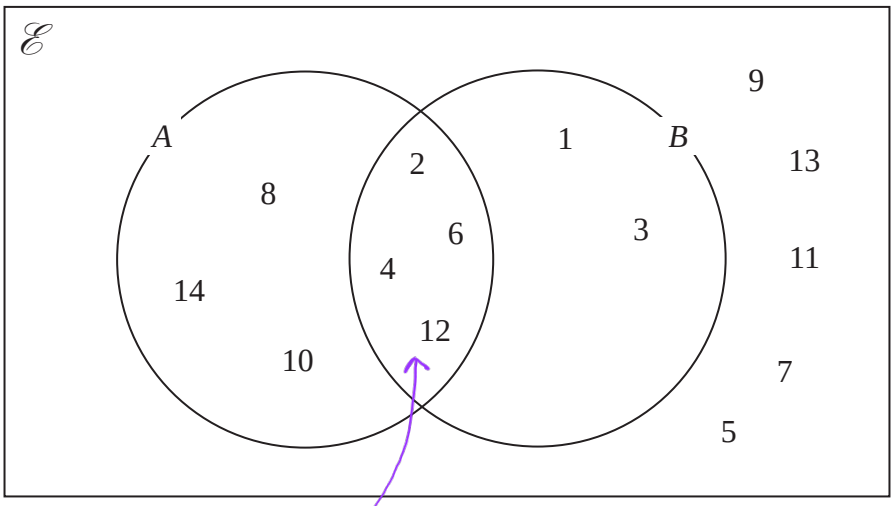
1 The numbers from 1 to 14 are shown in the Venn diagram.



(a) List the members of the set $A \cap B$

2, 4, 6, 12 (1)

.....

(1)

(b) List the members of the set B' ↷ everything but B

5, 7, 8, 9, 10, 11, 13, 14 (1)

.....

(1)

A number is picked at random from the numbers in the Venn diagram.

(c) Find the probability that this number is in set A but is **not** in set B.

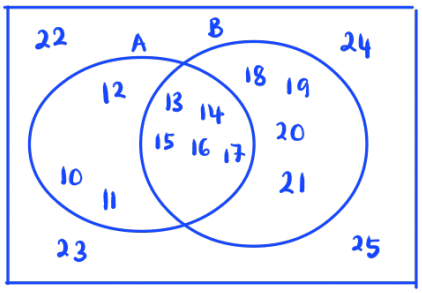
$\frac{3}{14}$ (2)

.....

(2)

(Total for Question 1 is 4 marks)

2 $\mathscr{E}$ = {integers x such that $10 \leqslant x \leqslant 25$}
$A = \{x : x < 18\}$
$B = \{x : 13 \leqslant x < 22\}$



(a) Write down n(A)

10, 11, 12, 13, 14, 15, 16, 17

8 (1)

(1)

(b) List the members of the set $(A \cup B)'$

↳ is not in A or B

22, 23, 24, 25 (1)

(2)

(c) List the members of the set $A' \cap B$

↳ is not in A and is in B

18, 19, 20, 21 (1)

(2)

$C \subset A$, $C \subset B$ and n(C) = 5

(d) List the members of the set C

13, 14, 15, 16, 17 (1)

(1)

(Total for Question 2 is 6 marks)

3 B = {b, l, u, e}

G = {g, r, e, y}

W = {w, h, i, t, e}

(a) List all the members of the set

(i) $B \cup G$

$B \cup G = \{ b, l, u, e, g, r, y \}$

↑ Combine the two sets together

(1)

$\{ b, l, u, e, g, r, y \}$

(ii) $W \cap G'$

$G' = \{ b, l, u, w, h, i, t \}$

$W = \{ w, h, i, t, e \}$

$W \cap G' = \{ w, h, i, t \}$

(1)

$\{ w, h, i, t \}$

(2)

Serena writes down the statement $B \cap G \cap W = \varnothing$

(b) Is Serena's statement correct?
You must give a reason for your answer.

No, Serena is wrong because the letter e appears in all three sets. (1)

(1)

(Total for Question 3 is 3 marks)

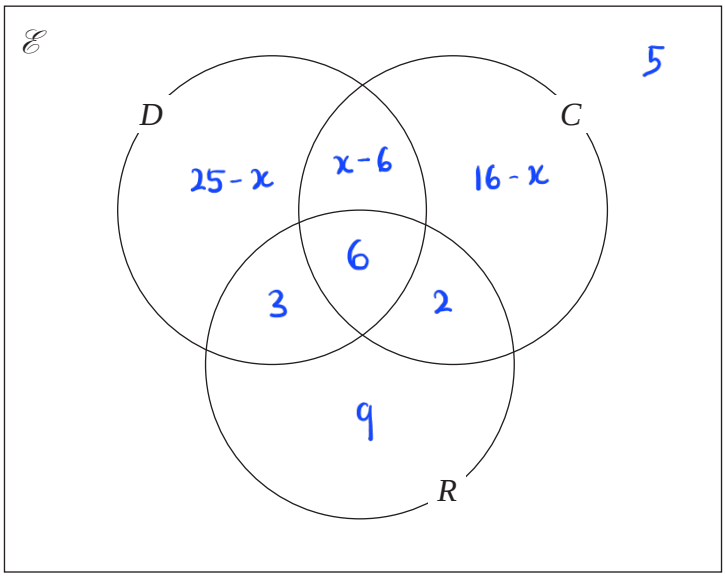
4 Some students in a school were asked the following question.

"Do you have a dog (*D*), a cat (*C*) or a rabbit (*R*)?"

Of these students

28 have a dog
18 have a cat
20 have a rabbit
8 have both a cat and a rabbit
9 have both a dog and a rabbit
x have both a dog and a cat
6 have a dog, a cat and a rabbit
5 have not got a dog or a cat or a rabbit

(a) Using this information, complete the Venn diagram to show the number of students in each appropriate subset.
Give the numbers in terms of *x* where necessary.



(3)

Given that a total of 50 students answered the question,

(b) work out the value of *x*.

$(25-x)+(x-6)+(16-x)+3+6+9+2+5 = 50$ (1)

$60 - x = 50$

$x = 60 - 50$

$= 10$ (1)

$x =$ 10

(2)

not C → not D

(c) Find $n(C' \cap D')$

9 + 5 = 14 (1)

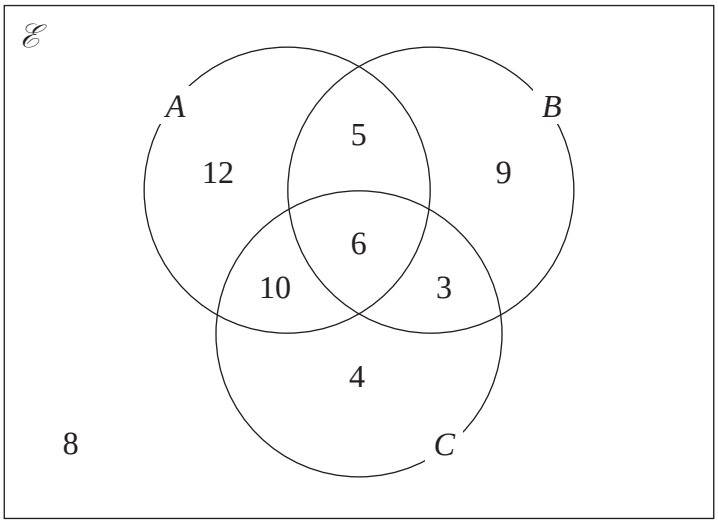
14

.....

(1)

(Total for Question 4 is 6 marks)

5 The Venn diagram shows a universal set, $\mathscr{E}$ and sets A, B and C.



12, 5, 9, 10, 6, 3, 4 and 8 represent the **numbers** of elements.

Find

(i) $n(A \cup B)$

C is in A or in B

$10 + 12 + 6 + 5 + 3 + 9 = 45$

45 (1)

.....

(1)

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

is not in A and B

$4 + 8 = 12$

12 (1)

.....

(1)

(iii) $n([A \cap B] \cup C)$

is in A and B or in C

$5 + 6 + 4 + 10 + 3 = 28$

28 (1)

.....

(1)

(Total for Question 5 is 3 marks)

6 $\mathscr{E}$ = {letters of the alphabet}
B = {b, r, a, z, i, l}
I = {i, r, e, l, a, n, d}

(a) List the members of the set

(i) $B \cup I$ – in set B or in set I

b, r, a, z, i, l, e, n, d (1)

(ii) $B \cap I'$ - in set B and not in set I

b, z (1)

(2)

K = {k, e, n, y, a}

Cody writes down the statement $B \cap K = \varnothing$
Cody's statement is wrong.

(b) Explain why.

There is letter 'a' in both sets. (1)

(1)

(Total for Question 6 is 3 marks)

7 $\mathscr{E}$ = {21, 22, 23, 24, 25, 26, 27, 28, 29, 30}
A = {22, 24, 26, 28, 30}
B = {21, 24, 27, 30}

(a) List the members of the set

(i) $A \cap B$ - is in set A AND set B

24, 30 (1)

(ii) A' - not in set A

21, 23, 25, 27, 29 (1)

(2)

C = {23, 25, 29} - all not in set A or set B

(b) Using set notation, find an expression for C in terms of A and B.

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

(1)

(Total for Question 7 is 3 marks)

8 Two events A and B are such that $n(A) = 62$ $n(B) = 30$ and $n(A \cup B) = 68$

Given that $n(\mathscr{E}) = 80$

(a) complete the Venn diagram to show the number of elements in each region.

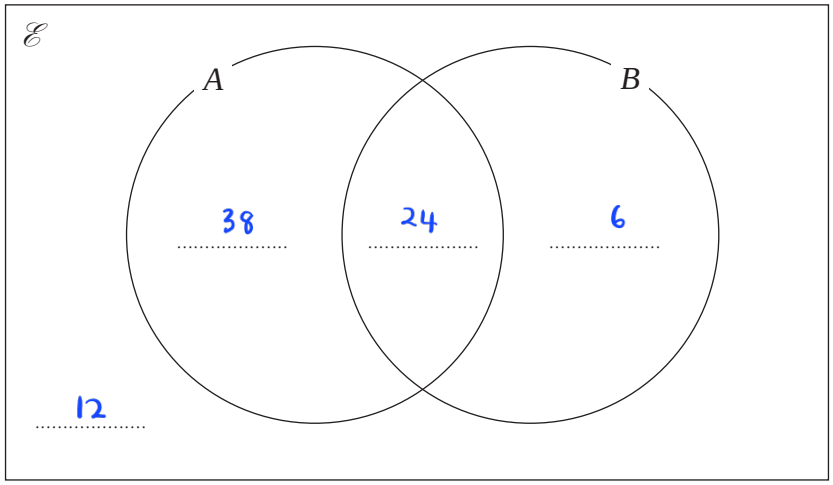
Let $n(A \cap B) = x$

$n(A \cup B) = n(A) + n(B) - x$

$68 = 62 + 30 - x$

$x = 92 - 68 = 24$

$80 - 68 = 12$



(2)

An element is chosen at random from $\mathscr{E}$.

(b) Using the Venn diagram, find the probability that this element is in

(i) $A \cap B$ – overlap of A and B

$\frac{24}{80}$ (1)

(1)

(ii) $A \cup B'$ – is in A and not in B

$62 + 12 = 74$ (1)

$\frac{74}{80}$ (1)

(2)

(Total for Question 8 is 5 marks)

9 $\mathscr{E}$ = {20, 21, 22, 23, 24, 25, 26, 27, 28, 29}

A = {odd numbers}
B = {multiples of 3}

List the members of the set

(i) $A \cap B$ - an odd number and a multiple of 3

{ 21, 27 }

{ 21, 27 } (1)

(1)

(ii) $A \cup B$ - an odd number or a multiple of 3

{ 21, 23, 24, 25, 27, 29 }

(1)
{ 21, 23, 24, 25, 27, 29 }

(1)

(Total for Question 9 is 2 marks)

10 Some students were asked the following question.

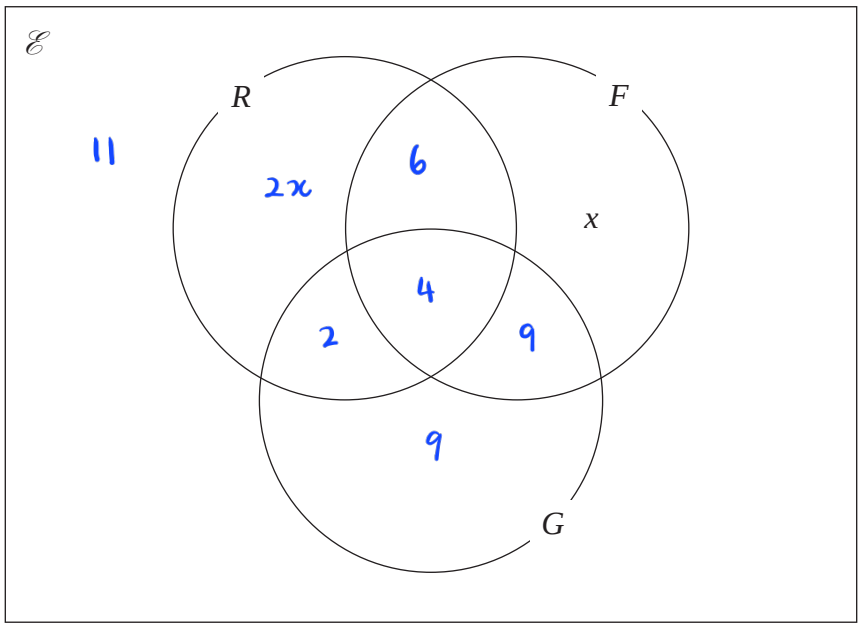
"Which of the subjects Russian (R), French (F) and German (G) do you study?"

Of these students

4 study all three of Russian, French and German
10 study Russian and French
13 study French and German
6 study Russian and German
24 study German
11 study none of the three subjects
the number who study Russian only is twice the number who study French only.

Let x be the number of students who study French only.

(a) Show all this information on the Venn diagram, giving the number of students in each appropriate subset, in terms of x where necessary.



(3)

Given that the number of students who were asked the question was 80

(b) work out the number of these students that study Russian.

$80 = 11 + 2x + 6 + 4 + 2 + 9 + 9 + x$ (1)

$= 3x + 41$

$3x = 80 - 41$

$3x = 39$

$x = 13$ (1)

Russian $= 2(13) + 12$

$= 26 + 12$

$= 38$ (1)

38

(3)

(Total for Question 10 is 6 marks)

11 $\mathscr{E}$ = {9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20}
A = {multiples of 3}
B = {odd numbers}

(a) List the members of the set

(i) $A \cap B$ - is in Set A and Set B

9, 15 (1)

(1)

(ii) $A \cup B$ - is in Set A or Set B

9, 11, 12, 13, 15, 17, 18, 19 (1)

(1)

(b) Is it true that $24 \in A$?

Tick one of the boxes below.

Yes	No
	✓

Give a reason for your answer.

24 is not between 9 and 20. (1)

(1)

→ is in Set C and not in set B

Set C has 4 members such that $C \cap B' = \{10, 18\}$

(c) List the members of one possible set C

not in Set B : 10, 12, 14, 16, 18, 20

Members of C : Any 2 numbers except 12, 14, 16, 20

9, 10, 11, 18 (2)

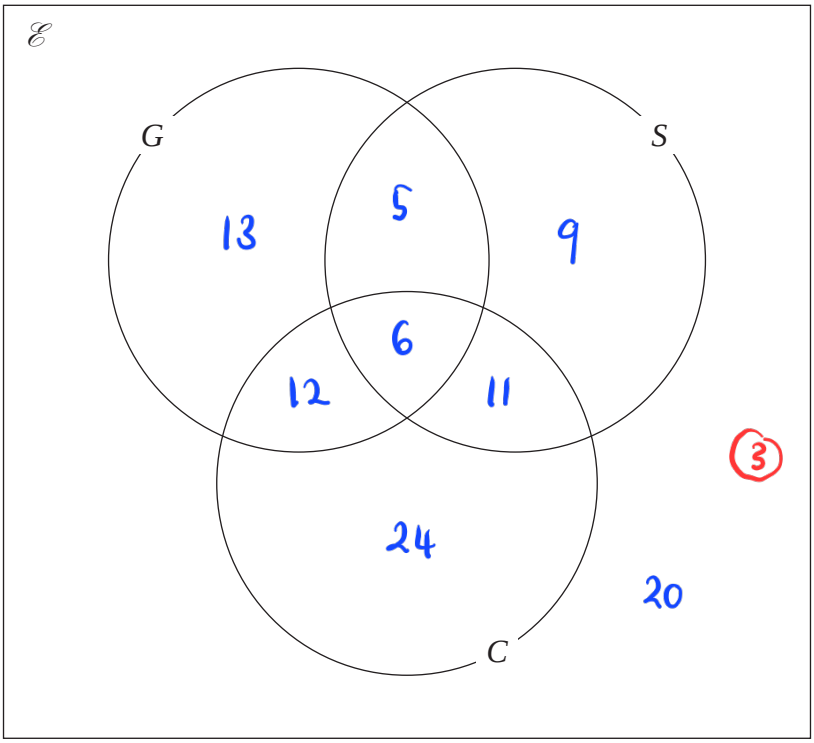
(2)

(Total for Question 11 is 5 marks)

12 100 farmers are asked if they have goats (G), sheep (S) or chickens (C) on their farms.

Of these farmers
- 31 have sheep
- 53 have chickens
- 6 have goats, sheep and chickens
- 11 have sheep and goats
- 17 have sheep and chickens
- 18 have goats and chickens
- 20 do not have any goats, sheep or chickens

(a) Using this information, complete the Venn diagram to show the number of farmers in each appropriate subset.



(3)

(b) Find

(i) n(G)

$13+12+5+6 = 36$

36 (1)

(1)

(ii) n($[G \cup S]'$)

$24+20 = 44$

44 (1)

(1)

(iii) n($G' \cap C$)

$24+11 = 35$

35 (1)

(1)

One of the farmers who has chickens is chosen at random.

(c) Find the probability that this farmer also has goats.

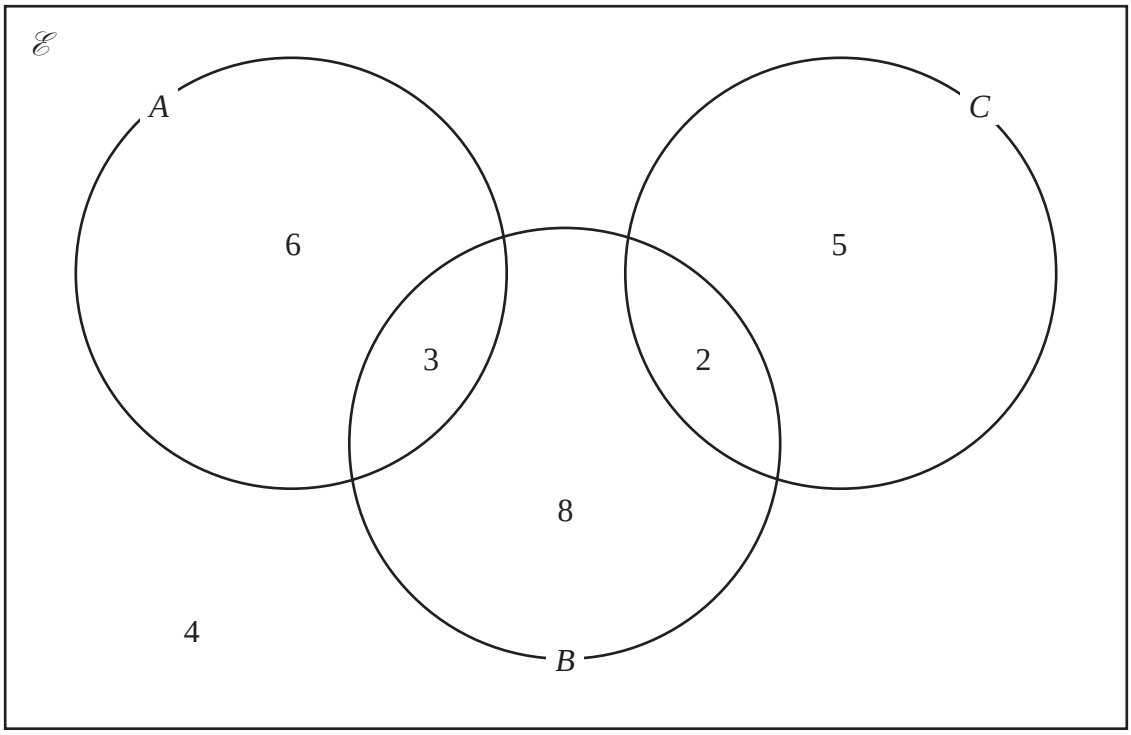
$$\frac{12+6}{24+12+6+11} = \frac{18}{53}$$

$\frac{18}{53}$ (2)

(2)

(Total for Question 12 is 8 marks)

13 The Venn diagram shows a universal set $\mathscr{E}$ and three sets A, B and C.



6, 3, 8, 2, 5 and 4 represent the **numbers** of elements.

Find

(i) $n(A \cup B)$

$6 + 3 + 8 + 2 = 19$

19 (1)

(1)

(ii) $n(A \cap C)$

0 (1)

(1)

(iii) $n(B \cap C')$

$8 + 3 = 11$

11 (1)

(1)

(iv) $n(A' \cup B' \cup C')$

28 (1)

(1)

(Total for Question 13 is 4 marks)

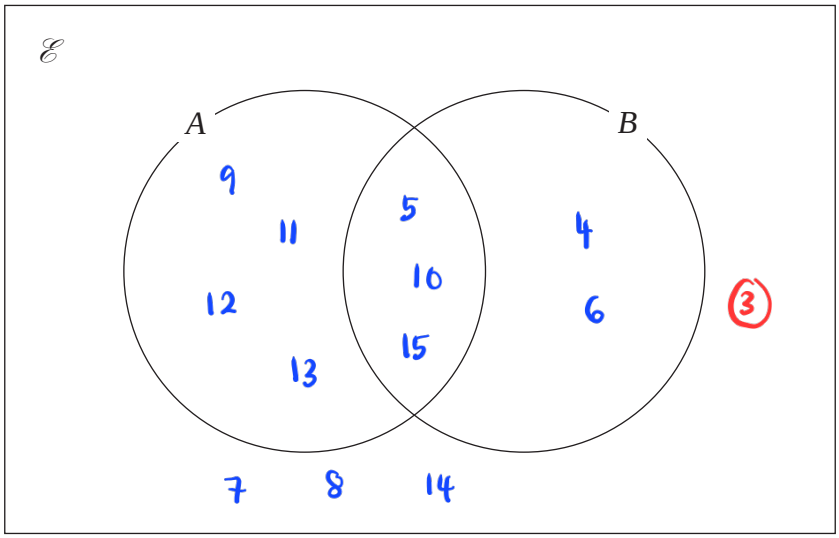
14 $\mathscr{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$

$A \cap B = \{5, 10, 15\}$

$B' = \{7, 8, 9, 11, 12, 13, 14\}$

$A' = \{4, 6, 7, 8, 14\}$

Complete the Venn diagram for this information.



(Total for Question 14 is 3 marks)

15 A, B and C are three sets.

$n(A \cap B \cap C) = 5$

$n(A \cap B \cap C') = 2$

$n(A \cap C) = 5$

$n(A) = 17$

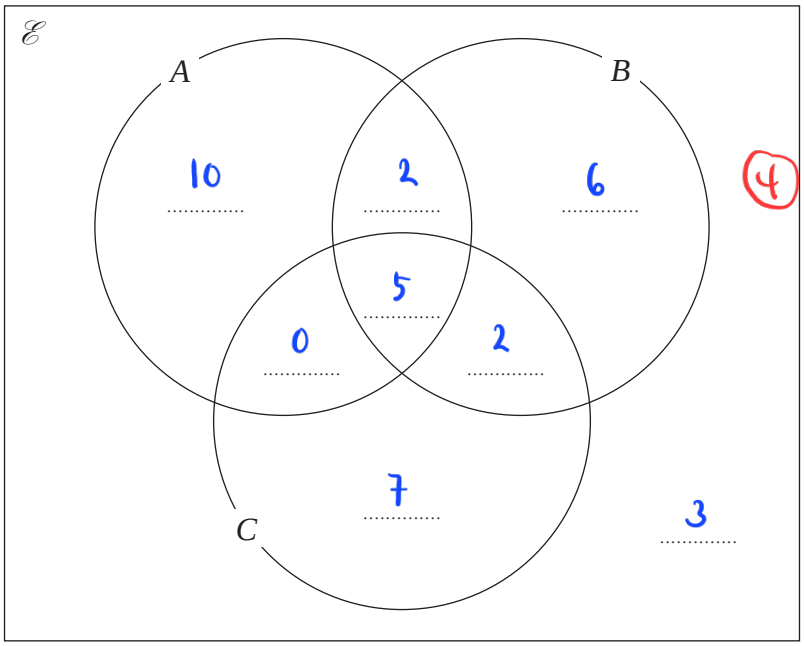
$n\left([A \cup B \cup C]'\right) = 3$

$n(A' \cap B \cap C') = 6$

$n(B \cap C) = 7$

$n(C) = 14$

Complete the Venn diagram to show the number of elements in each region.

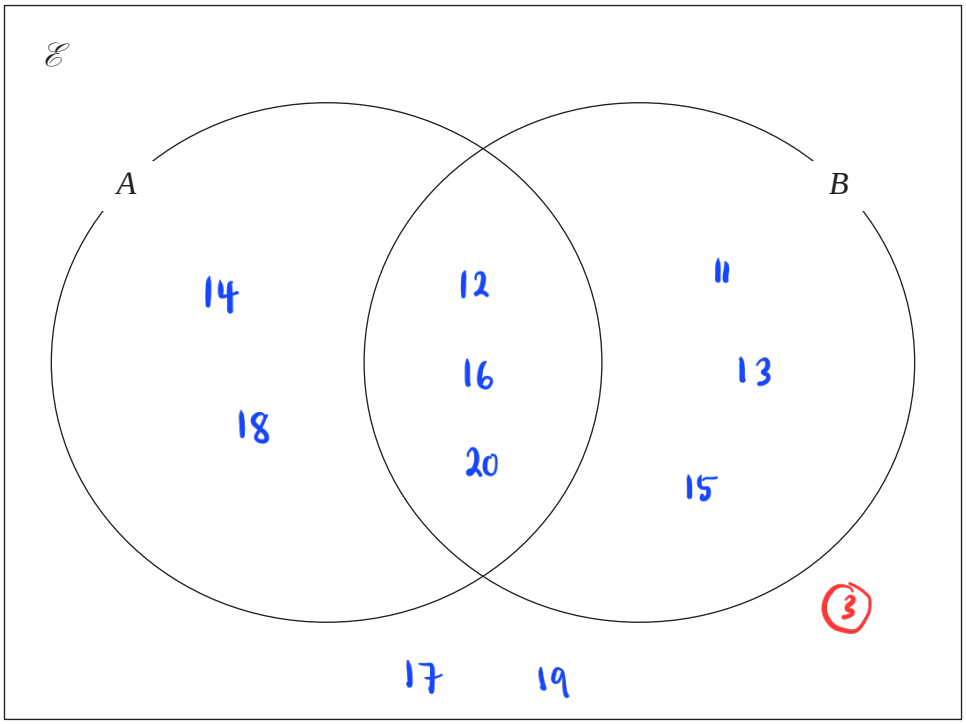


(Total for Question 15 is 4 marks)

16 $\mathscr{E}$ = {11, 12, 13, 14, 15, 16, 17, 18, 19, 20}

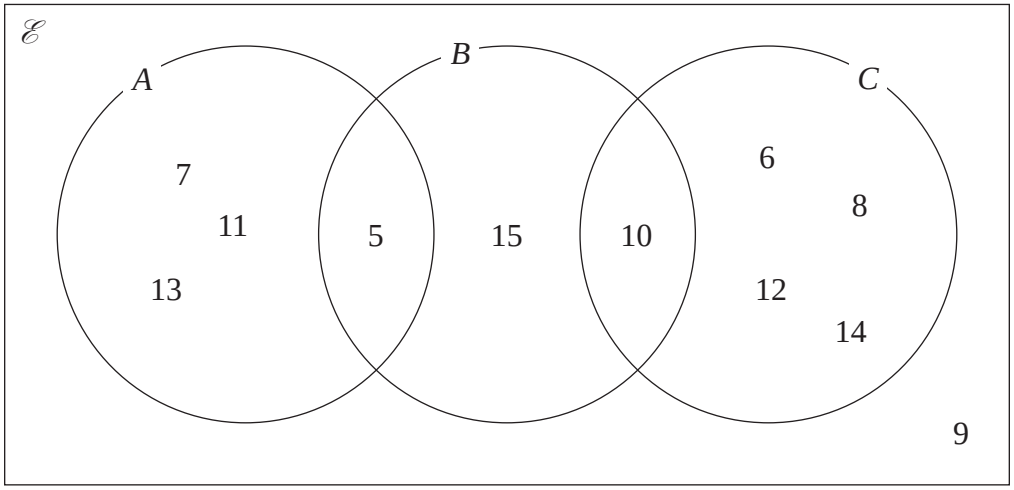
A = {even numbers}
$A \cap B$ = {12, 16, 20}
$(A \cup B)'$ = {17, 19}

Complete the Venn diagram for the sets $\mathscr{E}$, A and B



(Total for Question 16 is 3 marks)

17 Here is a Venn diagram.



(a) Write down the numbers that are in the set

(i) A

7, 11, 13, 5 (1)

(1)

(ii) $B \cup C$

5, 6, 8, 10, 12, 14, 15 (1)

(1)

Dominic writes down $9 \notin C$

(b) Explain why Dominic is correct.

9 is not a member of C (1)

(1)

(Total for Question 17 is 3 marks)

18 30 adults booked to stay in a hotel.

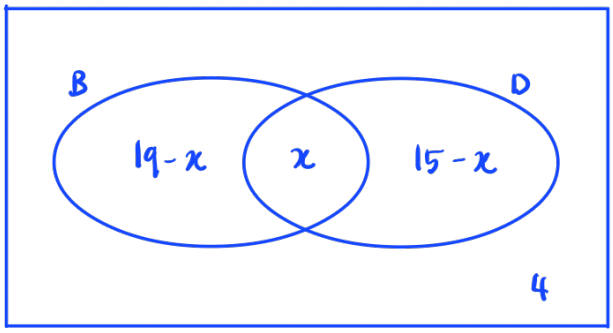
19 adults booked breakfast
15 adults booked dinner
4 adults did not book breakfast or dinner

Some adults booked breakfast **and** dinner.

Meihui chooses at random two of the 30 adults.

Work out the probability that these two adults each booked breakfast **and** dinner.

x = breakfast and dinner



(1)

$19 - x + x + 15 - x + 4 = 30$

$38 - x = 30$

$x = 8$ (1)

$\frac{8}{30} \times \frac{7}{29} = \frac{56 \div 2}{870 \div 2} = \frac{28}{435}$ (1)

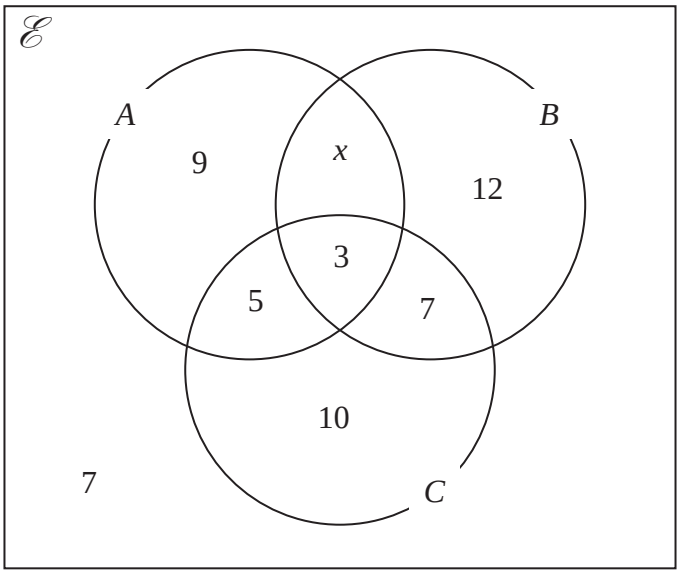
(1)

$\frac{28}{435}$

(Total for Question 18 is 4 marks)

19 The Venn diagram shows a universal set $\mathscr{E}$ and sets A, B and C

The numbers and the letter x represent **numbers** of elements.



Given that $n(A \cup B) = 42$

(a) find the value of x

$x = 42 - 9 - 5 - 3 - 7 - 12$

$= 6$

$x =$ 6 (1)

(1)

(b) Find $n(A')$

$7 + 10 + 7 + 12 = 36$

36 (1)

(1)

(c) Find $n(B' \cap C)$

$5 + 10 = 15$

15 (1)

(1)

(Total for Question 19 is 3 marks)