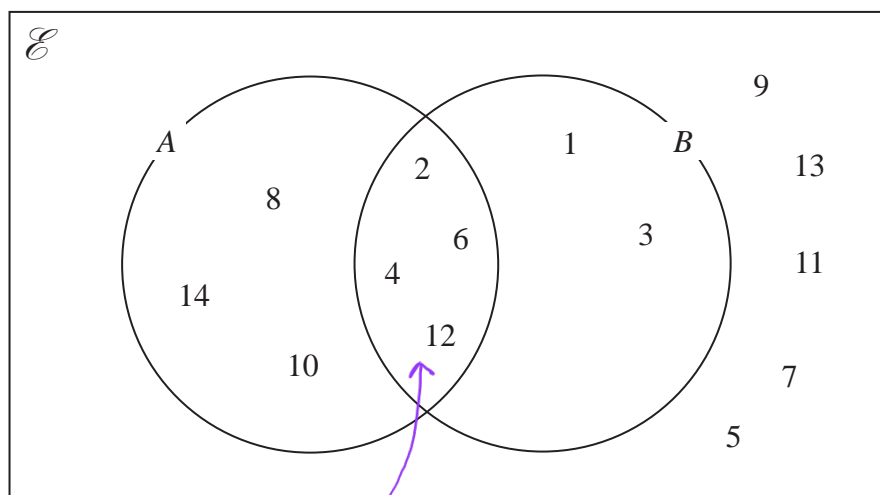


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- 1 The numbers from 1 to 14 are shown in the Venn diagram.



- (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.

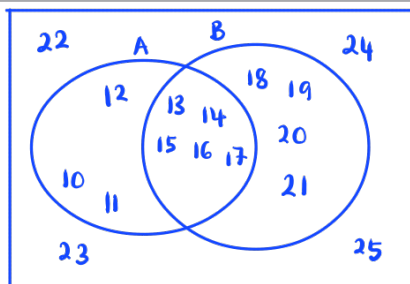
$\frac{3}{14}$ (2)

(2)

(Total for Question 1 is 4 marks)



- 2 $\mathcal{E} = \{\text{integers } x \text{ such that } 10 \leq x \leq 25\}$
 $A = \{x : x < 18\}$
 $B = \{x : 13 \leq x < 22\}$



- (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)

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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

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

(ii) $W \cap G'$

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

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

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

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

(2)

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

(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.

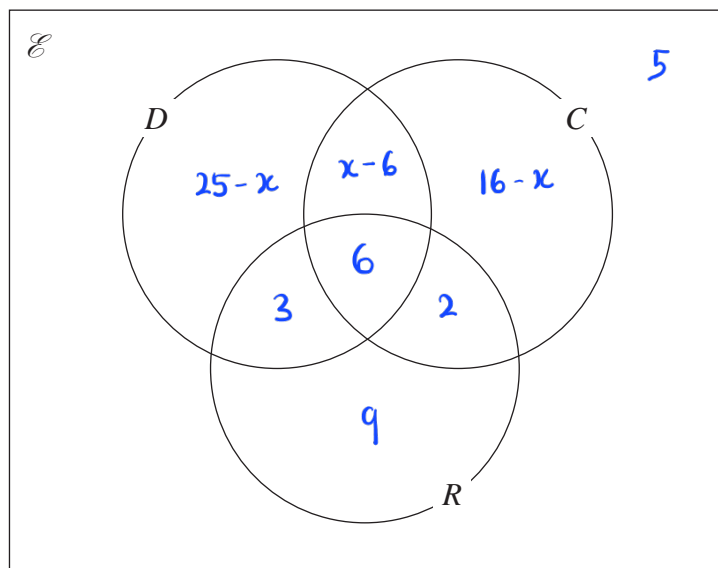
“Do you have a dog (D), a cat (C) or a rabbit (R)?”

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 .

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

$$60 - x = 50$$

$$x = 60 - 50$$

$$= 10 \quad (1)$$

$$x = \underline{\quad 10 \quad}$$

(2)



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

↗ not c ↘ not D

$$9 + 5 = 14 \quad \textcircled{1}$$

14

(1)

(Total for Question 4 is 6 marks)

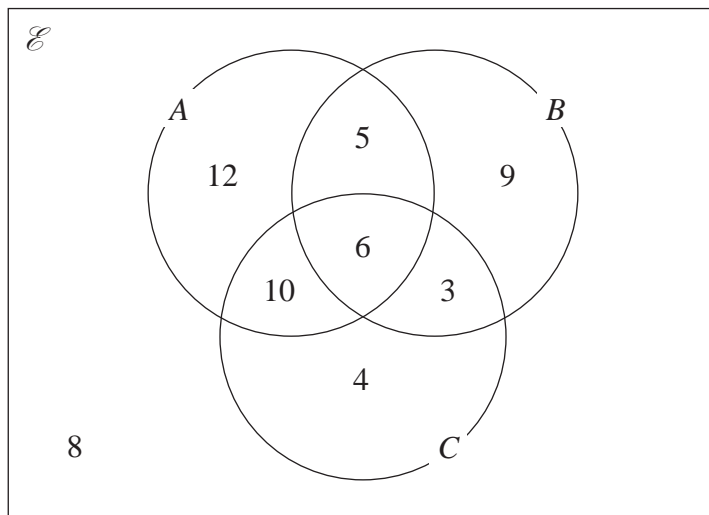
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5 The Venn diagram shows a universal set, \mathcal{E} and sets A , B and C .



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

Find

C is in A or in B

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

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

45 (1)

(1)

C is not in A and B

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

$$4 + 8 = 12$$

12 (1)

(1)

C is in A and B or in C

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

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

28 (1)

(1)

(Total for Question 5 is 3 marks)

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6 $\mathcal{E} = \{\text{letters of the alphabet}\}$

$B = \{\text{b, r, a, z, i, l}\}$

$I = \{\text{i, r, e, l, a, n, d}\}$

(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)

$K = \{\text{k, e, n, y, a}\}$

Cody writes down the statement $B \cap K = \emptyset$

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

(a) List the members of the set

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

24, 30 (1)

(ii) $A' - B$ - 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 $n(\mathcal{E}) = 80$

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

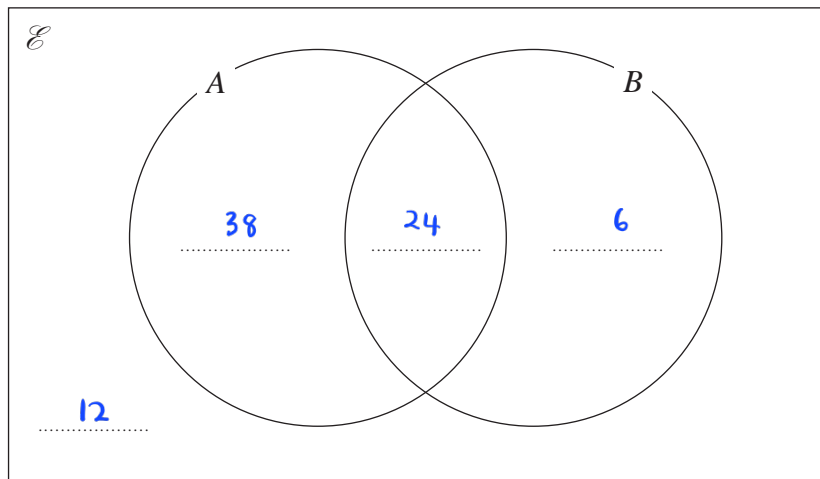
$$\text{Let } n(A \cap B) = x$$

$$80 - 68 = 12$$

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

$$68 = 62 + 30 - x$$

$$x = 92 - 68 = 24$$



(2)

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

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

(i) $A \cap B$ - overlap of A and B

$$\frac{24}{80} \quad \textcircled{1}$$

(1)

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

$$62 + 12 = 74$$

$\textcircled{1}$

$$\frac{74}{80} \quad \textcircled{1}$$

(2)

(Total for Question 8 is 5 marks)



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

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

$B = \{\text{multiples of 3}\}$

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

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

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

(1)

(Total for Question 9 is 2 marks)

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10 Some students were asked the following question.

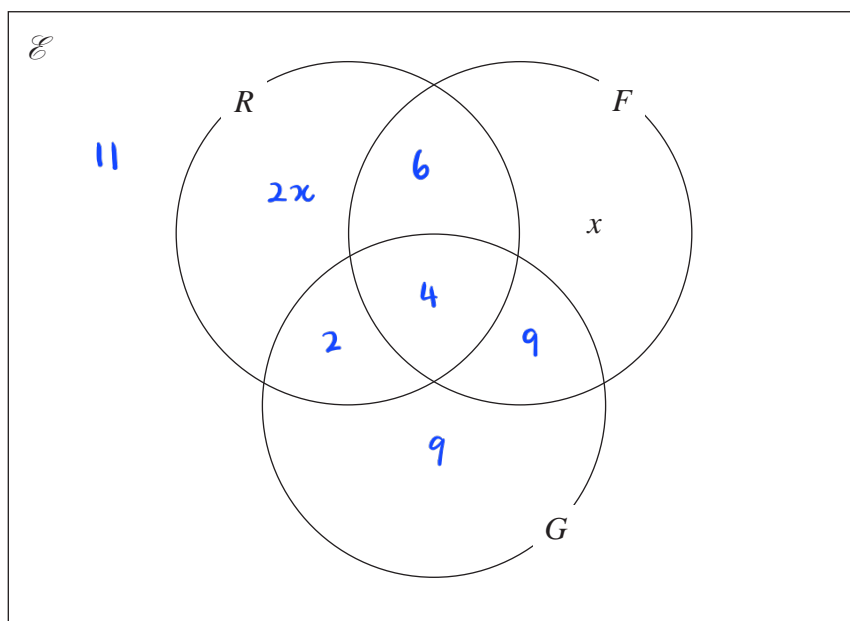
“Which of the subjects Russian (R), French (F) and German (G) do you study?”

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)

(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.

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

$$= 3x + 41$$

$$3x = 80 - 41$$

$$3x = 39$$

$$x = 13 \quad (1)$$

$$\text{Russian} = 2(13) + 12$$

$$= 26 + 12$$

$$= 38 \quad (1)$$

38

(3)

(Total for Question 10 is 6 marks)



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

(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)

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

→ is in Set C and not in set B

(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)

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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

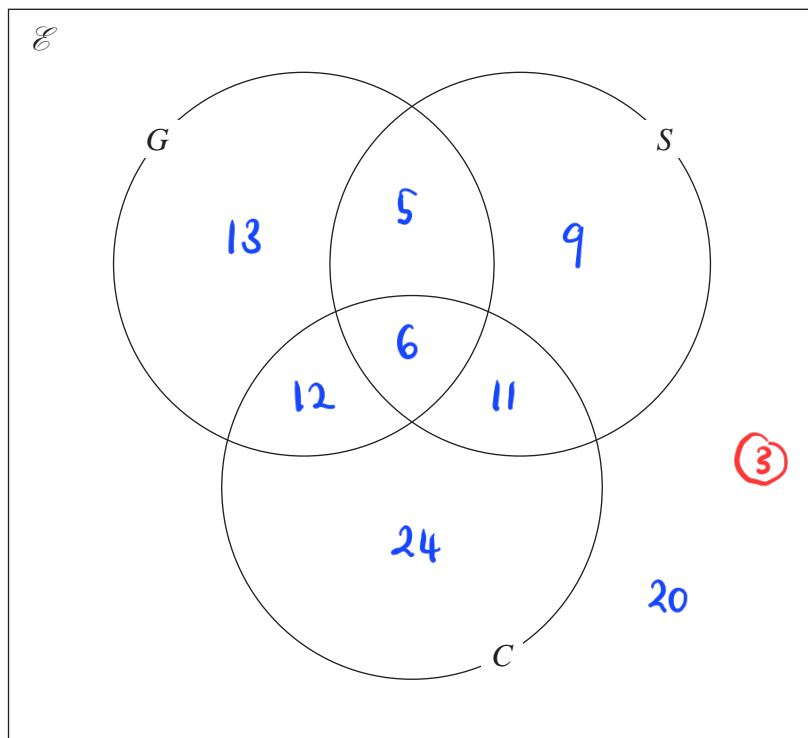
11 have sheep and goats

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)

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(b) Find

(i) $n(G)$

$$13 + 12 + 5 + 6 = 36$$

$$36 \text{ (1)}$$

(1)

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

$$24 + 20 = 44$$

$$44 \text{ (1)}$$

(1)

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

$$24 + 11 = 35$$

$$35 \text{ (1)}$$

(1)

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

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

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

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

(2)

(Total for Question 12 is 8 marks)

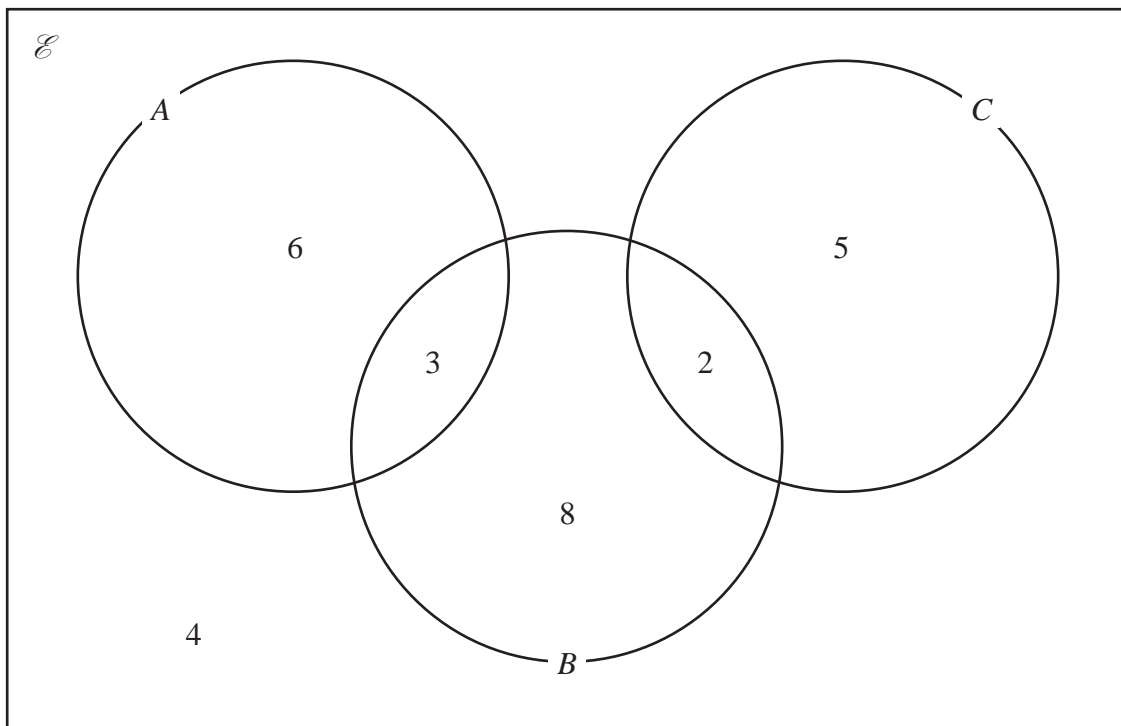
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13 The Venn diagram shows a universal set \mathcal{E} and three sets A , B and C .



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

Find

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

$$6 + 3 + 8 + 2 = 19$$

$$19 \quad (1)$$

(1)

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

$$0 \quad (1)$$

(1)

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

$$8 + 3 = 11$$

$$11 \quad (1)$$

(1)

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

$$28 \quad (1)$$

(1)

(Total for Question 13 is 4 marks)

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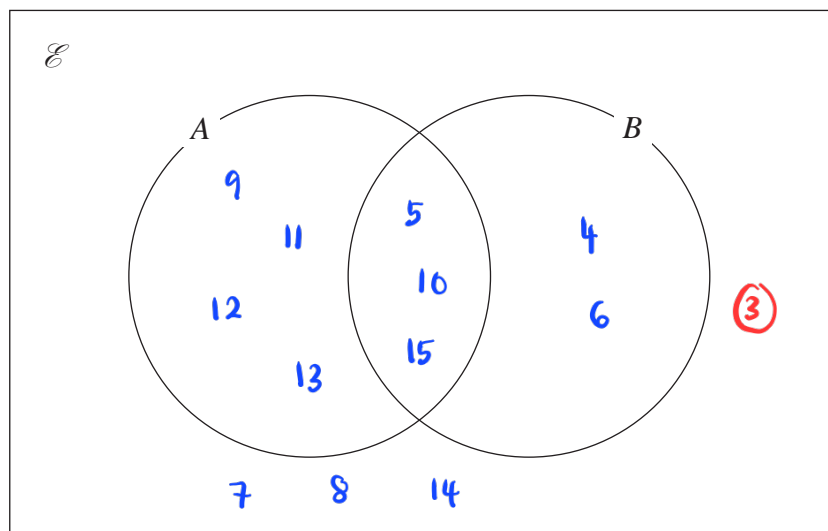
$$14 \quad \mathcal{E} = \{4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15\}$$

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

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

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

Complete the Venn diagram for this information.



(Total for Question 14 is 3 marks)

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15 A , B and C are three sets.

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

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

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

$$n(A) = 17$$

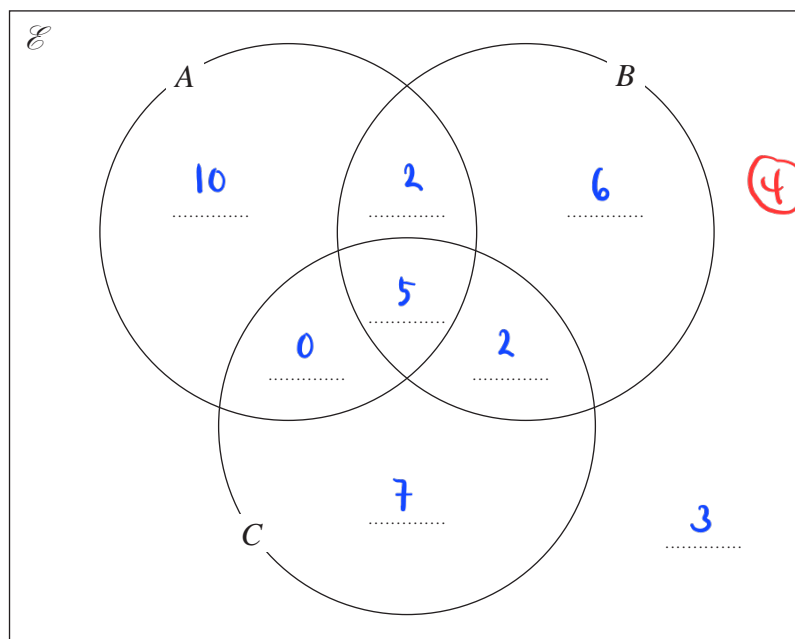
$$n([A \cup B \cup C]') = 3$$

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

$$n(B \cap C) = 7$$

$$n(C) = 14$$

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



(Total for Question 15 is 4 marks)



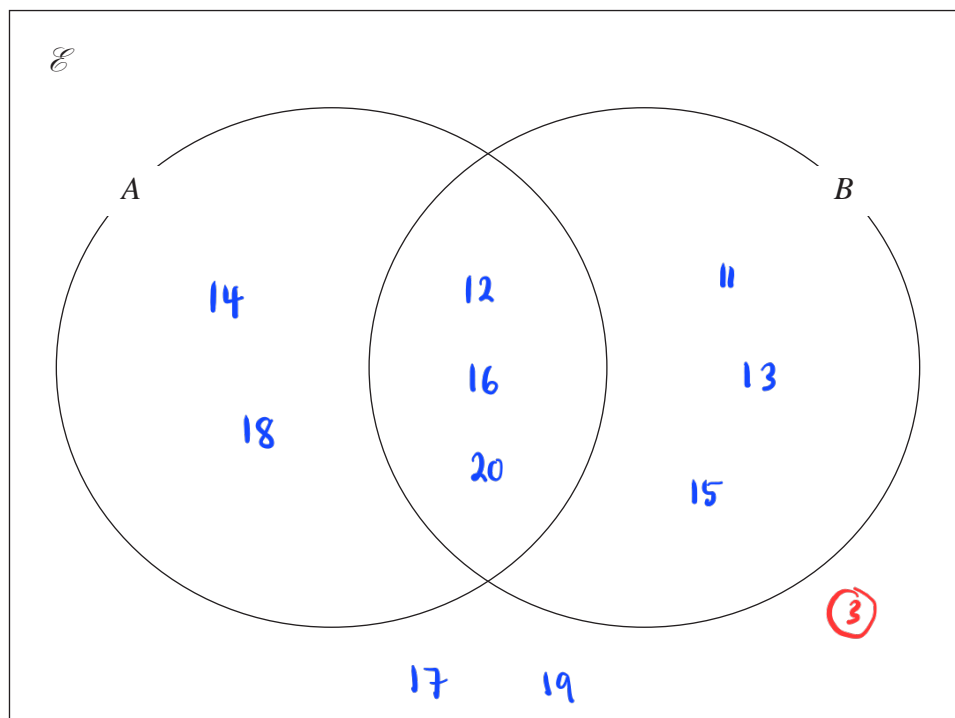
16 $\mathcal{E} = \{11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$

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

$A \cap B = \{12, 16, 20\}$

$(A \cup B)' = \{17, 19\}$

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



(Total for Question 16 is 3 marks)

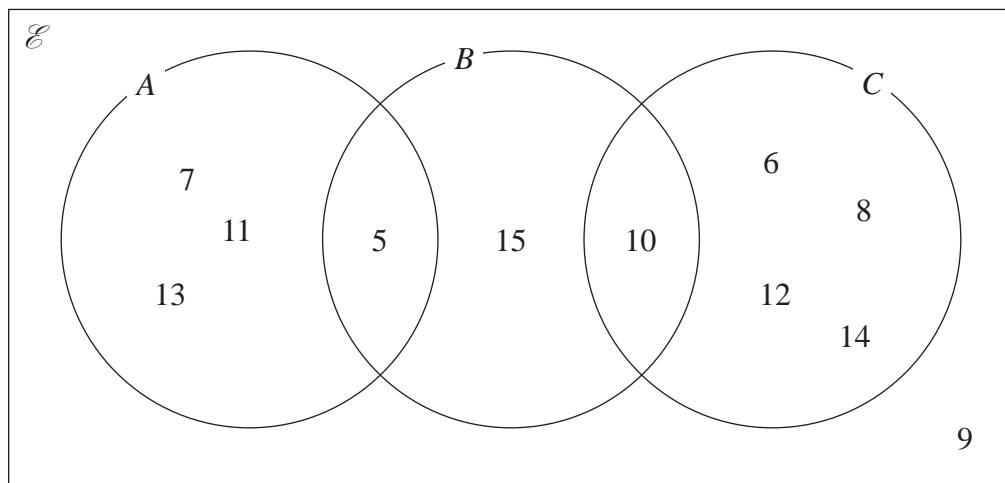
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17 Here is a Venn diagram.



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(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

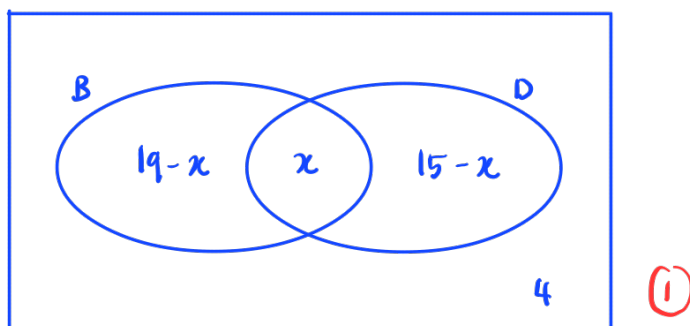
4 adults did not book breakfast or dinner

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



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

$$38-x = 30$$

$$x = 8 \quad (1)$$

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

(1)

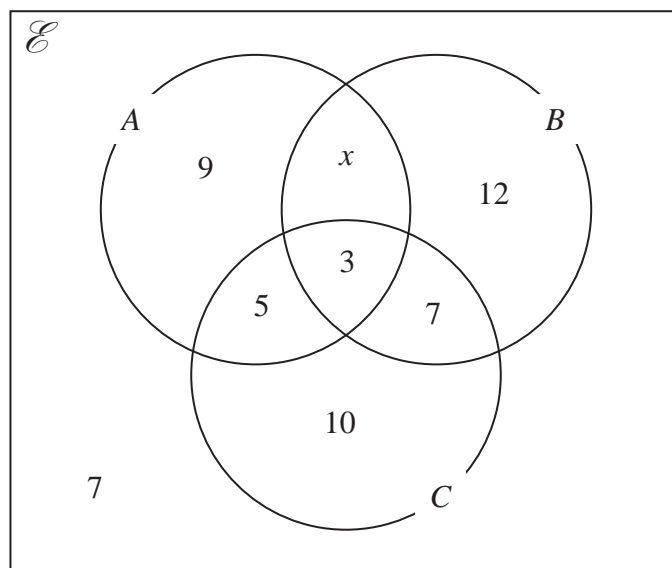
$$\frac{28}{435}$$

(Total for Question 18 is 4 marks)



19 The Venn diagram shows a universal set \mathcal{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

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

$$= 6$$

$$x = \frac{6 \quad \textcircled{1}}{(1)}$$

(b) Find $n(A')$

$$7 + 10 + 7 + 12 = 36$$

$$\frac{36 \quad \textcircled{1}}{(1)}$$

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

$$5 + 10 = 15$$

$$\frac{15 \quad \textcircled{1}}{(1)}$$

(Total for Question 19 is 3 marks)

