



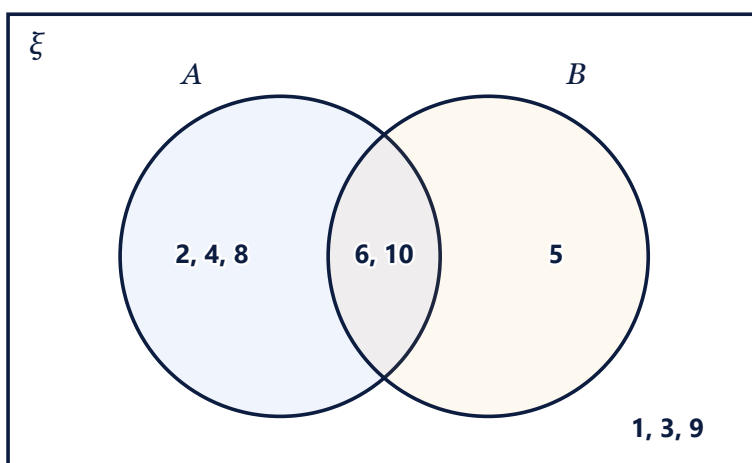
1 $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$

$A = \{\text{even numbers}\}$ $B = \{\text{multiples of 5}\}$

Kim draws a Venn diagram. She puts:

2, 4, 8 in A only 6, 10 in the intersection of A and B 5 in B only 1, 3, 9 outside both circles.

Write down **two** mistakes Kim has made.



(2 marks)

6 is even but not a multiple of 5, so it belongs in A only, not in A intersection B

Every number in the universal set must appear exactly once: 7 is odd and not a multiple of 5, so it should be outside both circles, but Kim has left it out

2 $A = \{\text{factors of 12}\}$ $B = \{\text{factors of 18}\}$

a. List the members of $A \cap B$.

b. Is 9 a member of $A \cup B$? Give a reason for your answer.

(3 marks)

$A = \{1, 2, 3, 4, 6, 12\}$ and $B = \{1, 2, 3, 6, 9, 18\}$

The intersection is the numbers in both sets: $\{1, 2, 3, 6\}$

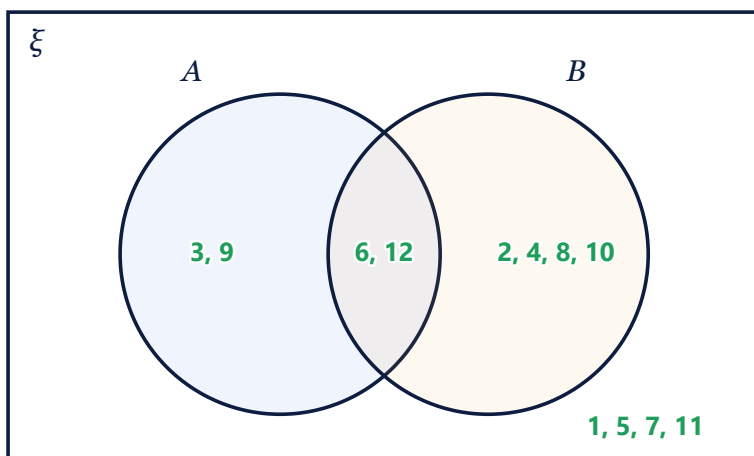
The union contains every number in A or B (or both). 9 is a factor of 18, so 9 is in B and therefore in $A \cup B$

3

$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

$$A = \{\text{multiples of 3}\} \quad B = \{\text{even numbers}\}$$

Complete the Venn diagram.



(3 marks)

$$A = \{3, 6, 9, 12\} \text{ and } B = \{2, 4, 6, 8, 10, 12\}$$

Numbers in both sets: 6 and 12 go in the intersection

A only: 3 and 9. B only: 2, 4, 8, 10

The remaining numbers 1, 5, 7, 11 go outside both circles

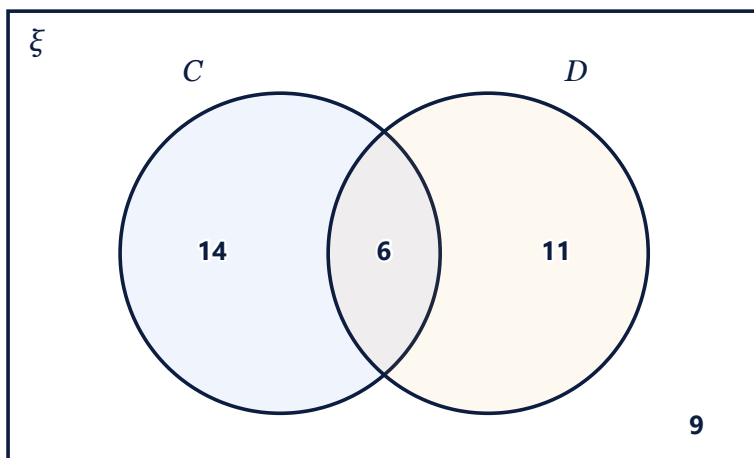
4

40 people were asked whether they drink coffee (C) and whether they drink tea (D).

14 drink coffee only, 6 drink both, 11 drink tea only and 9 drink neither.

One of the 40 people is chosen at random.

- Find the probability that this person drinks both coffee and tea.
- Find the probability that this person drinks coffee or tea or both.



(3 marks)

$$P(\text{both}) = \frac{6}{40} = \frac{3}{20}$$

$$\text{Number who drink coffee or tea or both} = 14 + 6 + 11 = 31$$

$$P(\text{coffee or tea or both}) = \frac{31}{40}$$

5

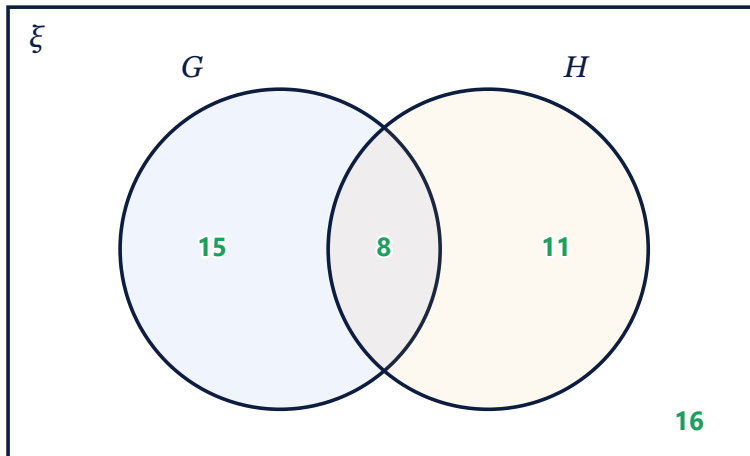
There are 50 students in a year group.

23 study geography (G).

19 study history (H).

8 study both geography and history.

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



(4 marks)

Put 8 in the intersection first

$$\text{Geography only} = 23 - 8 = 15$$

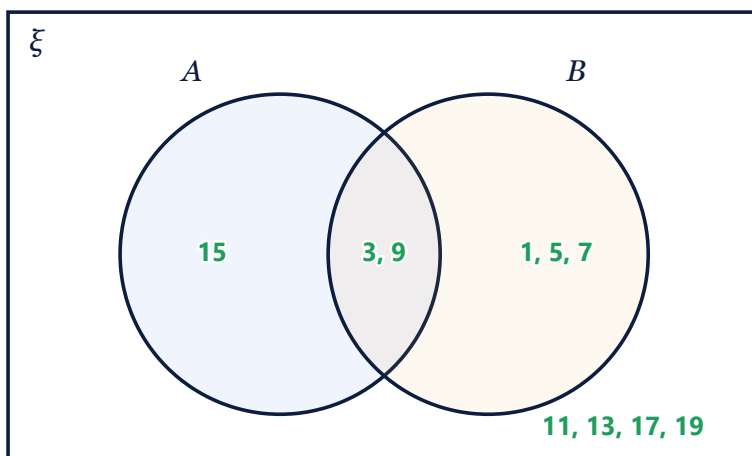
$$\text{History only} = 19 - 8 = 11$$

$$\text{Neither} = 50 - 15 - 8 - 11 = 16$$

Check

$$15 + 8 + 11 + 16 = 50$$

6

 $\xi = \{\text{odd numbers between 0 and 20}\}$ $A = \{\text{multiples of 3}\}$ $B = \{\text{numbers less than 10}\}$ Draw a Venn diagram to show the sets A and B, putting every member of ξ in the correct region.

(4 marks)

$$\xi = \{1, 3, 5, 7, 9, 11, 13, 15, 17, 19\}$$

$$A = \{3, 9, 15\} \text{ and } B = \{1, 3, 5, 7, 9\}$$

3 and 9 are in both sets, so they go in the intersection

A only: 15. B only: 1, 5, 7. Outside both: 11, 13, 17, 19

7

 $\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20\}$ $A = \{\text{prime numbers}\}$ $B = \{\text{odd numbers}\}$

- a. Write down the numbers that go in each region of a Venn diagram: A only, A and B , B only, and neither.
- b. A number is chosen at random from ξ . Find the probability that it is in $A \cap B$.

(4 marks)

a)

 A (primes): 2, 3, 5, 7, 11, 13, 17, 19 B (odd): 1, 3, 5, 7, 9, 11, 13, 15, 17, 19 A only: 2

both: 3, 5, 7, 11, 13, 17, 19

 B only: 1, 9, 15

neither: 4, 6, 8, 10, 12, 14, 16, 18, 20

check: $1 + 7 + 3 + 9 = 20 \checkmark$

b)

$$P(A \cap B) = \frac{7}{20}$$

b) $\frac{7}{20}$

8

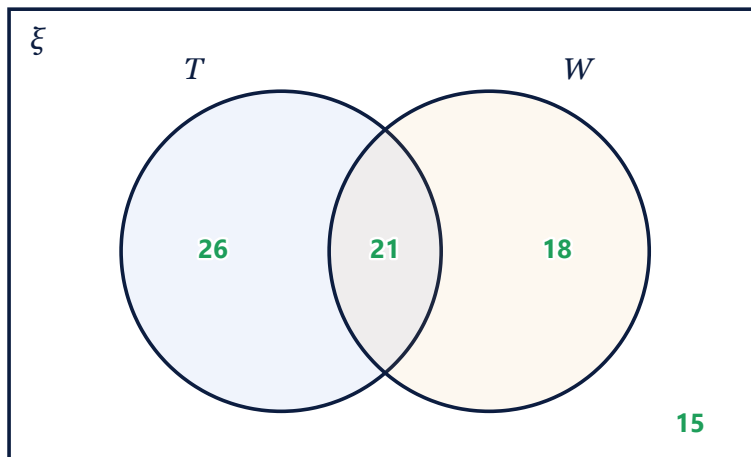
A gym has 80 members.

47 members use the treadmill (T).

39 members use the weights (W).

21 members use both the treadmill and the weights.

- Complete the Venn diagram to show the number of members in each region.
- One of the 80 members is chosen at random. Work out the probability that this member uses neither the treadmill nor the weights.



(5 marks)

$$\text{Treadmill only} = 47 - 21 = 26 \text{ and weights only} = 39 - 21 = 18$$

$$\text{Neither} = 80 - 26 - 21 - 18 = 15$$

$$P(\text{neither}) = \frac{15}{80} = \frac{3}{16}$$

Check

$$26 + 21 + 18 + 15 = 80$$

9

60 people were asked whether they have a dog (D) or a cat (C).

32 people have a dog.

27 people have a cat.

11 people have both a dog and a cat.

- Work out the number of people who have a dog but not a cat.
- Work out the number of people who have neither a dog nor a cat.
- One of the 60 people is chosen at random. Work out the probability that this person has a dog but not a cat.

(5 marks)

$$\text{Dog but not cat} = 32 - 11 = 21$$

$$\text{Cat but not dog} = 27 - 11 = 16, \text{ so neither} = 60 - 21 - 11 - 16 = 12$$

$$P(\text{dog but not cat}) = \frac{21}{60} = \frac{7}{20}$$

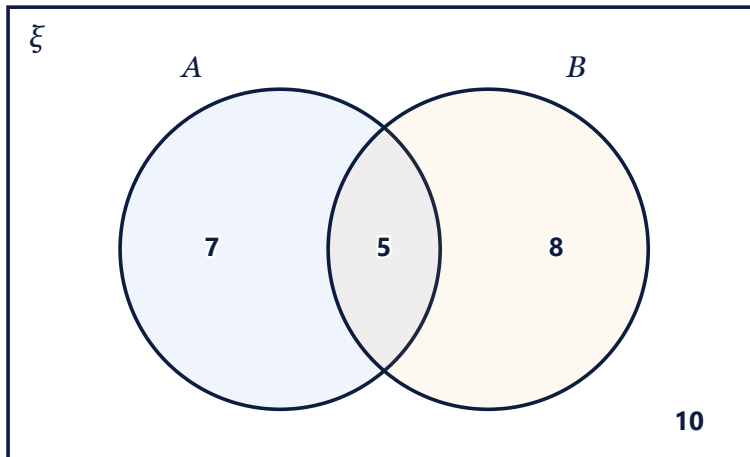
10

The Venn diagram regions for sets A and B contain these numbers of people:

A only: 7 $A \cap B$: 5 B only: 8 outside both: 10

One of the people is chosen at random.

- Find $P(A \cap B)$.
- Find $P(A')$.
- Find $P(A \cup B)$.



(5 marks)

$$\text{Total} = 7 + 5 + 8 + 10 = 30$$

$$P(A \cap B) = \frac{5}{30} = \frac{1}{6}$$

A' is everyone not in A

$$8 + 10 = 18, \text{ so } P(A') = \frac{18}{30} = \frac{3}{5}$$

$$A \cup B \text{ contains } 7 + 5 + 8 = 20 \text{ people, so } P(A \cup B) = \frac{20}{30} = \frac{2}{3}$$

11

$$\xi = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}$$

$$A = \{\text{even numbers}\} \quad B = \{\text{factors of 12}\}$$

- List the members of $A' \cap B$.
- List the members of $(A \cup B)'$.
- A number is chosen at random from ξ . Find the probability that it is in $A \cap B'$.

(4 marks)

$$A = \{2, 4, 6, 8, 10, 12\}$$

$$B = \{1, 2, 3, 4, 6, 12\}$$

a) $A' \cap B$: odd and a factor of 12

$$1, 3$$

b) $(A \cup B)'$: in neither

$$5, 7, 9, 11$$

c) $A \cap B'$: even but not a factor of 12

$$8, 10$$

$$P = \frac{2}{12}$$

$$= \frac{1}{6}$$

$$\boxed{\text{a) } 1, 3 \text{ b) } 5, 7, 9, 11 \text{ c) } \frac{1}{6}}$$

12

100 people went to a music festival.

58 saw band X.

45 saw band Y.

23 saw both bands.

- Work out the number of people who saw neither band.
- One person who saw band X is chosen at random. Work out the probability that this person also saw band Y.

(5 marks)

$$X \text{ only} = 58 - 23 = 35 \text{ and } Y \text{ only} = 45 - 23 = 22$$

$$\text{Neither} = 100 - 35 - 23 - 22 = 20$$

58 people saw band X, and 23 of them also saw band Y

$$P(\text{saw Y given saw X}) = \frac{23}{58}$$

13 80 students were asked which sports they play from football (F), rugby (R) and cricket (C).

4 students play all three sports.

12 students play football and rugby.

10 students play football and cricket.

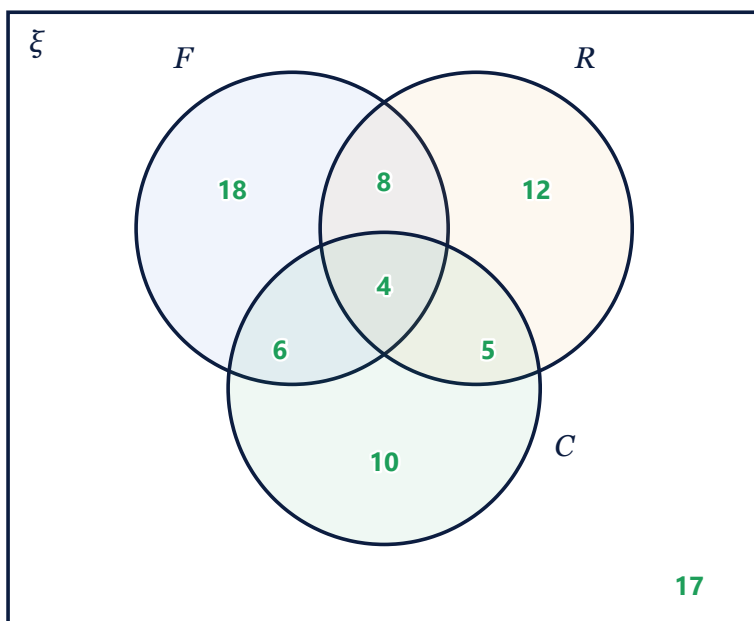
9 students play rugby and cricket.

36 students play football.

29 students play rugby.

25 students play cricket.

- Complete the Venn diagram to show the number of students in each region.
- One of the 80 students is chosen at random. Work out the probability that this student plays none of the three sports.



(6 marks)

Put 4 in the centre first

F and R only = $12 - 4 = 8$; F and C only = $10 - 4 = 6$; R and C only = $9 - 4 = 5$

F only = $36 - 8 - 6 - 4 = 18$; R only = $29 - 8 - 5 - 4 = 12$; C only = $25 - 6 - 5 - 4 = 10$

Sum inside the circles = $18 + 12 + 10 + 8 + 6 + 5 + 4 = 63$, so none = $80 - 63 = 17$

$$P(\text{none}) = \frac{17}{80}$$

14 90 people were asked which streaming services they use from A, B and C.

5 people use all three services.

14 people use A and B.

11 people use A and C.

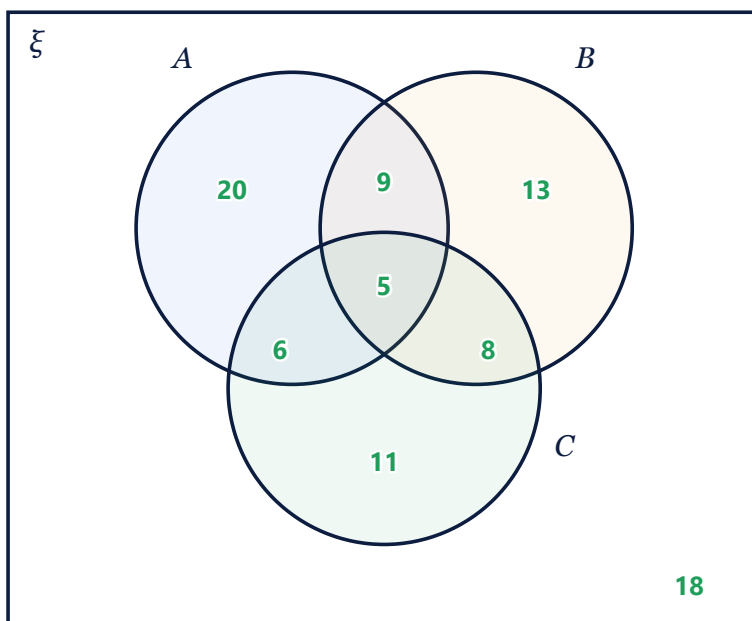
13 people use B and C.

40 people use A.

35 people use B.

30 people use C.

- Complete the Venn diagram to show the number of people in each region.
- One person who uses service A is chosen at random. Work out the probability that this person also uses service C.



(6 marks)

Put 5 in the centre

A and B only = $14 - 5 = 9$; A and C only = $11 - 5 = 6$; B and C only = $13 - 5 = 8$

A only = $40 - 9 - 6 - 5 = 20$; B only = $35 - 9 - 8 - 5 = 13$; C only = $30 - 6 - 8 - 5 = 11$

Inside the circles

$20 + 13 + 11 + 9 + 6 + 8 + 5 = 72$, so none = $90 - 72 = 18$

40 people use A, and $6 + 5 = 11$ of them also use C, so $P(\text{uses C given uses A}) = \frac{11}{40}$