EXAM PAPERS PRACTICE

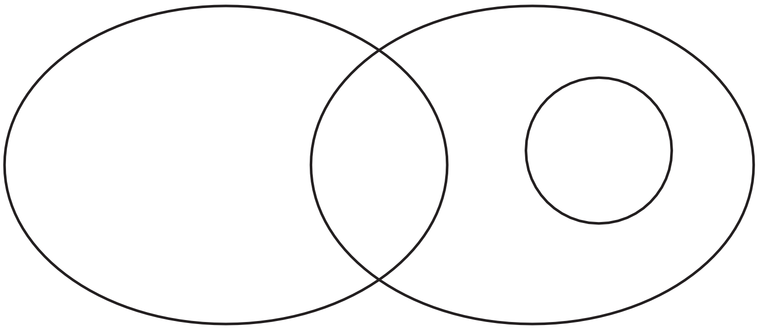
Sets & Venn Diagrams

Model Answers

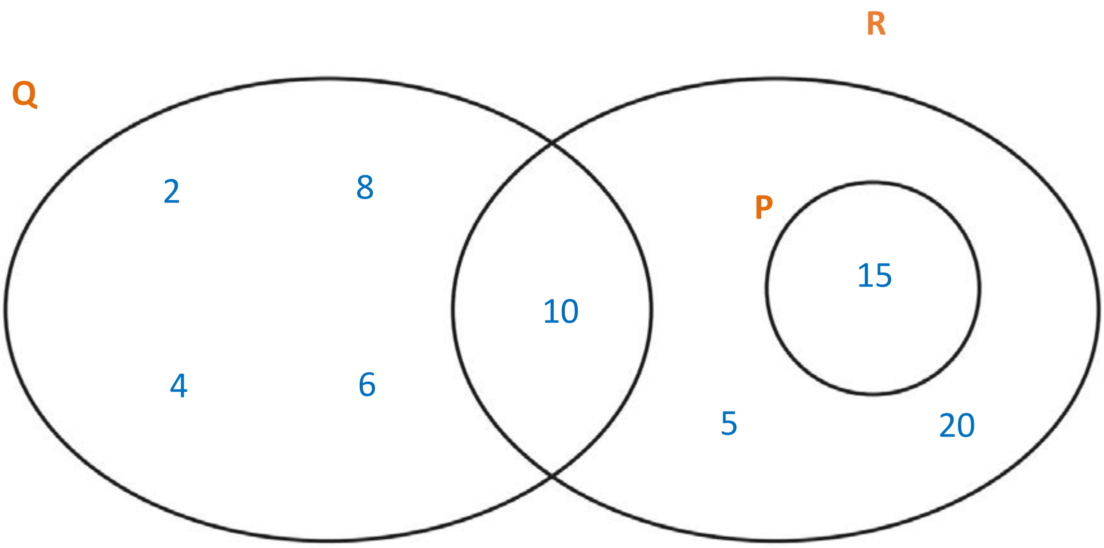
Question 1

$Q = \{2, 4, 6, 8, 10\}$ and $R = \{5, 10, 15, 20\}$.
$15 \in P$, $n(P) = 1$ and $P \cap Q = \varnothing$.

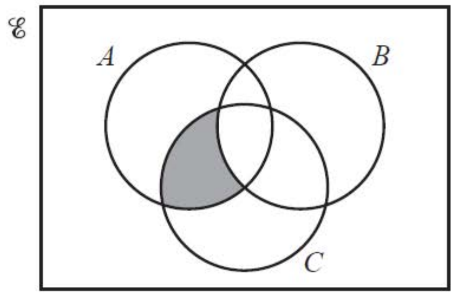
Label each set and complete the Venn diagram to show this information.



[3]

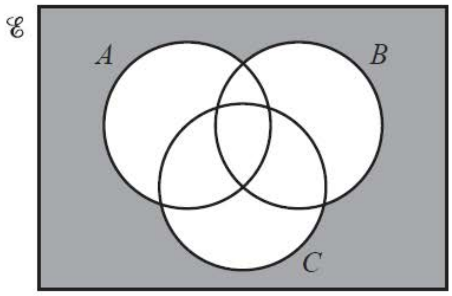


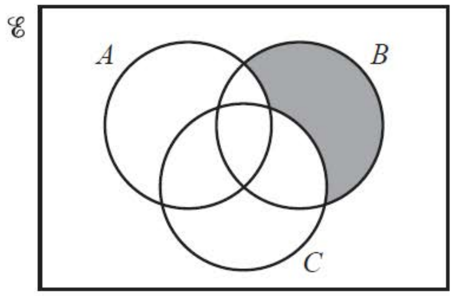
Question 2



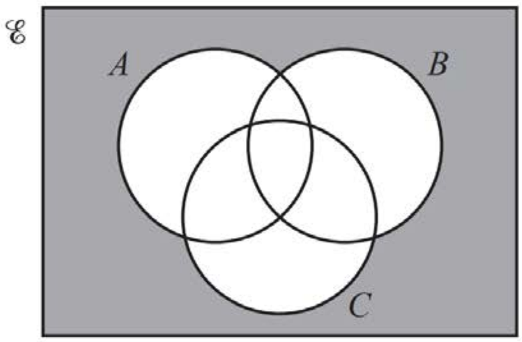
The shaded area in the diagram shows the set $(A \cap C) \cap B'$.

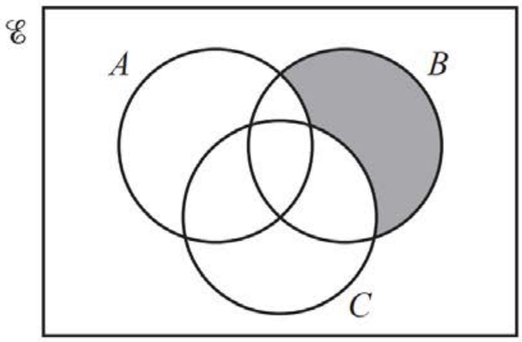
Write down the set shown by the shaded area in each diagram below.





[2]



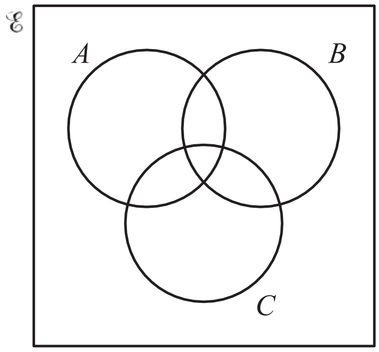


$(A \cup B \cup C)'$ ....

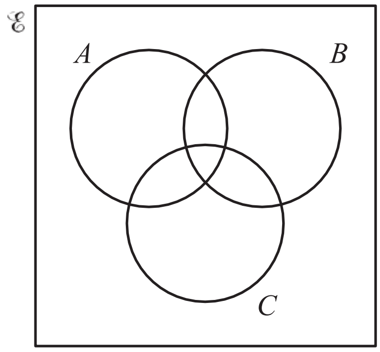
$B \cap (A \cup C)'$ ....

Question 3

Shade the required regions in the Venn diagrams below.

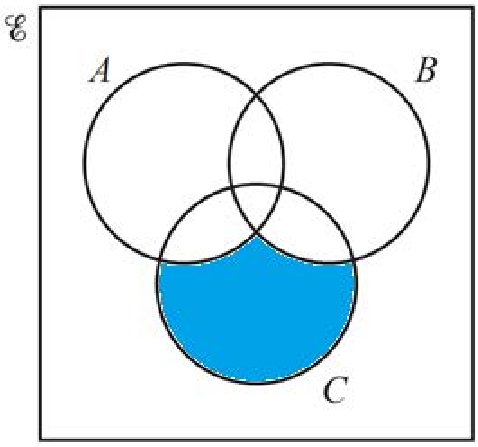


$(A \cup B)' \cap C$

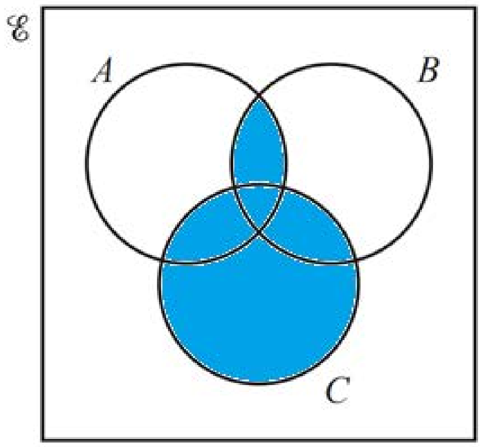


$(A \cap B) \cup C$

[2]

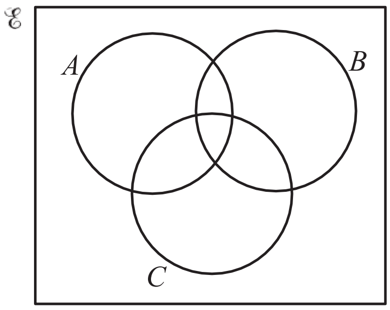


$(A \cup B)' \cap C$

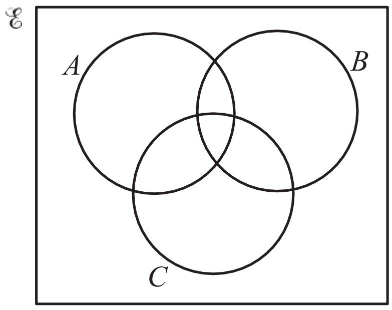


$(A \cap B) \cup C$

Shade the region required in each Venn Diagram.



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

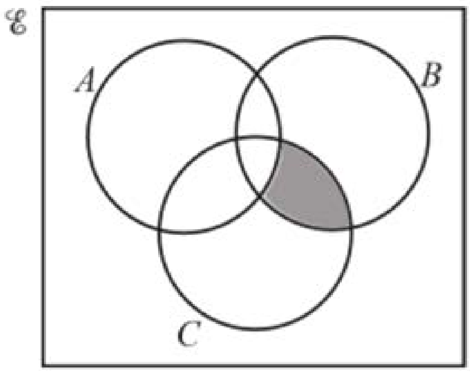


$A' \cap (B \cup C)$

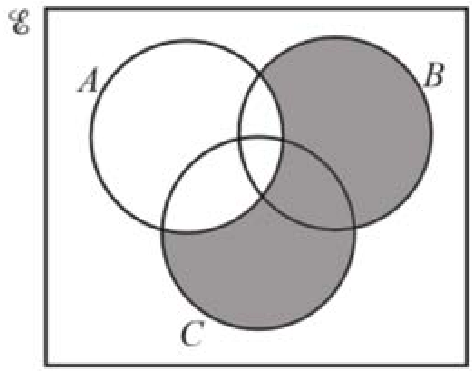
[2]

To answer this question we first need to understand set notation:

- A' = Everything **not** in A
- A ∩ B = Everything in both A **and** B
- A ∪ B = Everything in A **or** B



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

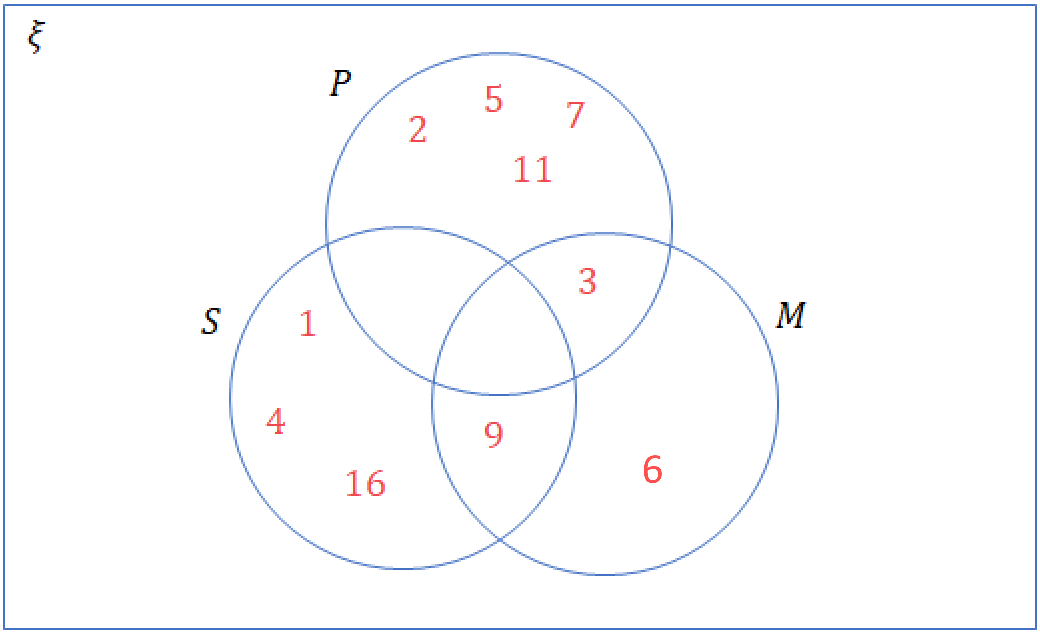


$A' \cap (B \cup C)$

Question 5

$\mathscr{E} = \{1,2,3,4,5,6,7,9,11,16\}$ $P = \{2,3,5,7,11\}$ $S = \{1,4,9,16\}$ $M = \{3,6,9\}$

(a) Draw a Venn diagram to show this information. [2]



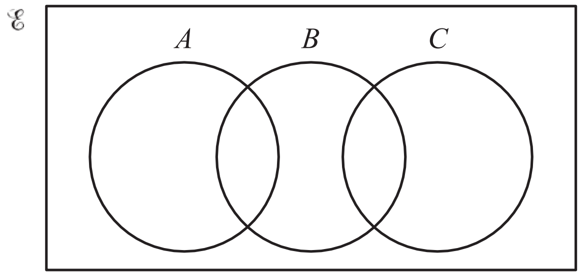
(b) Write down the value of n($M'\cap P$). [1]

4

Question 6

On the Venn diagrams shade the regions

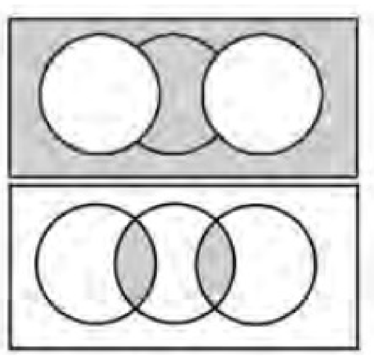
(a) $A' \cap C'$, [1]



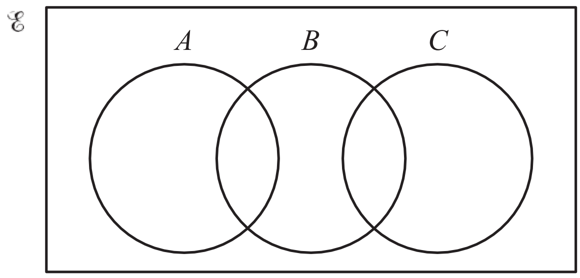
A' represents the elements which are NOT in A.

Similarly, C' represents the elements which are NOT in C.

The intersection of the 2 represents all the elements, except the ones which are in Set A or Set C.



(b) $(A \cup C) \cap B$. [1]



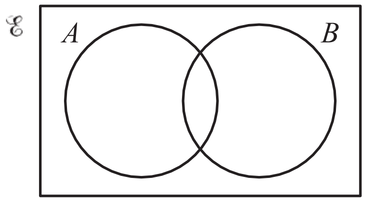
The union of Sets A and C represents all the elements in both sets.

The intersection with Set B represents the elements in both Sets A and C which are also in Set B.

Therefore, we shade only the intersections of Set A and Set B and Set C and Set B.

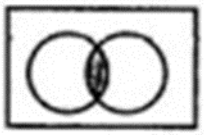
Question 7

(a) Shade the region $A \cap B$.

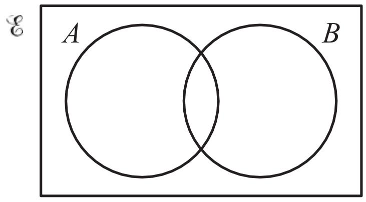


[1]

A ∩ B represents the area common to both Set A and B.

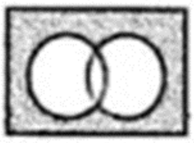


(b) Shade the region $(A \cup B)'$.

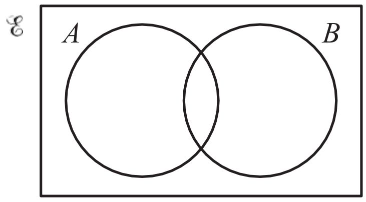


[1]

The reunion of 2 Sets represents all the elements in both Set A and B. The complement of this reunion would be any area which is not Set A or Set B.

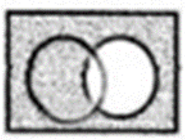


(c) Shade the complement of set B.



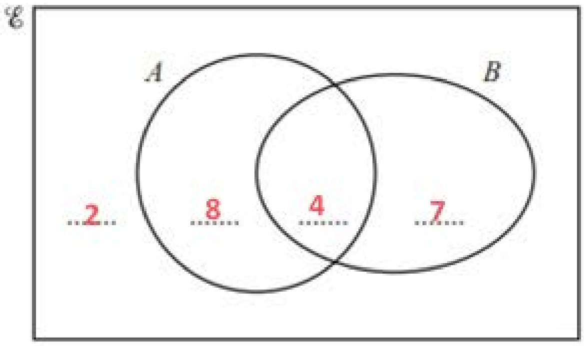
[1]

The complement of B represents all regions except Set B.



Question 8

n($\mathscr{E}$) = 21, n($A \cup B$) = 19, n($A \cap B'$) = 8 and n(A) = 12.
Complete the Venn diagram to show this information. [3]



Venn diagrams notations:

A' = complement of A – the elements that are not in Set A

A ∪ B = the union of Set A and Set B – the elements that are in either Set A or Set B

A ∩ B = the intersection of Set A and Set B – this represents the elements that are both in Set A and in Set B

To calculate the numbers on the result above:

n(C) = 21, so the total number of elements is 21.

n (A ∪ B) = 19

From these 2 conditions we understand that the reunion of A and B is 19 elements so the last 2 elements are outside the reunion.

n(A) = 12, so the total number of elements in diagram A is 12.

$n(A \cap B') = 8$, so the intersection of the elements that are in A with the elements that are not in B is 8. This means that there are 8 elements in A which are not in B.

By subtracting $12 - 8 = 4$ we deduce that there are 4 elements which are common to both Set A and Set B.

The rest of the elements until the total number of 21 are the elements which are only in Set B: $21 - (2 + 4 + 8) = 7$

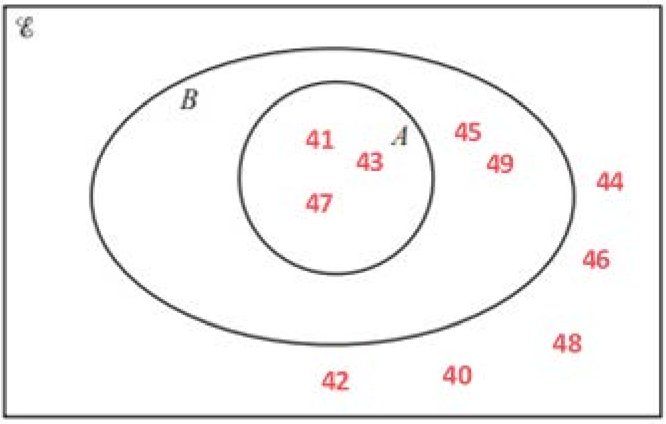
Question 9

$\mathscr{E} = \{40, 41, 42, 43, 44, 45, 46, 47, 48, 49\}$
$A = \{\text{prime numbers}\}$
$B = \{\text{odd numbers}\}$

(a) Place the 10 numbers in the correct places on the Venn diagram. [2]

The prime numbers from the list are: 41, 43, 47

The odd numbers are: 41, 43, 45, 47, 49



(b) State the value of $n(B \cap A')$. [1]

Venn diagrams notation is as follows:

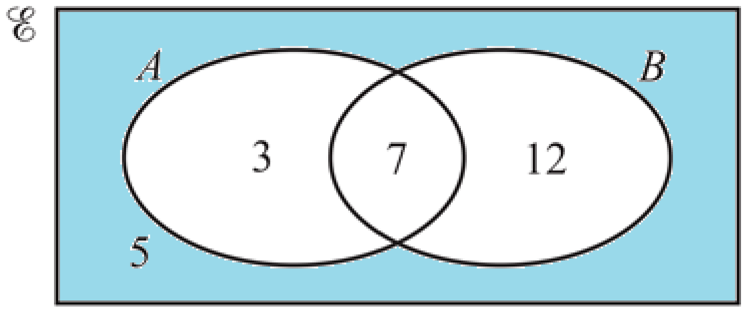
A' = complement of A – the elements that are not in Set A

A ∩ B = the intersection of Set A and Set B – this represents the elements that are both in Set A and in Set B

n(B ∩ A') means the number of elements which are in B and are not in A

n(B ∩ A') = 2

Question 10



The Venn diagram shows the numbers of elements in each region.

(a) Find n($A \cap B'$). [1]

B' refers to elements not in B, i.e. 3 and 5.

A ∩ B' is whatever elements are common to both A and B'.

n(A ∩ B') is the number of elements that are common to both A and B', which here is

3

(b) An element is chosen at random.

Find the probability that this element is in set B. [1]

There are 27 elements in total here and 19 of them are in B, therefore the probability that an element chosen is in B is

19/27

(c) An element is chosen at random from set A.

Find the probability that this element is also a member of set B. [1]

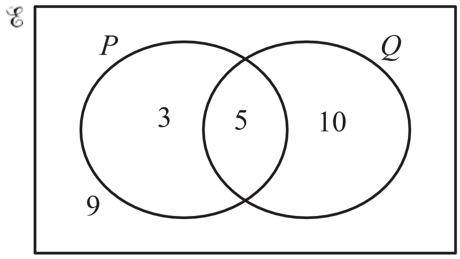
There are 10 elements in set A and 7 of them is also in set B therefore the probability that the element chosen is in set B is

7/10

(d) On the Venn diagram, shade the region $(A \cup B)'$. [1]

(A U B)' is the area that is not the union of A added with B.

Question 11



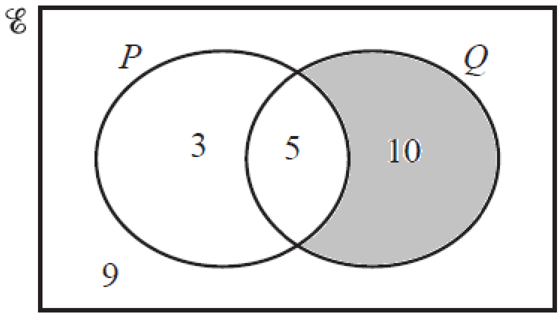
The Venn diagram shows the number of elements in each set.

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

[1]

We are looking for a region, which is the intersection of Q and not P.

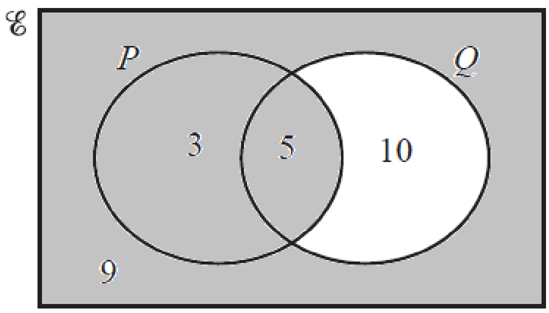
This must be the region, which belongs to Q only.



$n(P' \cap Q) = \mathbf{10}$

(b) Complete the statement n(.................................) = 17. [1]

We can get 17 by summing the regions of only P, intersection of P and Q and neither P or Q.

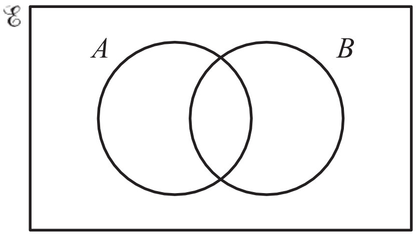


This is the region: either belongs to P or does not belong to Q.

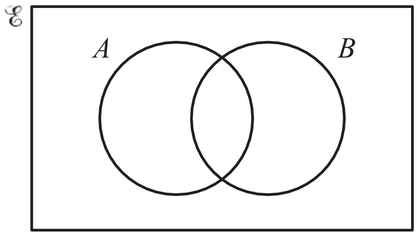
Therefore:

$n(\boldsymbol{P} \cup \boldsymbol{Q}') = 17$

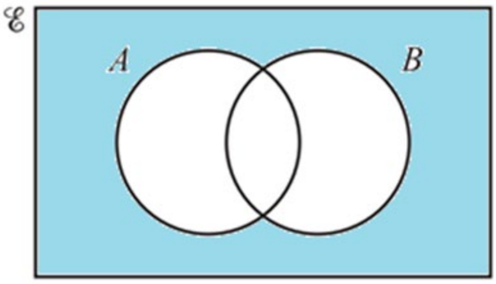
Shade the region required in each Venn diagram. [2]



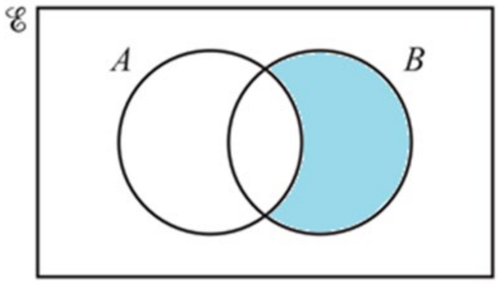
$(A \cup B)'$



$A' \cap B$



$(A \cup B)'$



$A' \cap B$

Question 13

The lights and brakes of 30 bicycles are tested.
The table shows the results.

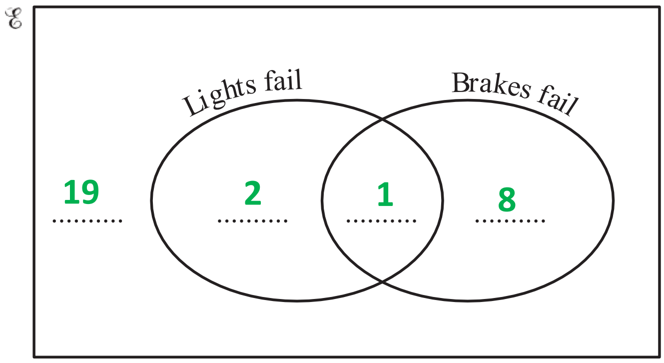
	Lights	Brakes
Fail test	3	9
Pass test	27	21

The lights and brakes both failed on one bicycle only.

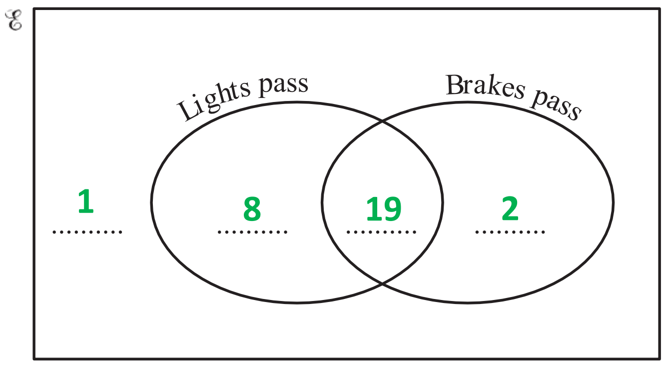
$\mathscr{E}$ = {30 bicycles}
Complete the Venn diagrams.

[2]

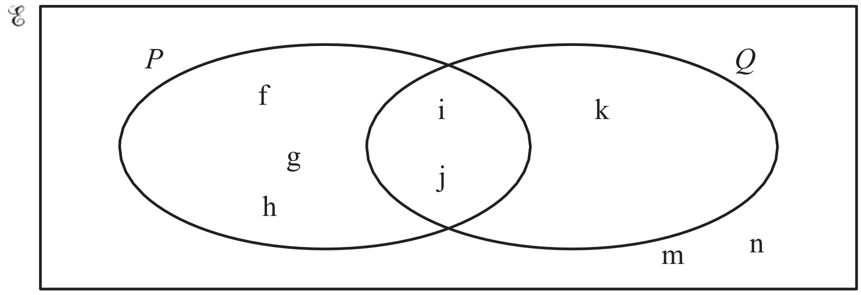
(a)



(b) [2]



Question 14



(a) Use the information in the Venn diagram to complete the following.

(i) $P \cap Q =$ $\{i, j\}$ [1]

(ii) $P' \cup Q =$ $\{i, j, k, m, n\}$ [1]

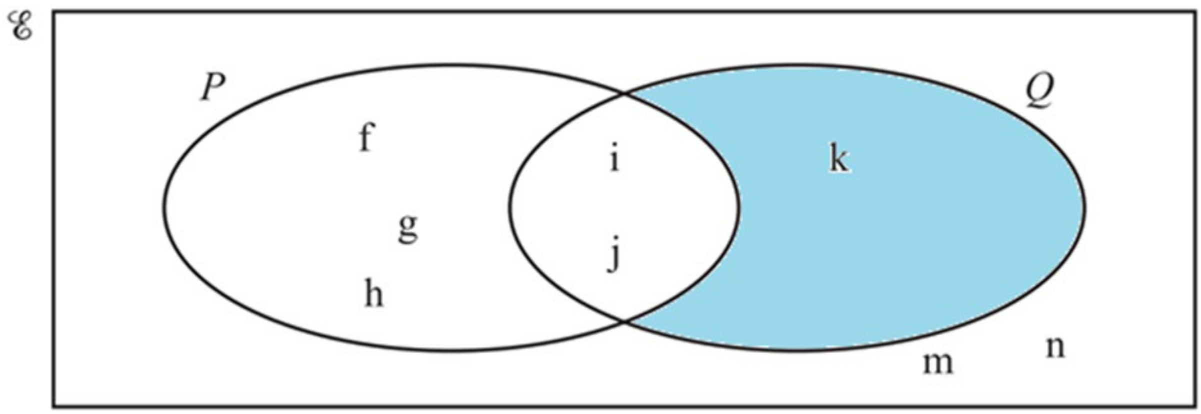
(iii) $n(P \cup Q)' =$ 2 [1]

(b) A letter is chosen at random from the set Q.

Find the probability that it is also in the set P. [1]

$\frac{2}{3}$

(c) On the Venn diagram shade the region $P' \cap Q$. [1]

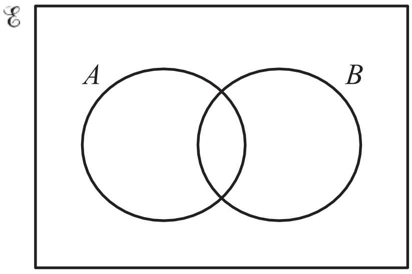


(d) Use a set notation symbol to complete the statement. [1]

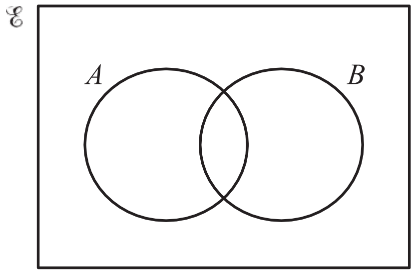
$\{f, g, h\} \subset P$

Question 15

Shade the required region on each Venn diagram. [2]



$A' \cup B$



$A' \cap B'$

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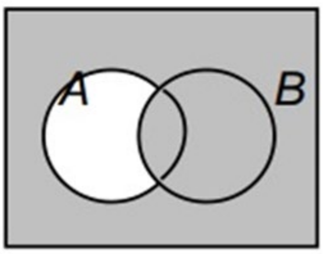
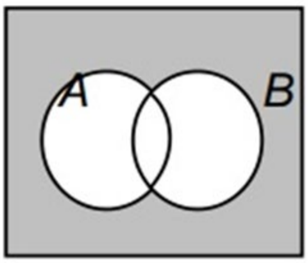


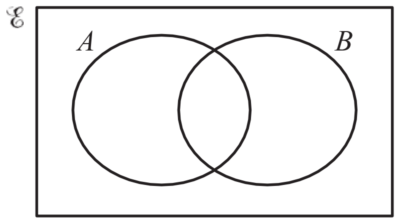
A' ∪ B



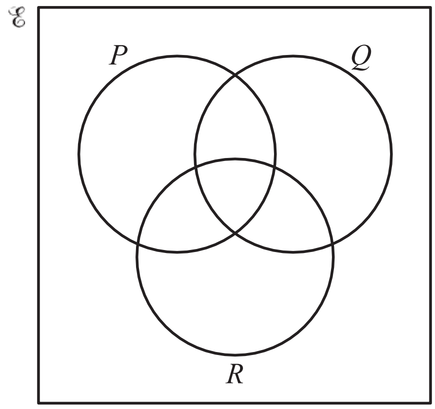
A' ∩ B'

Question 16

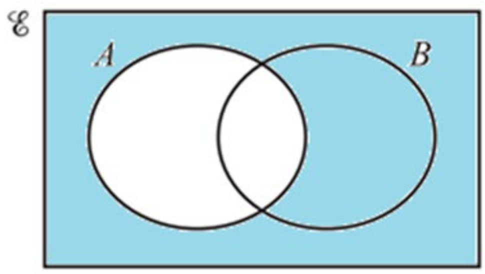
Shade the required region in each of the Venn diagrams. [2]



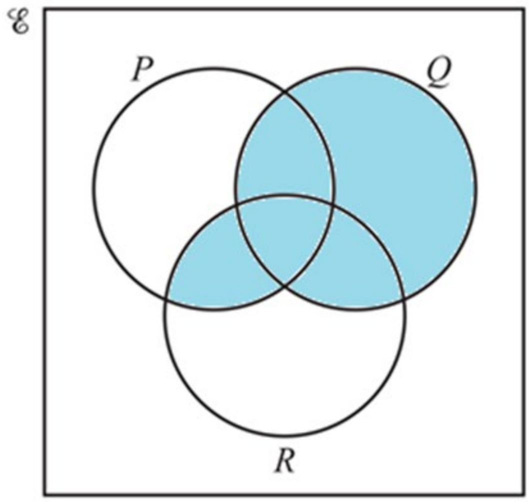
A'



$(P \cap R) \cup Q$

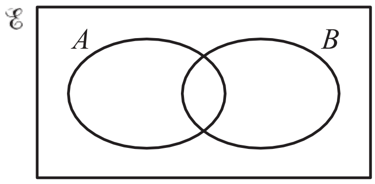


A'

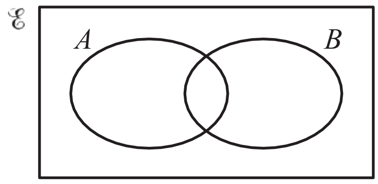


$(P \cap R) \cup Q$

Shade the required region on each Venn diagram. [2]

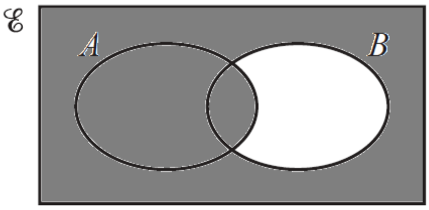


$A \cup B'$



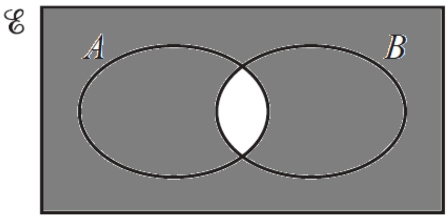
$(A \cap B)'$

$A \cup B'$ is a region which belongs to either A or <u>does not</u> belong to B.



$A \cup B'$

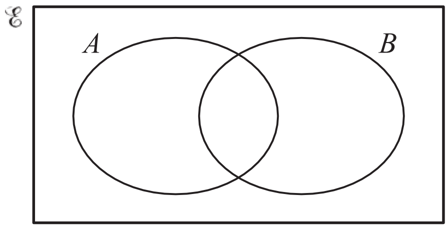
$(A \cap B)'$ is a region which does not belong to the intersection of A and B.



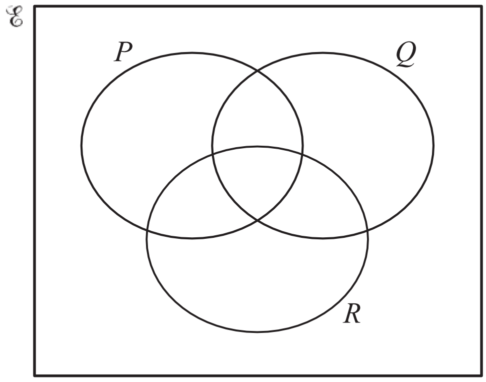
$(A \cap B)'$

Question 18

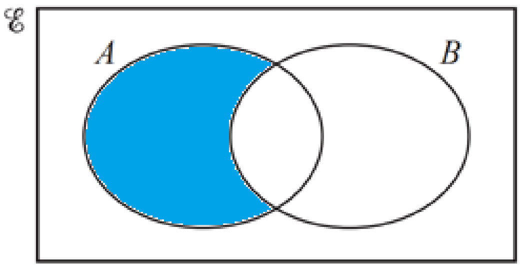
Shade the required region on each Venn diagram. [2]



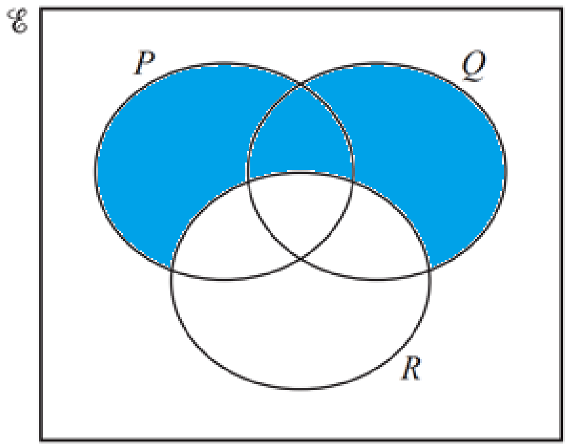
$A \cap B'$



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



$A \cap B'$



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