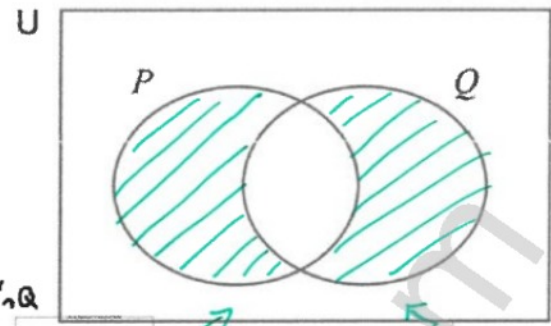
7

[1]

9 On the Venn diagrams, shade the given subsets.



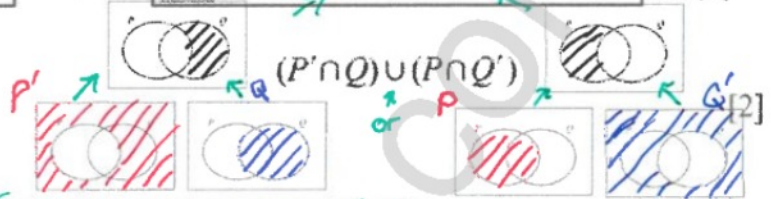
$A \cup B$



$P' \cap Q$

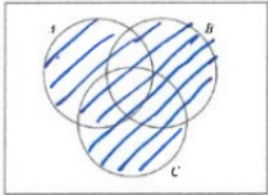
$P \cap Q'$

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

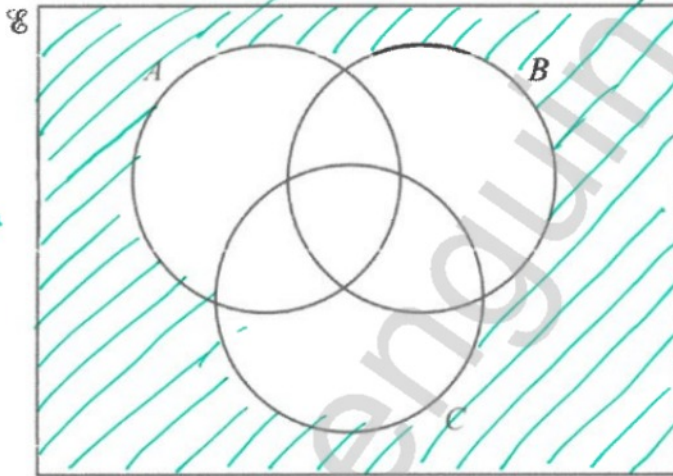


19

$A \cup B \cup C$



complement

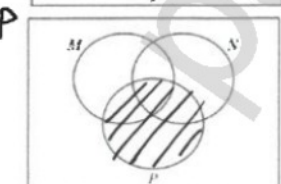
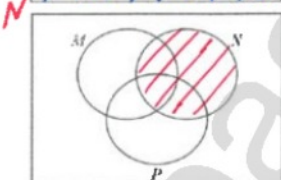
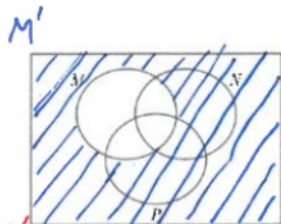


In the Venn diagram, shade the region $(A \cup B \cup C)'$.

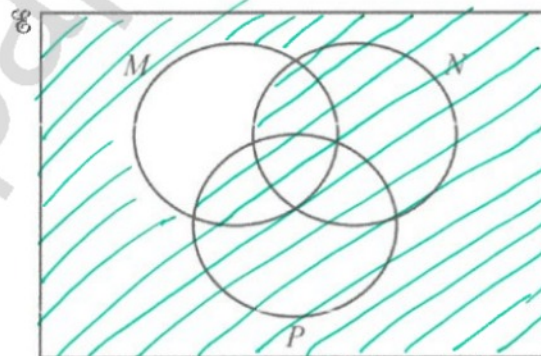
[1]

19 In this Venn diagram, shade the region $M' \cup N \cup P$.

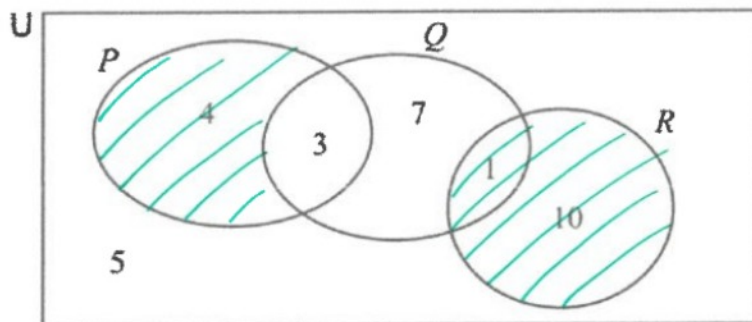
or or



or



[1]



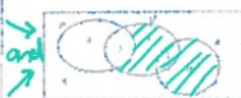
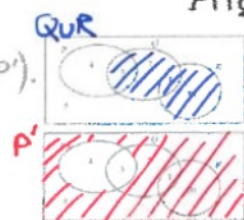
The Venn diagram shows the number of elements in each subset.

- (a) Use set notation to complete the statement.

$$P \cap Q \cap R = \emptyset$$

[1]

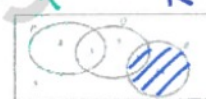
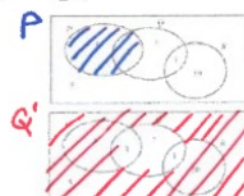
- (b) Find $n((Q \cup R) \cap P')$.



18

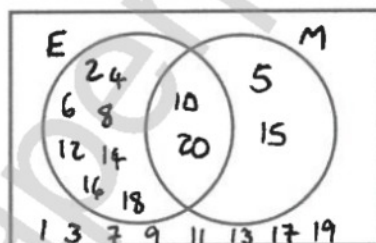
[1]

- (c) Shade the subset $(P \cap Q') \cup R$.



- 6 $\mathcal{E} = \{x: 1 \leq x \leq 20\}$
 $E = \{\text{even numbers}\}$
 $M = \{\text{multiples of 5}\}$

- (a) Find $n(M)$.



4

[1]

- (b) Find the elements in the set $E \cap M$.

10, 20

[1]

- (c) $y \notin E$.

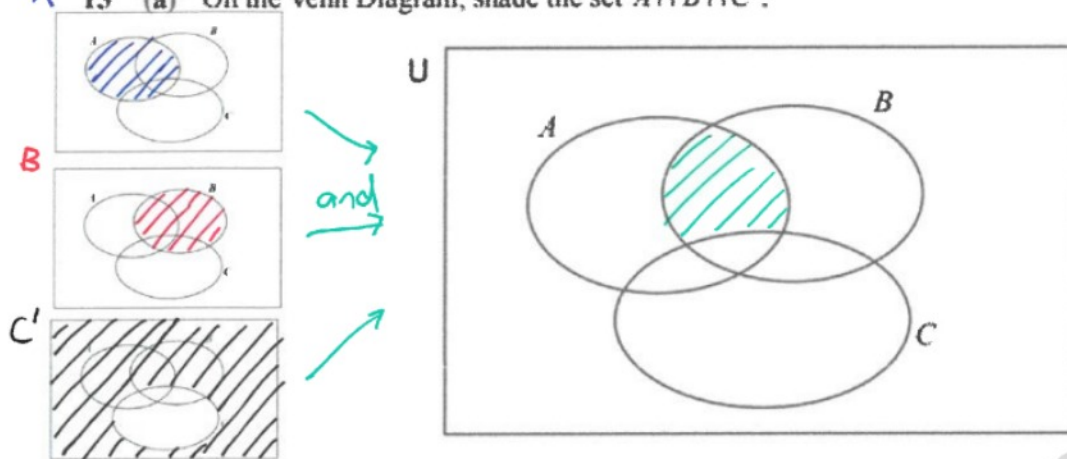
Write down a possible value of y .

5

[1]

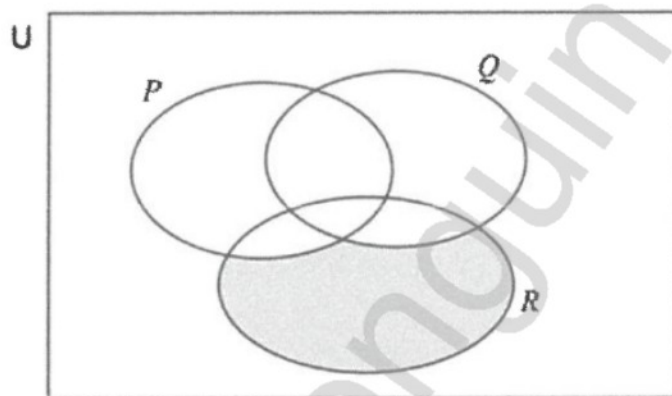
(or 15, or 1, 3, 7, 9...)

15 (a) On the Venn Diagram, shade the set $A \cap B \cap C'$.



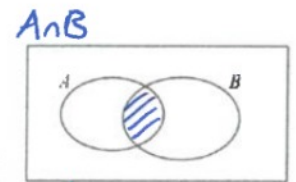
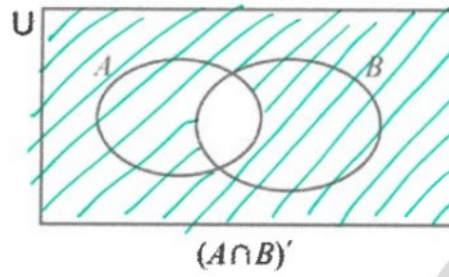
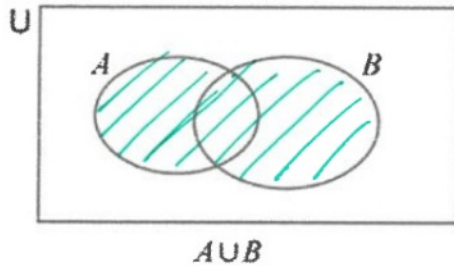
[1]

(b) Use set notation to describe the shaded region.



$R \cap P' \cap Q'$ [1]
(others possible)

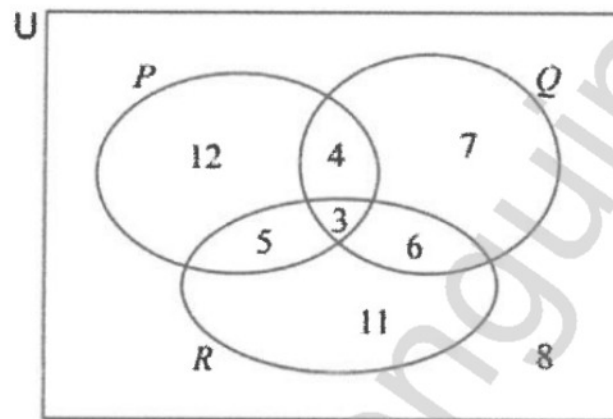
11 (a) In each Venn diagram, shade the given set.



← Complement

[2]

(b) In this Venn diagram, the number of elements in each of the subsets is shown.



Find.

(i) $n(P \cup (Q \cap R))$

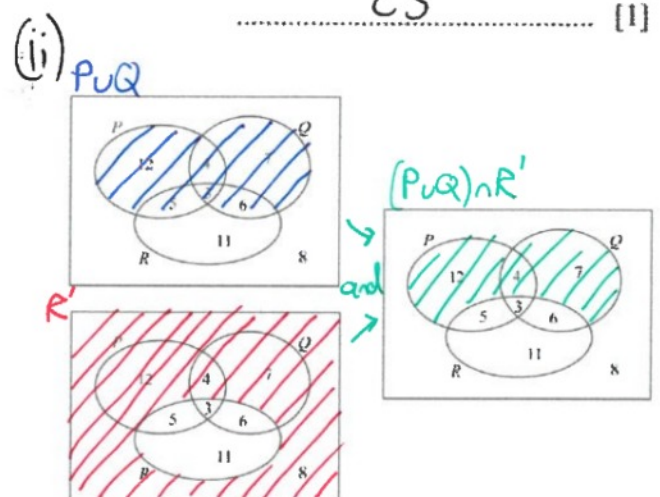
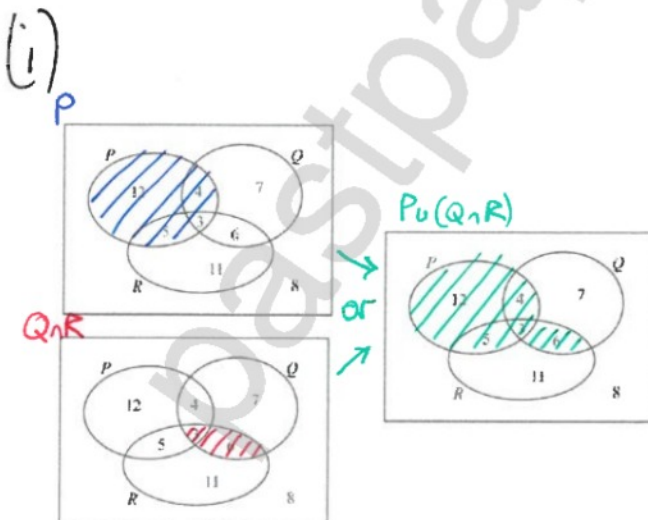
30

[1]

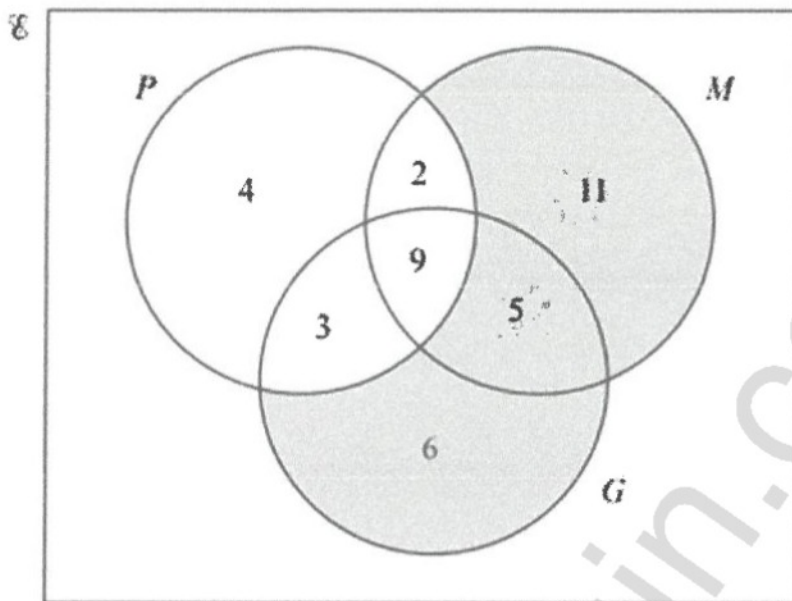
(ii) $n((P \cup Q) \cap R')$

23

[1]



- 16 The Venn diagram shows the number of students in a class of 40 who study physics (P), mathematics (M) and geography (G).



- (a) Use set notation to describe the shaded region.

(b) Find $n((P \cap G) \cup M')$.

$P \cap G$

M'

or

$(M \cup G) \cap P'$ [1]

22 [1]

- (c) A student is chosen at random from those studying geography.

Find the probability that this student also studies physics or mathematics but not both.

Geography students : 23

Geography and physics only : 3

Geography and maths only : 5

$$\frac{5+3}{23} = \frac{8}{23}$$

$\frac{8}{23}$ [2]

12 (a) $\mathcal{E} = \{\text{integers greater than 2}\}$

$A = \{\text{prime numbers}\}$

$B = \{\text{odd numbers}\}$

$C = \{\text{square numbers}\}$

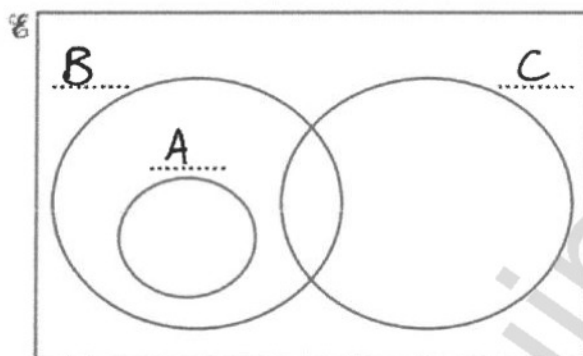
not odd (ie. even) and square

(i) Describe the type of numbers in the set $B' \cap C$.

even square numbers [1]

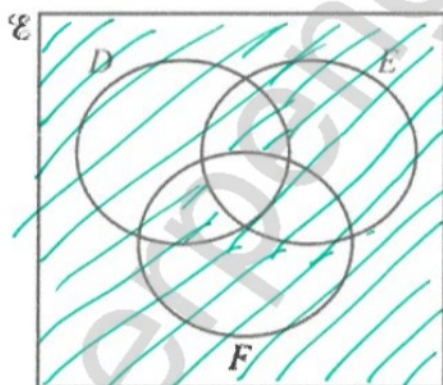
(ii) Complete the set labels on the Venn diagram.

Because 2 is not included, all the prime numbers are odd, so A is entirely within B.



[1]

(b)

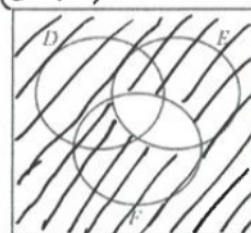


Shade the region $D' \cup (E \cap F)'$.

or

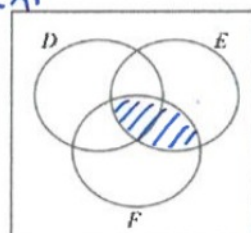
$(E \cap F)'$

[1]



complement

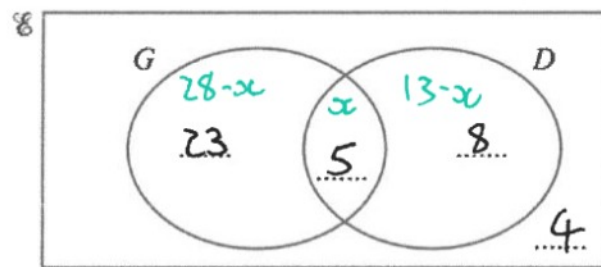
$E \cap F$



19 (a) In a class of 40 students:

- 28 wear glasses (G)
- 13 have driving lessons (D)
- 4 do not wear glasses and do not have driving lessons.

$$28 - x + x + 13 - x + 4 = 40$$



$$\begin{aligned} 45 - x &= 40 \\ -45 & \quad -45 \\ -x &= -5 \\ x &= 5 \end{aligned}$$

(i) Complete the Venn diagram.

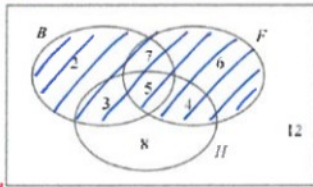
[2]

(ii) Use set notation to describe the region that contains a total of 32 students.

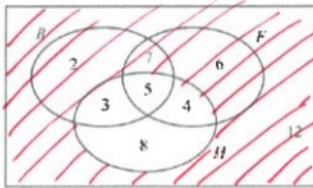
$$G \cup D' \quad [1]$$

- (b) This Venn diagram shows information about the number of students who play basketball (B), football (F) and hockey (H).

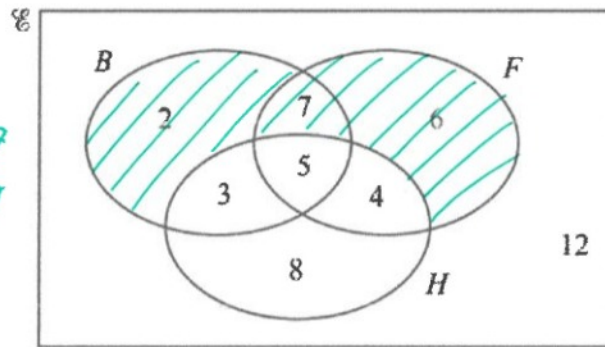
$B \cup F$



H'



and

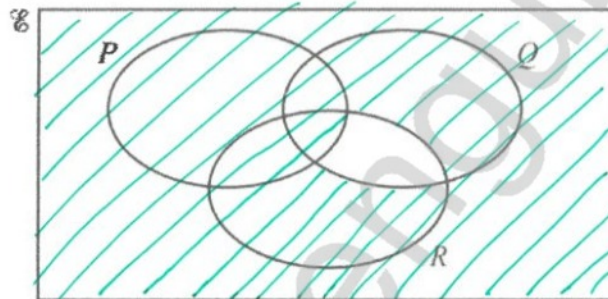


Find $n((B \cup F) \cap H')$.

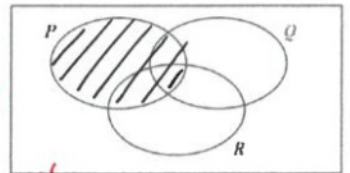
15

[1]

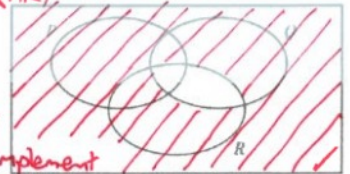
(c)



P

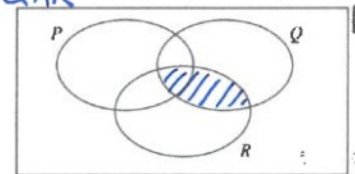


or $(Q \cap R)'$



complement

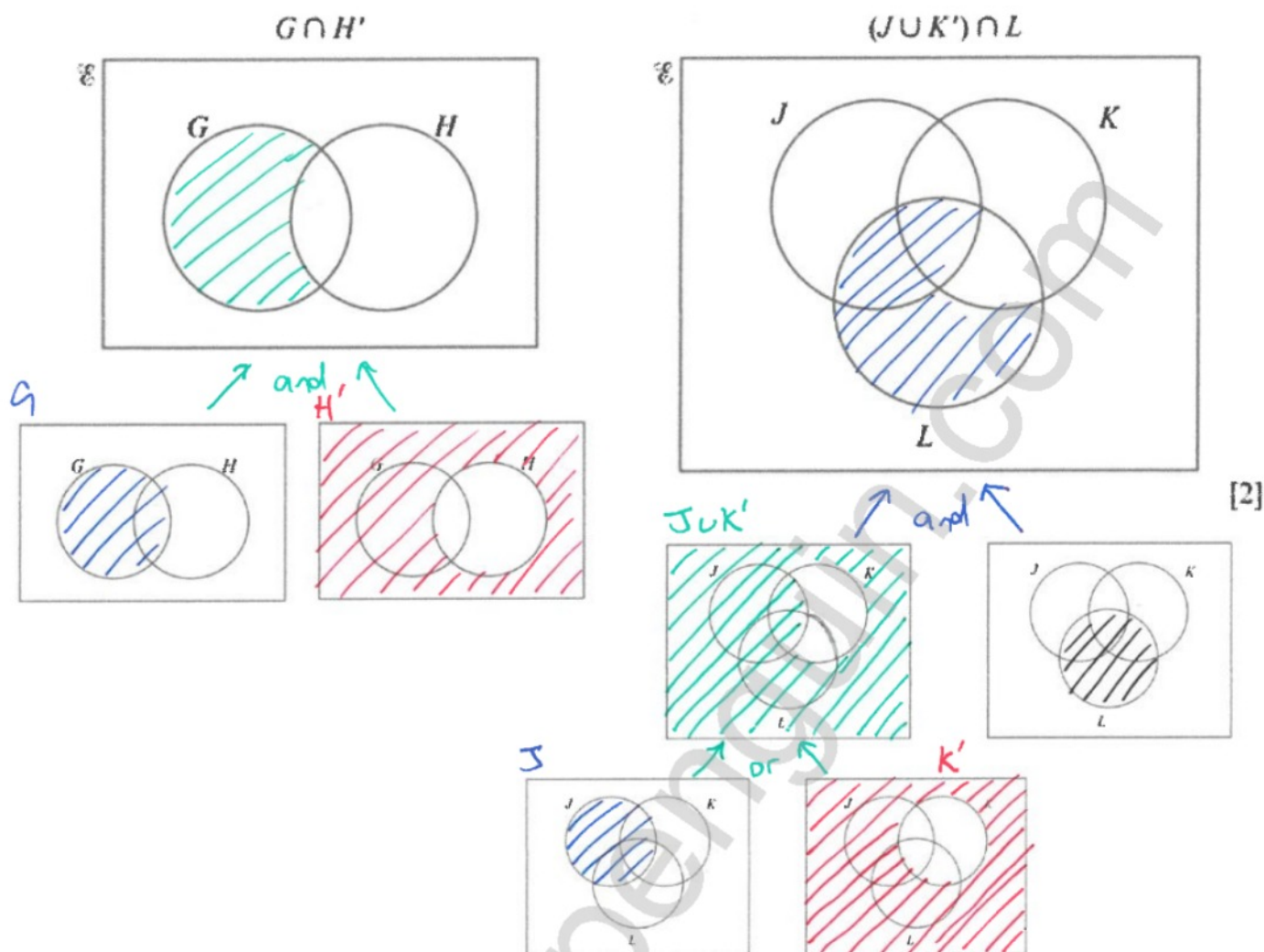
$Q \cap R$



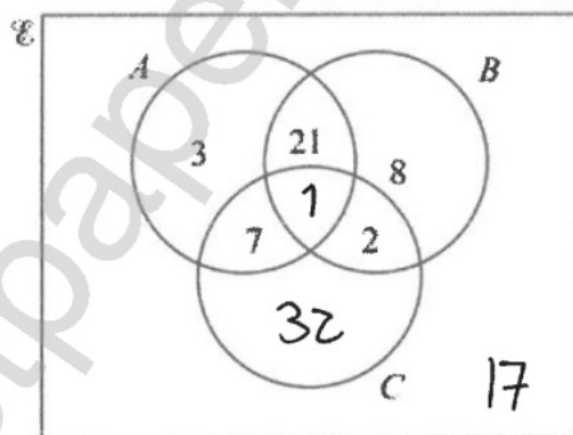
[1]

Shade the region $P \cup (Q \cap R)'$.

16 (a) Shade the region indicated in each Venn diagram.



(b) The Venn diagram shows some information about the number of elements in sets A, B, C and E.



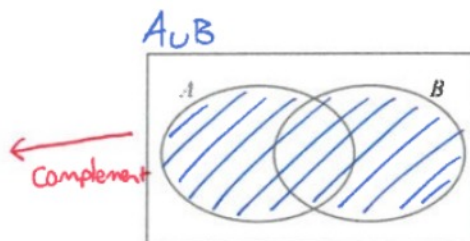
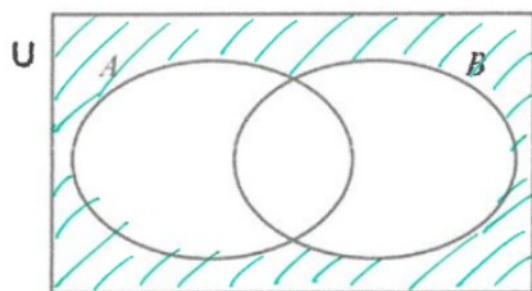
Given the following information, complete the Venn diagram.

$$\begin{aligned} n(A \cap B \cap C) &= 1 \\ n(A \cup B \cup C)' &= 17 \\ n(C) &= 42 \end{aligned}$$

$$\begin{aligned} &\leftarrow 42 - (1 + 2 + 7) \\ &= 32 \end{aligned}$$

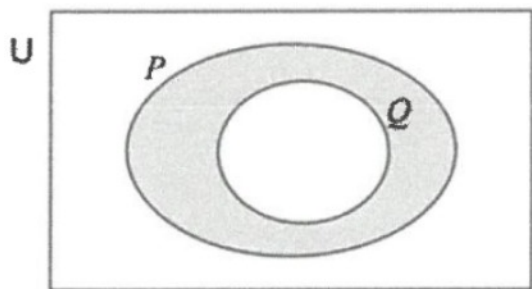
[2]

- 11 (a) On the Venn diagram, shade $(A \cup B)'$.



[1]

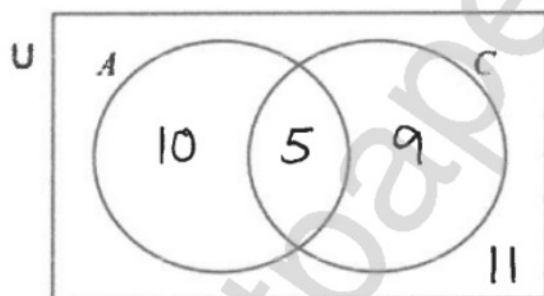
- (b) Use set notation to describe the shaded region.



$P \cap Q'$ [1]

- (c) There are 35 students in a class.
The students are asked if they like athletics (A) or cricket (C).
 $n(A) = 15$
 $n(C) = 14$
 $n(A \cap C) = 5$

Complete the Venn diagram below by writing the number of elements in each subset.



[2]