



- 1 A Venn diagram shows the numbers of students in a year group who take Art (A) and Music (M).

Region	Number of students
A only	12
$A \cap M$ (both)	8
M only	15
Neither	5

A student is chosen at random from the 40 students.

Work out $P(A | M)$, the probability that the student takes Art given that they take Music.

(2 marks)

Given M: only look inside M

$$n(M) = 8 + 15 = 23$$

$$n(A \cap M) = 8$$

$$P(A | M) = \frac{n(A \cap M)}{n(M)}$$

$$\frac{8}{23}$$

- 2 100 students were asked how they travel to school. The two-way table shows the results.

	Walk	Bus	Car	Total
Year 10	18	22	10	50
Year 11	12	14	24	50
Total	30	36	34	100

A student is chosen at random.

Given that the student travels by bus, work out the probability that they are in Year 11.

(2 marks)

Given bus: only the Bus column

$$\text{Total on the bus} = 36$$

$$\text{Year 11 on the bus} = 14$$

$$P = \frac{14}{36}$$

$$\frac{7}{18}$$

3

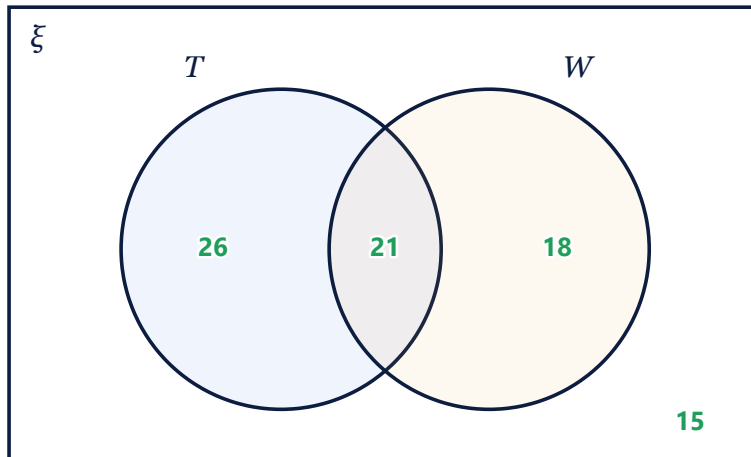
A gym has 80 members.

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

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

4

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)

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

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

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

5

$$\xi = \{1, 2, 3, \dots, 30\}$$

$$A = \{\text{multiples of 4}\}$$

$$B = \{\text{multiples of 6}\}$$

A number is chosen at random from ξ . Work out:

a. $P(A \mid B)$

b. $P(B \mid A)$

c. $P(B' \mid A')$

(5 marks)

$$A = \{4, 8, 12, 16, 20, 24, 28\} \quad n(A) = 7$$

$$B = \{6, 12, 18, 24, 30\} \quad n(B) = 5$$

$$A \cap B = \{12, 24\} \quad n(A \cap B) = 2$$

a)

$$P(A \mid B) = \frac{2}{5}$$

b)

$$P(B \mid A) = \frac{2}{7}$$

c) neither set = $30 - (7 + 5 - 2)$

$$n(A' \cap B') = 30 - 10 = 20$$

$$n(A') = 30 - 7 = 23$$

$$P(B' \mid A') = \frac{20}{23}$$

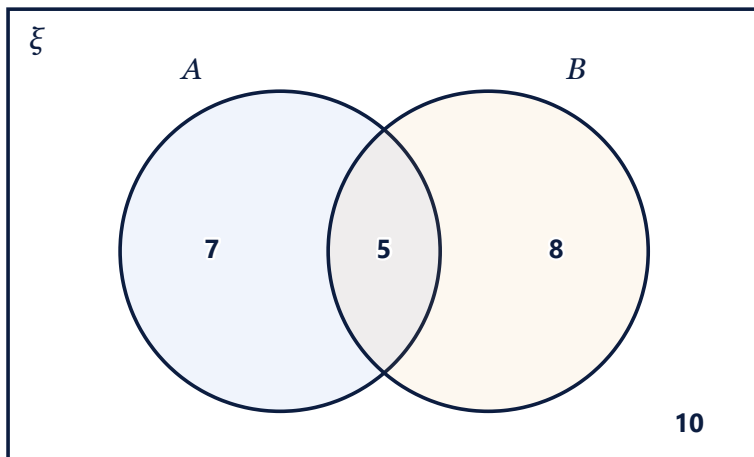
$\text{a) } \frac{2}{5} \quad \text{b) } \frac{2}{7} \quad \text{c) } \frac{20}{23}$
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6 The Venn diagram regions for sets A and B contain these numbers of people:

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

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

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

7 100 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

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

8

A and B are two events.

$P(A) = 0.5$, $P(B) = 0.4$ and $P(A \cup B) = 0.7$

a. Work out $P(A \cap B)$.

b. Work out $P(B | A)$.

(4 marks)

a.)

$$0.7 = 0.5 + 0.4 - P(A \cap B)$$

$$P(A \cap B) = 0.9 - 0.7$$

$$P(A \cap B) = 0.2$$

b.)

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

$$P(B | A) = \frac{0.2}{0.5}$$

$$\boxed{a) 0.2 \quad b) 0.4}$$

9

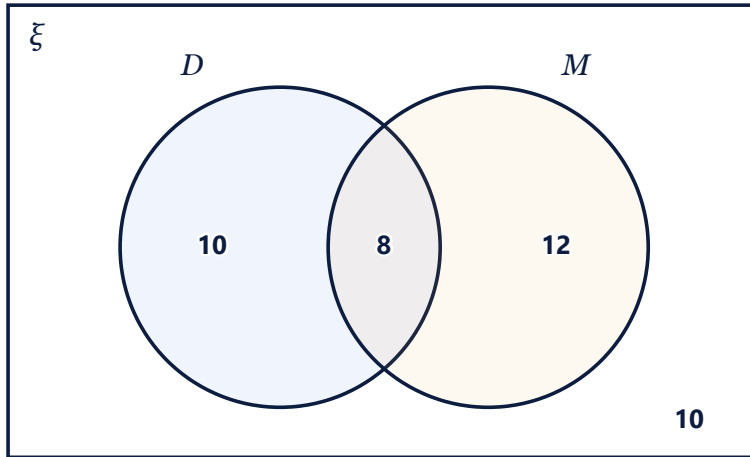
There are 40 students in a year group.

The Venn diagram for drama (D) and music (M) shows:

D only: 10 $D \cap M$: 8 M only: 12 neither: 10

Two of the students who do music are chosen at random, without replacement.

Work out the probability that both of these students also do drama.



(5 marks)

Number of students who do music = $8 + 12 = 20$

Of these, 8 also do drama

$$P(\text{first student also does drama}) = \frac{8}{20}$$

$$P(\text{second student also does drama}) = \frac{7}{19}$$

$$P(\text{both do drama}) = \frac{8}{20} \times \frac{7}{19} = \frac{56}{380} = \frac{14}{95}$$

$$\frac{14}{95}$$

10

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.

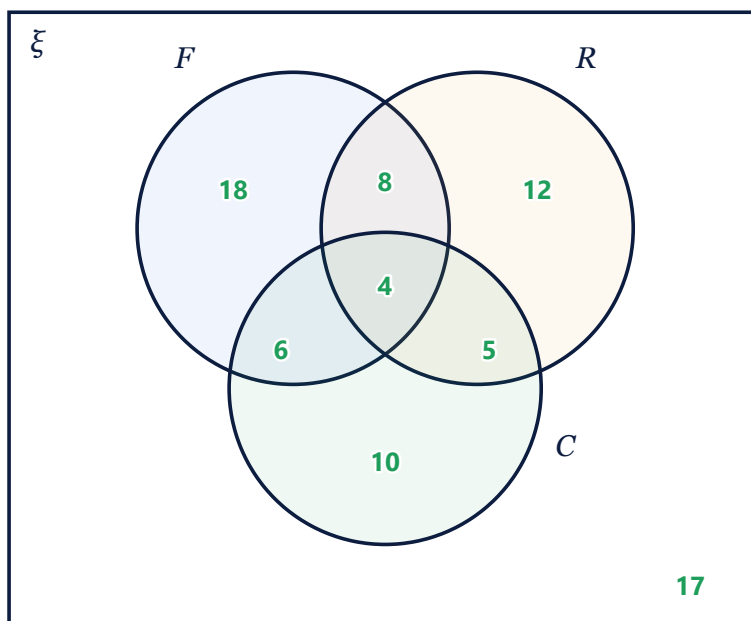
9 students play rugby and cricket.

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

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

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

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

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

11 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.

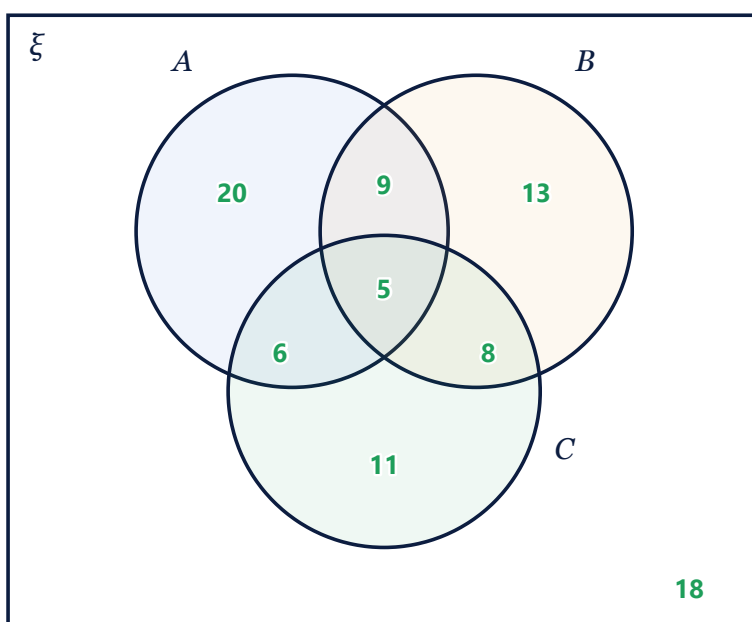
13 people use B and C.

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 $P(\text{uses C given uses A}) = \frac{11}{40}$