

Venn diagrams and sets

Exam questions

Foundation and Higher tiers

Please write clearly in block capitals.

Name

Class

Teacher

Time allowed: 95 minutes

Materials

For this booklet you need a black pen, a pencil, a ruler, a rubber and a calculator for Section B.

Instructions

- Use black ink or black ballpoint pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer all questions in the spaces provided.
- **Section A** (questions 1 to 12): you must not use a calculator.
- **Section B** (questions 13 to 21): you may use a calculator.
- Do all rough work in this booklet. Cross through any work you do not want marked.

Information

- The marks for each question are shown in brackets.
- The maximum mark for this booklet is 83.

Advice

- Read each question carefully.
- In all calculations, show clearly how you work out your answer.

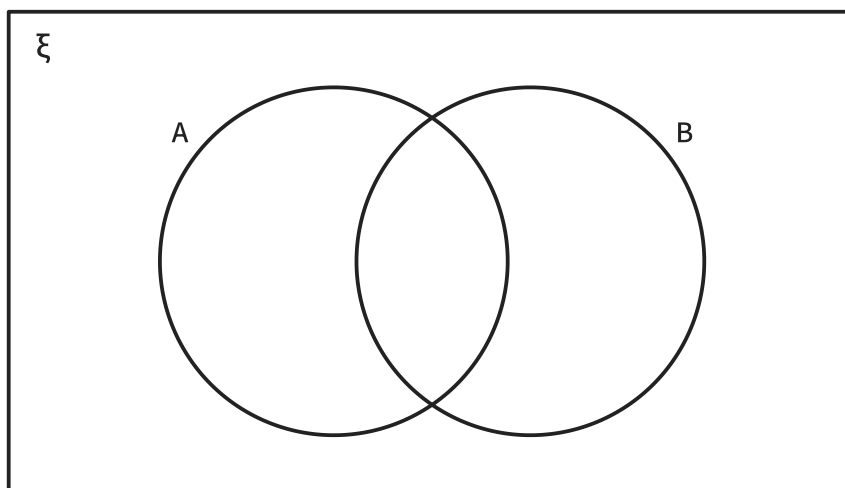
For teacher’s use

Q	Mark	Q	Mark
1		12	
2		13	
3		14	
4		15	
5		16	
6		17	
7		18	
8		19	
9		20	
10		21	
11			
TOTAL			

Section A**You must not use a calculator**Do not
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outside
the box

- 1** $\xi = \{\text{whole numbers from 1 to 12}\}$
 $A = \{\text{factors of 12}\}$
 $B = \{\text{odd numbers}\}$

(a) Complete the Venn diagram.

**[3 marks]**

- (b)** A number is chosen at random from ξ .
Work out the probability that the number is in both A and B.

Answer _____

[1 mark]

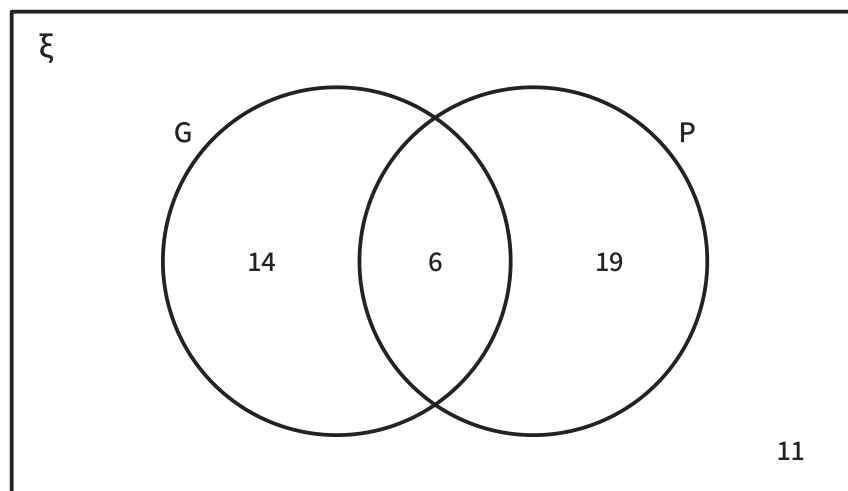
2

The Venn diagram shows information about the 50 students in a music class.

G = students who play the guitar

P = students who play the piano

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- (a) How many of the students play the piano?

Answer _____

[1 mark]

- (b) One of the students is chosen at random.
Work out the probability that this student plays exactly one of these instruments.

Answer _____

[2 marks]

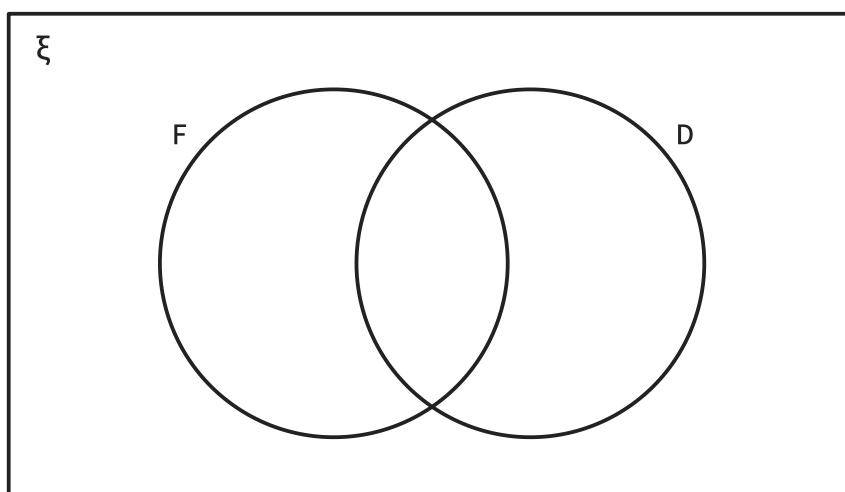
3

80 people went to a music festival.
 34 of them bought food.
 12 of them bought food and a drink.
 17 of them bought neither food nor a drink.

F = people who bought food

D = people who bought a drink

(a) Complete the Venn diagram.



[3 marks]

(b) One of the people is chosen at random.
 Work out the probability that this person bought a drink.

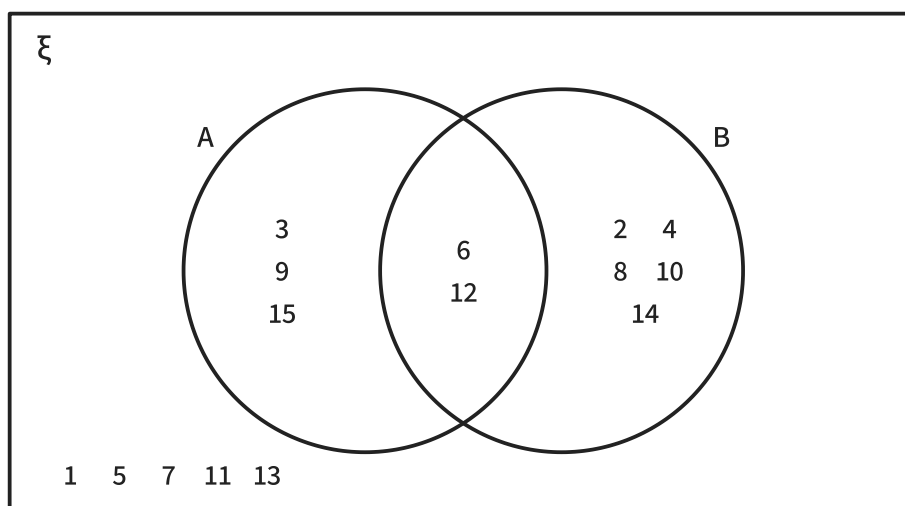
Answer _____

[1 mark]

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- 4 Here is a Venn diagram.

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

Answer _____

[1 mark]

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

Answer _____

[1 mark]

- (c) List the members of A'

Answer _____

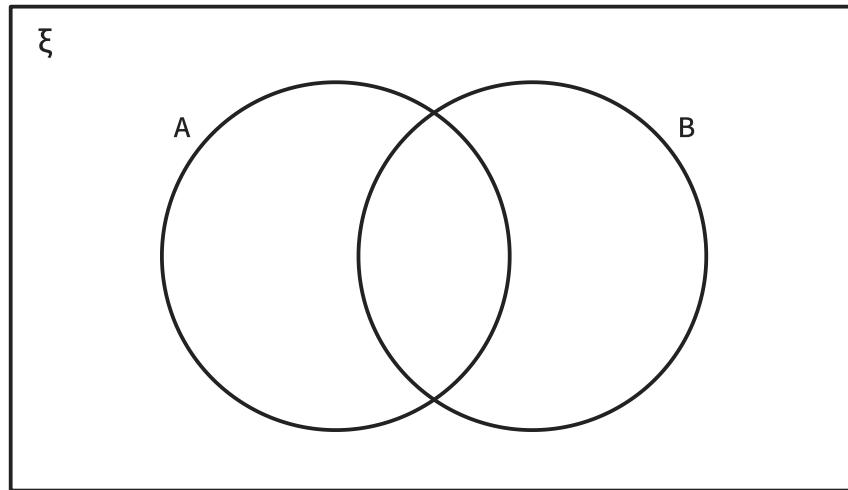
[1 mark]

- (d) A number is chosen at random from ξ .
Work out $P(A \cap B')$

Answer _____

[1 mark]

- 5 (a) On the Venn diagram, shade the region $A' \cap B$



[1 mark]

- (b) Which of these describes the members that are in A but not in B?
Circle your answer.

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

[1 mark]

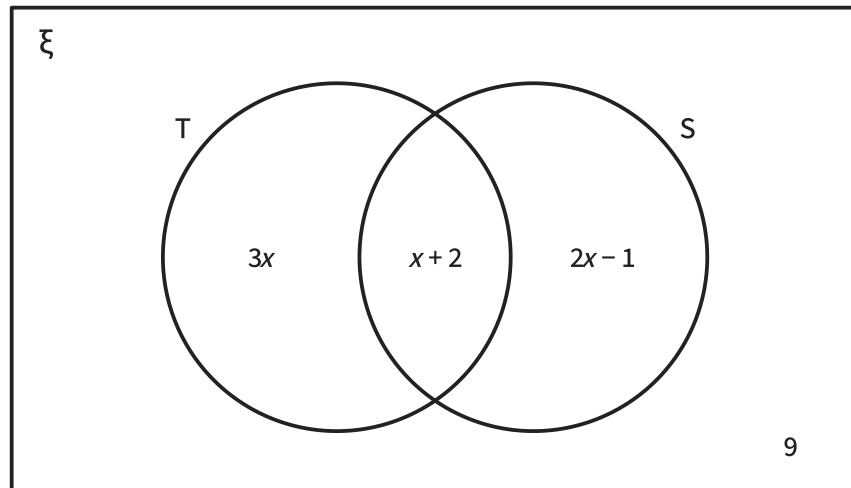
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6

There are 64 members in a sports club.

The Venn diagram shows how many play tennis (T) and how many play squash (S).

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- (a) Work out the value of x .

Answer _____

[3 marks]

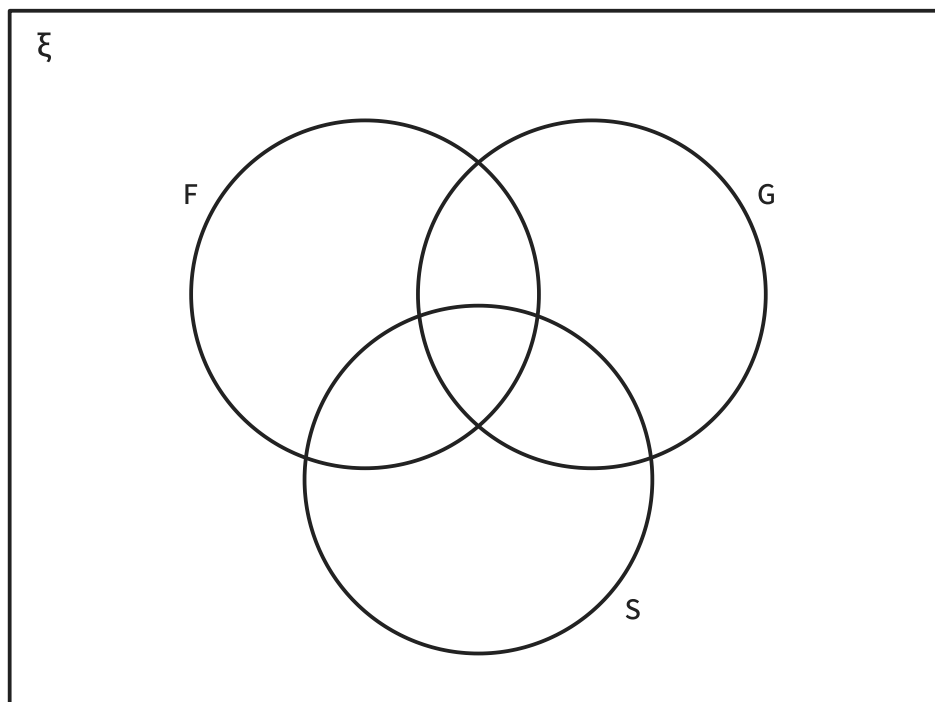
- (b) A member of the club is chosen at random.
Work out the probability that this member plays squash.

Answer _____

[2 marks]

- 7** 50 students were asked which of French (F), German (G) and Spanish (S) they study.
- 3 study all three languages.
 - 5 study French and German but not Spanish.
 - 4 study French and Spanish but not German.
 - 2 study German and Spanish but not French.
 - 22 study French. 15 study German. 18 study Spanish.

(a) Complete the Venn diagram.



[3 marks]

- (b)** A student is chosen at random.
Work out the probability that the student studies exactly one of these languages.

Answer _____

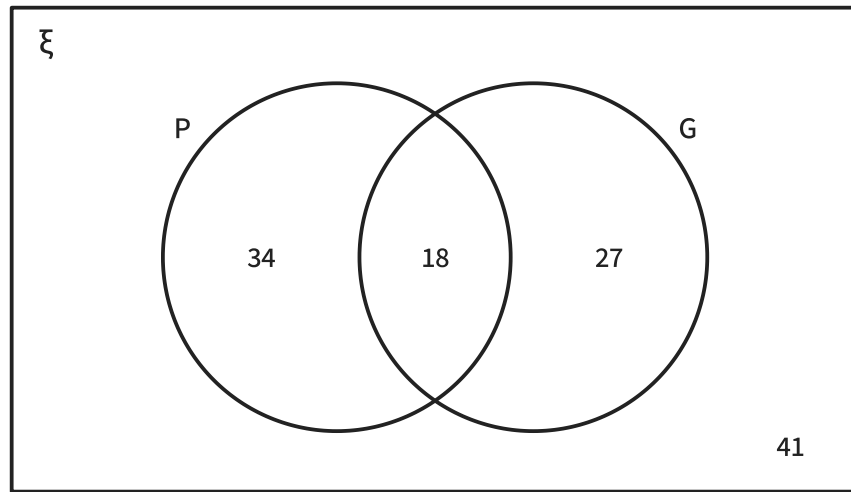
[2 marks]

8

The Venn diagram shows information about the guests at a hotel one day.

P = guests who used the pool

G = guests who used the gym



A guest who used the gym is chosen at random.

Work out the probability that this guest also used the pool.

Answer _____

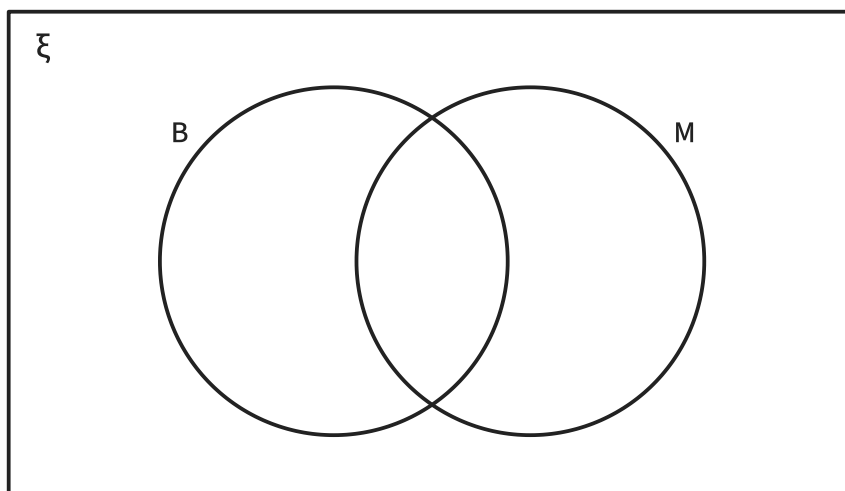
[2 marks]

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9

At a shop, the probability that a customer buys bread (B) is 0.45
The probability that a customer buys milk (M) is 0.3
The probability that a customer buys neither bread nor milk is 0.35

(a) Complete the Venn diagram to show the probabilities.



[3 marks]

(b) A customer buys milk.
Work out the probability that this customer also buys bread.

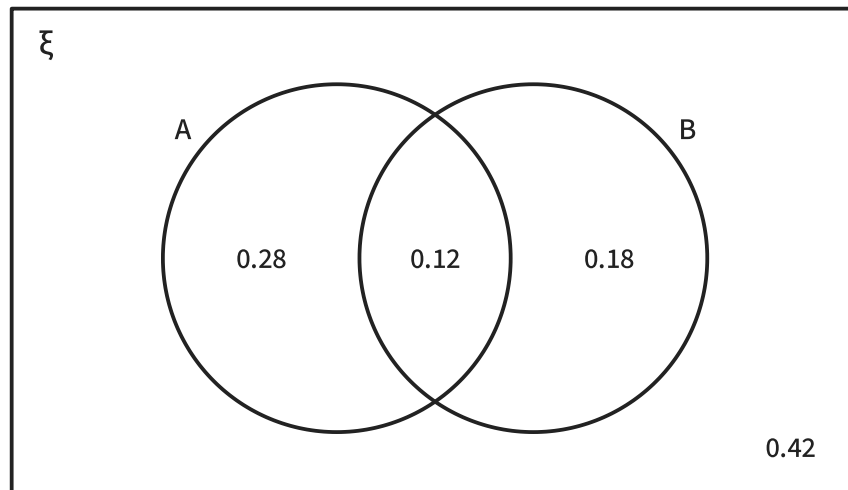
Answer _____

[2 marks]

10

The Venn diagram shows the probabilities of two events, A and B.

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Are the events A and B independent?

You must show your working.

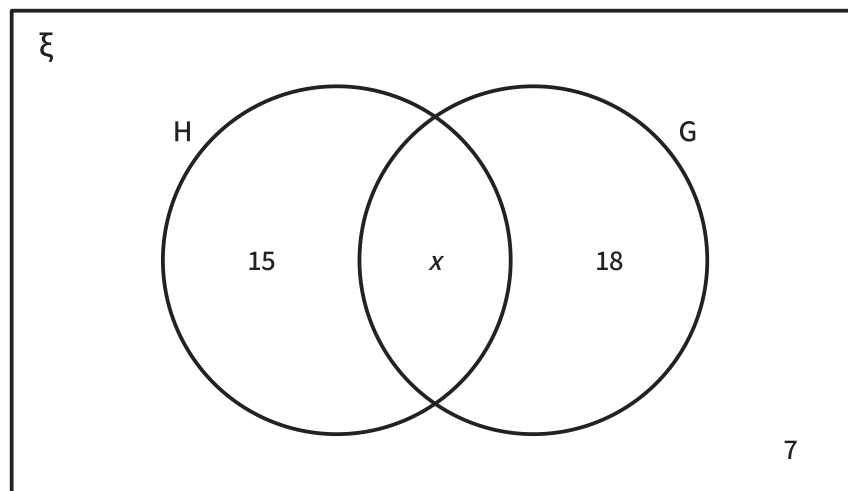
[3 marks]

11

The Venn diagram shows the numbers of students in a year group who study History (H) and Geography (G).

A student who studies Geography is chosen at random.

The probability that this student also studies History is $\frac{1}{4}$



Work out the total number of students in the year group.

Answer _____

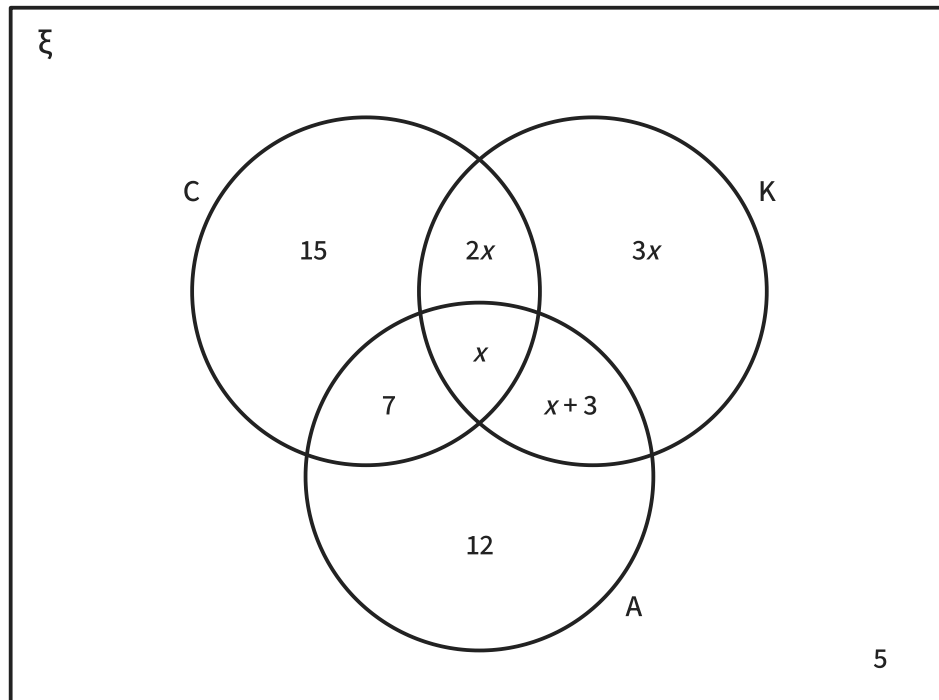
[4 marks]

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12

On a school trip, students could do climbing (C), kayaking (K) and archery (A). The Venn diagram shows the numbers of students who did each activity. A student who went kayaking is chosen at random. The probability that this student also went climbing is $\frac{2}{5}$

(a) Work out the number of students on the trip.



Answer _____

[4 marks]

(b) A student who did exactly two of the activities is chosen at random. Work out the probability that this student did archery.

Answer _____

[2 marks]

Section B



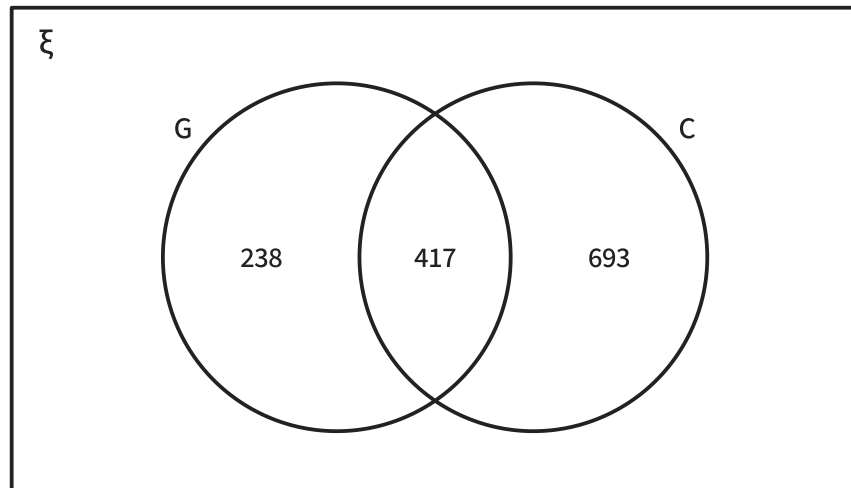
You may use a calculator

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- 13** The Venn diagram shows information about the 1857 visitors to a castle one day.

G = visitors who bought a guidebook

C = visitors who went to the café



- (a) How many of the visitors did not buy a guidebook and did not go to the café?

Answer _____

[1 mark]

- (b) One of the visitors is chosen at random.
Work out the probability that this visitor bought a guidebook but did **not** go to the café.
Give your answer as a decimal correct to 2 decimal places.

Answer _____

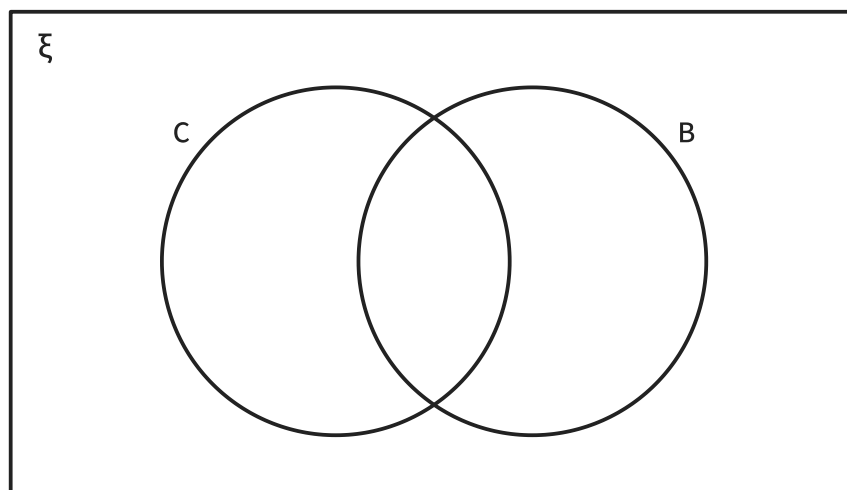
[2 marks]

- 14** 2450 people went to a farmers' market.
 1380 of them bought cheese.
 965 of them bought bread.
 512 of them bought cheese and bread.

C = people who bought cheese

B = people who bought bread

- (a)** Complete the Venn diagram.



[2 marks]

- (b)** One of the people is chosen at random.
 Work out the probability that this person bought neither cheese nor bread.
 Give your answer as a percentage correct to 1 decimal place.

Answer _____ %

[1 mark]

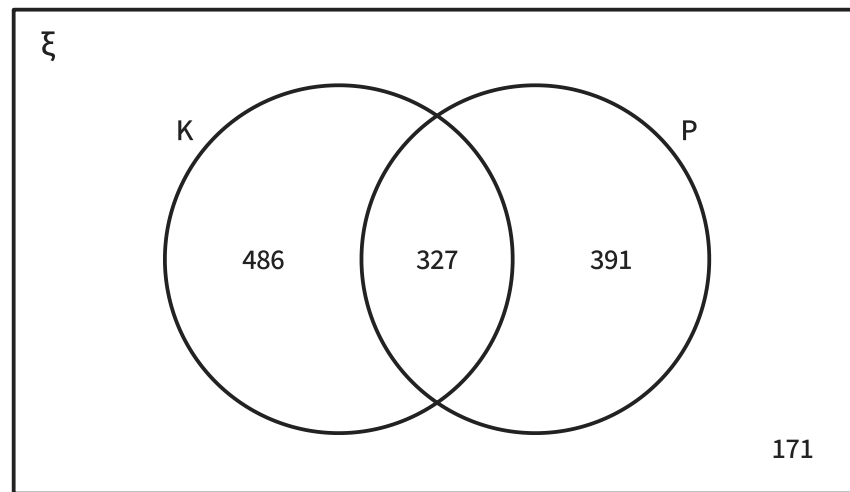
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15

The Venn diagram shows information about the 1375 members of an outdoor centre.

K = members who go kayaking

P = members who go paddleboarding



- (a) How many members are in the set K' ?

Answer _____

[1 mark]

- (b) A member is chosen at random.
Work out $P(K \cup P)$.
Give your answer to 3 decimal places.

Answer _____

[2 marks]

- (c) Work out $P(K' \cap P)$.
Give your answer to 3 decimal places.

Answer _____

[1 mark]

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16

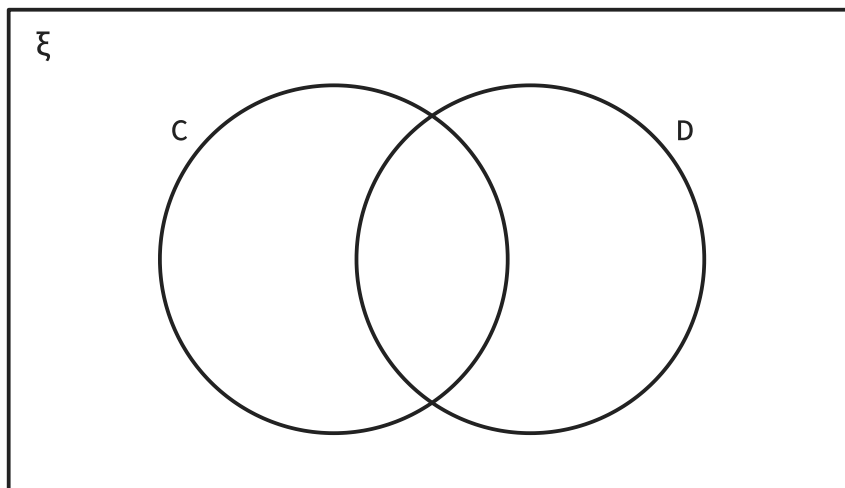
360 households were asked about their pets.

40% of the households have a cat (C).

15% of the households have neither a cat nor a dog.

Twice as many households have only a dog as have only a cat.

- (a) Complete the Venn diagram to show the number of households.



[3 marks]

- (b) A household is chosen at random.
Work out the probability that it has a cat or a dog but not both.

Answer _____

[1 mark]

17

In a town, the probability that a resident has a library card is 0.37
The probability that a resident has a gym membership is 0.24
The probability that a resident has both is 0.09

18 500 people live in the town.

Work out an estimate for the number of residents who have neither a library card nor a gym membership.

You may use a Venn diagram to help you.

Answer _____

[3 marks]

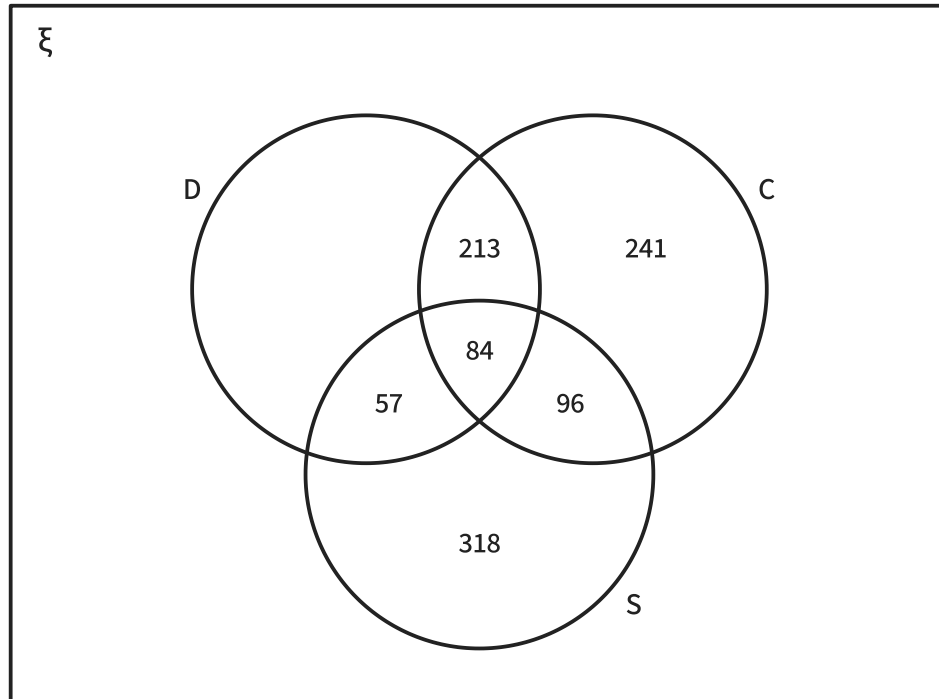
18

A streaming service asked 1680 of its subscribers which of drama (D), comedy (C) and sport (S) they watched last week.

The Venn diagram shows some of the results.

37.5% of the subscribers watched drama.

- (a) Work out the number of subscribers who watched none of drama, comedy or sport.



Answer _____

[3 marks]

- (b) A subscriber is chosen at random.

Work out the probability that this subscriber watched exactly two of drama, comedy and sport.

Give your answer to 3 decimal places.

Answer _____

[2 marks]

19

In a town, for a household chosen at random:

- the probability that it recycles glass is 0.584
- the probability that it recycles batteries is 0.437
- the probability that it recycles glass or batteries or both is 0.812

A household that recycles glass is chosen at random.

Work out the probability that this household also recycles batteries.

Give your answer to 3 decimal places.

You may use a Venn diagram to help you.

Answer _____

[4 marks]

20

On a shopping website

S is the event that a visitor uses the search bar

B is the event that a visitor adds an item to the basket

$$P(S) = 0.42 \quad P(S \cup B) = 0.5766$$

S and B are independent events.

(a) Work out $P(B)$.

Answer _____

[3 marks]

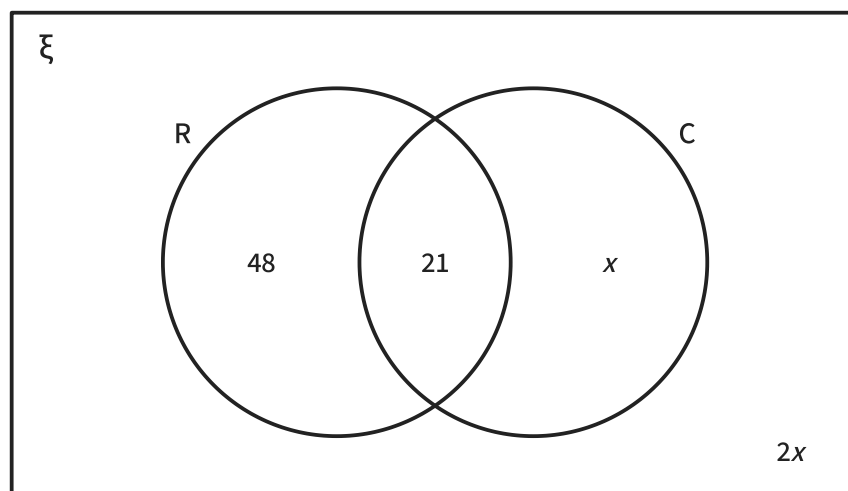
(b) The website has 5000 visitors one day.

Work out an estimate for the number of these visitors who do exactly one of these two things.

Answer _____

[2 marks]

- 21** The Venn diagram shows the numbers of members of a club who run (R) and who cycle (C).
Two different members of the club are chosen at random.
The probability that both of them run **and** cycle is $\frac{1}{26}$



Work out the number of members who cycle.

Answer _____

[5 marks]

END OF QUESTIONS