

Name	Date started	Target end date

WJEC GCSE Mathematics and Numeracy (Double Award) – Question Pack

Listing all equally likely outcomes using sample-space lists and possibility diagrams (two-way tables) – e.g. two dice, coin + die, two-card dra

REVISE

.wales

2.22 – Sample space & possibility diagrams

Spec 3.5.5 – Unit 2 (no calculator)

Listing all equally likely outcomes using sample-space lists and possibility diagrams (two-way tables) – e.g. two dice, coin + die, two-card draws – then counting favourables to find a probability. Sourced from legacy WJEC GCSE Mathematics / Mathematics–Numeracy Higher non-calculator papers, organised for revision under the 2025 spec.

2025 SPECIFICATION

Estimated time for entire question pack: ~3 hours 15 minutes

Derived from the GCSE Higher pace of ~1.5 min/mark (130 marks across 31 questions).

*You are advised to **not** attempt to complete all of this in one sitting.*

ABOUT THIS QUESTION PACK

This is a **focused single-topic practice pack**, not a single mock paper. Questions are organised against the 2025 specification. Questions are ordered chronologically by sitting, with custom-written and SAM questions at the end.

INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – method marks are awarded for clear setup.

*A calculator is **not** permitted on any question in this pack (Unit 2 is the non-calculator paper).*

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Sample space & possibility diagrams – what the new spec asks

WJEC GCSE Mathematics (first teaching 2025) · Unit 2: non-calculator.

Sample-space diagrams 3.5.5

- List or grid every equally likely outcome.
- Two events: use a two-way possibility diagram – $r \times c$ cells.
- Each cell is one equally likely outcome.

Probability from a grid 3.5.5

- $P = (\text{favourable cells}) \div (\text{total cells})$.
- Total cells = outcomes for event 1 \times outcomes for event 2.
- Simplify the resulting fraction.

Ordered outcomes 3.5.5

- Grid outcomes are ordered – (H, T) and (T, H) are distinct.
- If the question asks unordered, halve where appropriate.
- Be explicit about whether order matters in the answer.

Two-way tables 3.5.5

- From data: cell \div grand total = $P(\text{row} \cap \text{column})$.
- Row total \div grand total = marginal probability of that row.
- Use the table to compute conditional probabilities by restricting to one row or column.

Sample space & possibility diagrams in one page

Quick-reference notes – revisit before each question. Don't use during the questions.

Sample space

List every equally likely outcome of the experiment.

For two events use a *possibility diagram* (two-way grid): one event down the side, the other across the top.

Each cell of the grid is one equally likely outcome.

Counting favourable

$$P(\text{event}) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

Shade or tick the favourable cells in the grid, count them, then divide by the total.

Total = (number of outcomes for event 1) \times (number for event 2).

Two-dice example

Roll two fair dice. Grid has $6 \times 6 = 36$ cells.

$P(\text{sum} = 7)$: count the diagonal – $(1, 6), (2, 5), \dots, (6, 1) = 6$ cells.

So $P = 6/36 = 1/6$.

Ordered vs unordered

Ordered: (H, T) and (T, H) count as *different* outcomes. This is what the grid gives you.

Unordered: combine them into one.

Halve the count if both orderings are equally likely.

Read the question carefully – ordering usually matters in grid problems.

Coin + die example

Flip a coin then roll a die. Grid is $2 \times 6 = 12$ cells.

$$P(\text{H and even}) = 3/12 = 1/4.$$

The grid prevents missing outcomes or double-counting.

Two-way tables from data

Survey data already in a two-way table? The total of all cells is N (the sample size).

$$P(\text{row and column}) = \text{cell}/N.$$

Row totals and column totals give marginal probabilities.

Reading the question

'At least one': count any cell satisfying the condition – or use $1 - P(\text{none})$.

'Exactly two': very specific – only those cells.

'Same on both': the diagonal of the grid.

Common traps

- Forgetting to count (a, b) and (b, a) as separate outcomes in an ordered grid.
- Miscounting the grid total – always $r \times c$.
- Mixing favourable cells with marginal counts.
- Returning a probability > 1 – a clue you double-counted.

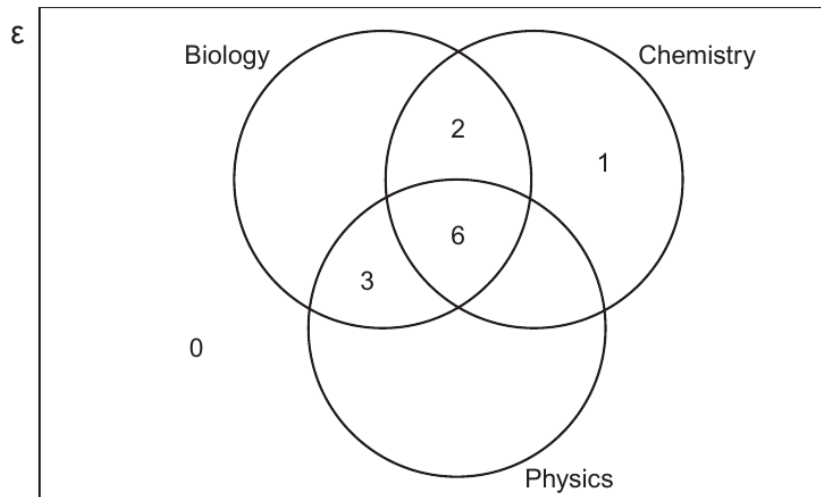
Examiner only

5. At a college, a total of 28 students study one or more of the science subjects: Biology, Chemistry and Physics.
 The 28 students form the universal set, \mathcal{E} .
 Some parts of the Venn diagram below have already been completed.

It is also known that:

- 5 students study only Biology
- 13 students study Chemistry

- (a) Complete the Venn diagram. [3]



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- (b) How many students study Biology and Chemistry but not Physics? [1]

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- (c) One of the students is chosen at random.
 What is the probability that this student studies Biology? [2]

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Examiner only

7. Alwyn often drives from Bangor to Cardiff. He always chooses one of two routes for these journeys. He either travels through Rhayader or through Hereford. The probability that he travels through Rhayader is 0.7.

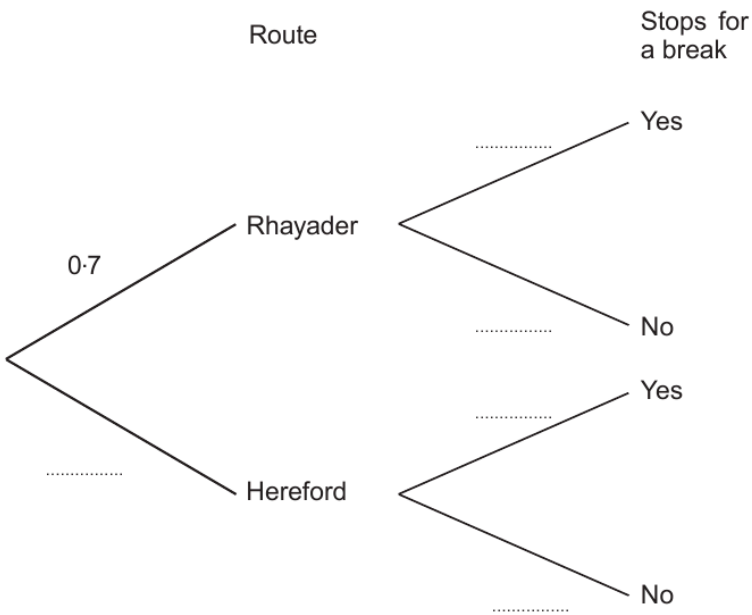
Sometimes he decides to stop for a break during his journey. His decision is independent of the route he takes.

The probability that he travels through Rhayader **and** stops for a break is 0.42.

- (a) Complete the following tree diagram. [4]

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- (b) Calculate the probability that Alwyn travels through Hereford but **does not** stop for a break. [2]

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Examiner
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18. A game played at a children's party involves throwing a ball into a bucket. Each child tries to get the ball into the bucket in the least number of throws. On each attempt, the probability that Sofia gets the ball into the bucket is 0.8. Each attempt is independent of any previous attempt.

Show that she is 5 times more likely to get the ball into the bucket on her first attempt than to have her first successful throw on her second attempt.

You must show all your working.

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END OF PAPER



Examiner
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1. Ceri has a set of cards.
Each of her cards is labelled North, East, South or West.

The table below shows the probability distribution when a card is taken from the set of cards at random.

Label	North	East	South	West
Probability	0.4	0.25	0.2	0.15

- (a) Ceri chooses one card at random from her set of cards.
What is the probability that the card is labelled East or South? [2]

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- (b) Sasha has an identical set of cards.
Ceri and Sasha each choose one card at random from their set of cards.
What is the probability that they both choose a card labelled North? [2]

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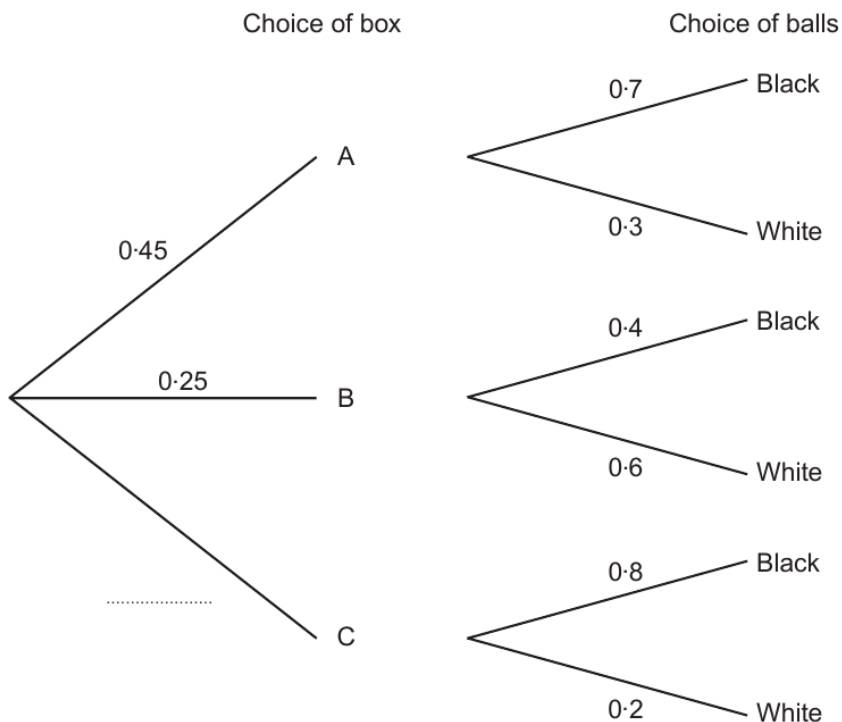


Examiner only

7. 100 boxes each contain 10 balls.
45 of the boxes are labelled A.
They each contain 7 black balls and 3 white balls.
25 of the boxes are labelled B.
They each contain 4 black balls and 6 white balls.
The rest of the boxes are labelled C.
They each contain 8 black balls and 2 white balls.

In a game, a player chooses a box at random, and then chooses a ball at random from that box.

(a) Complete the tree diagram shown below. [1]



(b) What is the probability that a player will select a black ball? [3]

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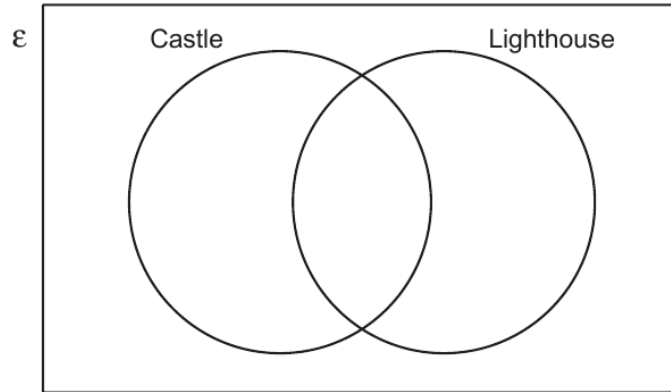


Examiner
only

7. A group of 20 people visited Anglesey for a weekend break.
- 10 of the group visited Beaumaris Castle.
 - 13 of the group visited South Stack Lighthouse.
 - 4 of the group did not visit either of these places.

(a) Complete the Venn diagram below to show this information.
The universal set, ϵ , contains all of the 20 people in the group.

[3]



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(b) One person is chosen at random from the group.
What is the probability that this person visited only one of the two places?

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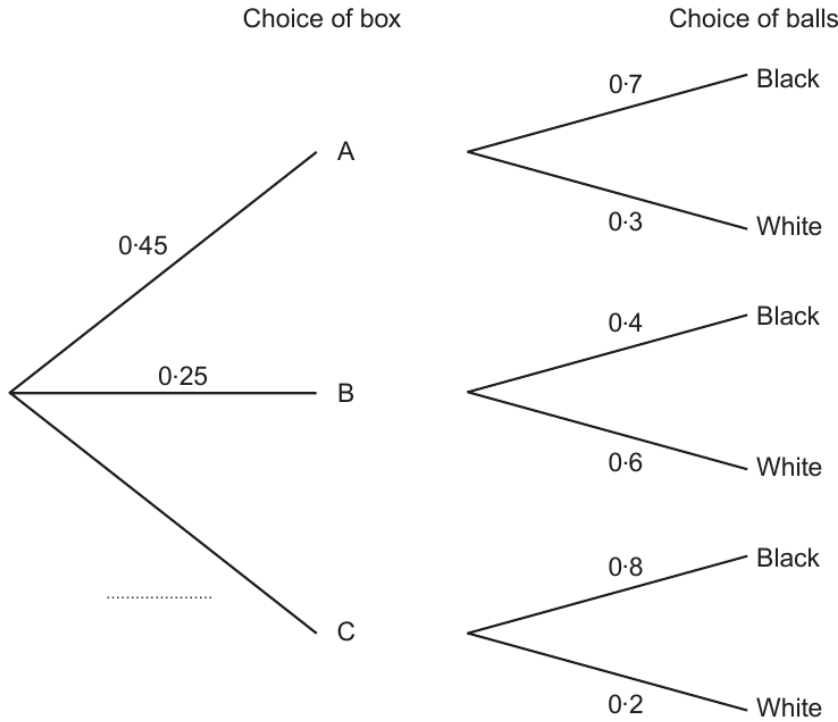


Examiner only

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(a) Complete the tree diagram shown below. [1]



(b) What is the probability that a player will select a black ball? [3]

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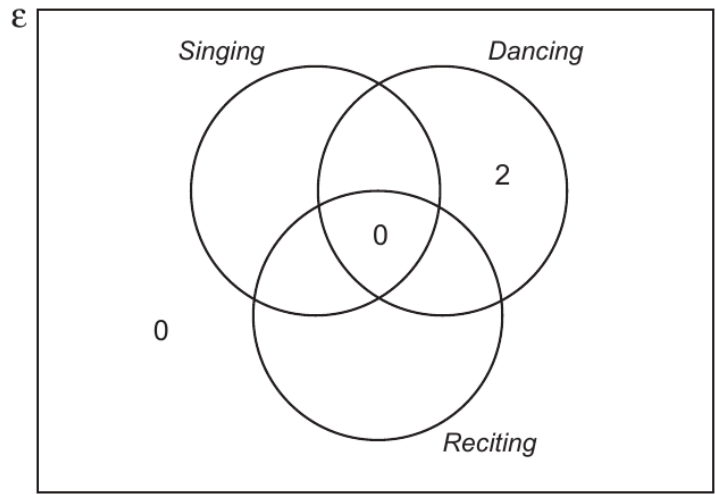


Examiner only

7. A group of pupils from a school took part in The Urdd National Eisteddfod. **All** of them competed in at least one of the following competitions: *Singing*, *Dancing* or *Reciting*.
- 2 of them only took part in a *Dancing* competition.
 - 5 only took part in a *Reciting* competition.
 - No one took part in both a *Reciting* and a *Dancing* competition.
 - 3 took part in both a *Singing* and a *Dancing* competition.
 - 9 took part in a *Reciting* competition.
 - 22 took part in a *Singing* competition.

The Venn diagram below shows some of the above information. The universal set, \mathcal{E} , contains all of the pupils in the group.

One of the pupils in the group is chosen at random. What is the probability that this person **only** took part in a *Singing* competition? [5]



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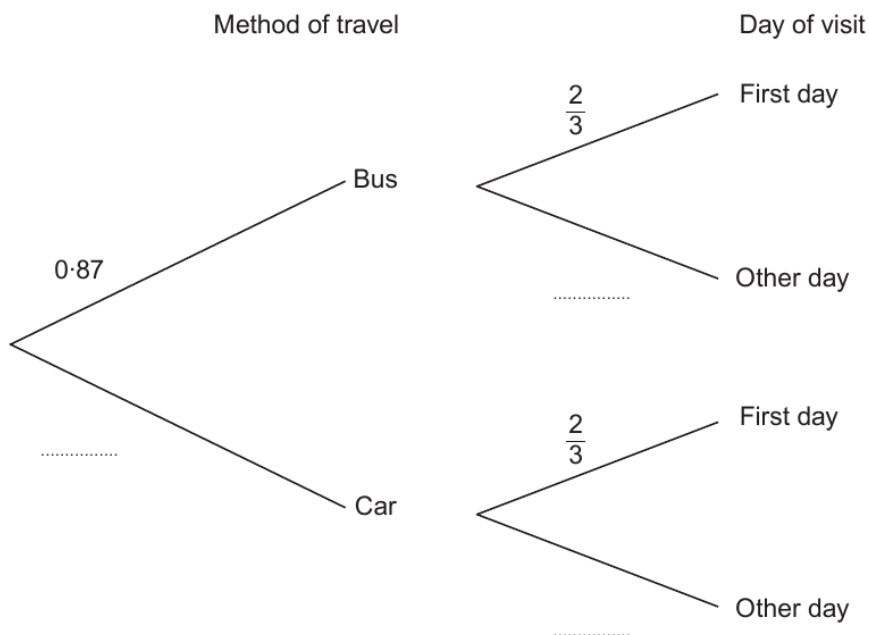
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Examiner only

8. All the members of a farming club visited the Royal Welsh Agricultural Show. They all travelled to the show either by bus or by car. None of them visited the show on more than one day. The decision to travel by car or by bus was independent of the day of the visit. A member of the club was selected at random. The probability that this member travelled by bus was 0.87. The probability that this member visited the show on the first day was $\frac{2}{3}$.

(a) Complete the tree diagram shown below. [2]



(b) What is the probability that a member, chosen at random, was **not** one of those who travelled by bus on the first day of the show? [3]

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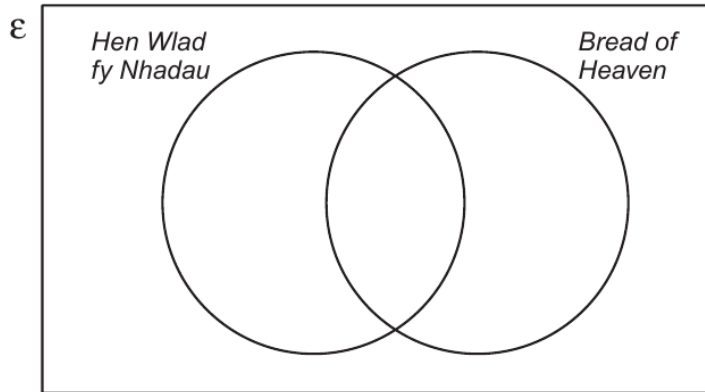


Examiner only

2. 30 rugby supporters travel to Cardiff on a coach. They decide to investigate how many of them can sing one, or both, of the songs 'Hen Wlad fy Nhadau' and 'Bread of Heaven'.

- 12 say they can sing both songs.
- 18 say they can sing 'Bread of Heaven'.
- 5 say they cannot sing either of the songs.

(a) Complete the Venn diagram below to show this information. The universal set, ϵ , contains all of the 30 supporters on the coach. [3]



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(b) One of these supporters is chosen at random. What is the probability that this person can sing 'Hen Wlad fy Nhadau'? [2]

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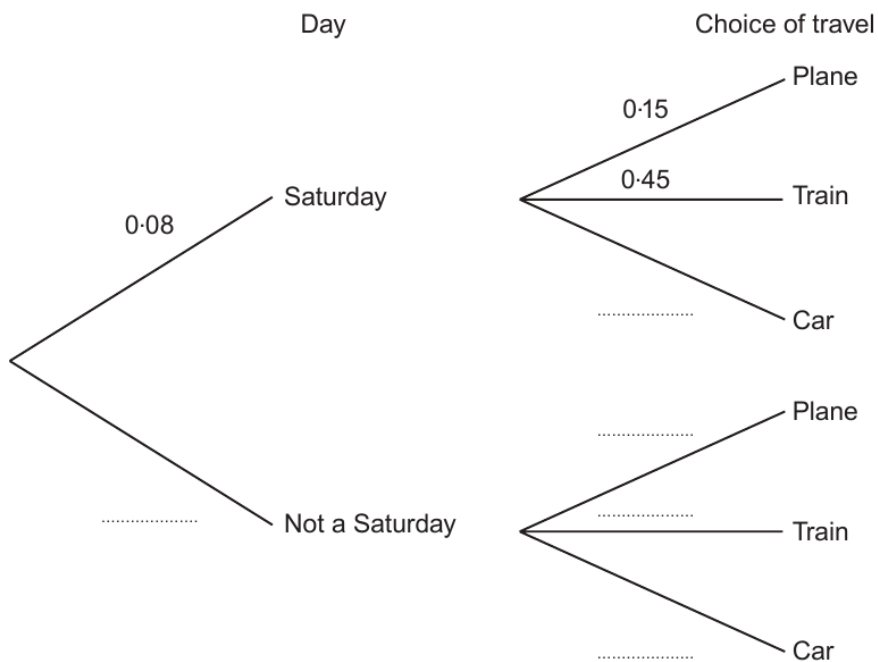


Examiner only

8. Alwena regularly travels from Anglesey to Cardiff to attend meetings. For each meeting, she chooses one of three ways to travel: by plane, train or car. The probability of a meeting being held on a Saturday is 0.08. The probability that Alwena travels by plane to a meeting is 0.15. The probability that she travels by train is 0.45. Her decision on how to travel is independent of the day on which the meeting is held.

(a) Complete the following tree diagram.

[3]



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(b) A meeting is chosen at random. Calculate the probability that the meeting is held on a Saturday and that Alwena travels by plane or by car. [3]

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Examiner only

8. Leah is visiting Cardiff.
The probability that she will go on a tour bus is 0.3.
The probability of Leah seeing a show at the Millennium Centre is independent of her going on a tour bus.

The probability that she goes on a tour bus and sees a show at the Millennium Centre is 0.24.

(a) Complete the following tree diagram. [4]

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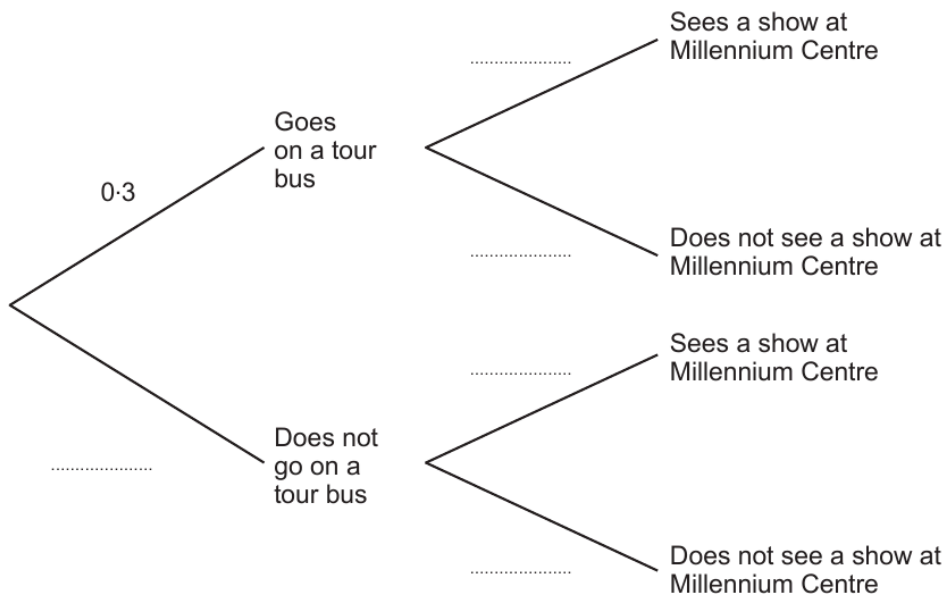
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(b) Calculate the probability that Leah does not go on a tour bus and does not see a show at the Millennium Centre. [2]

Examiner
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Examiner only

6. Dylan is having a weekend break in Wrexham.
The probability that he will visit *Erddig Gardens* is 0.7.
The probability of Dylan going to the *Bersham Heritage Centre* is independent of him visiting *Erddig Gardens*.

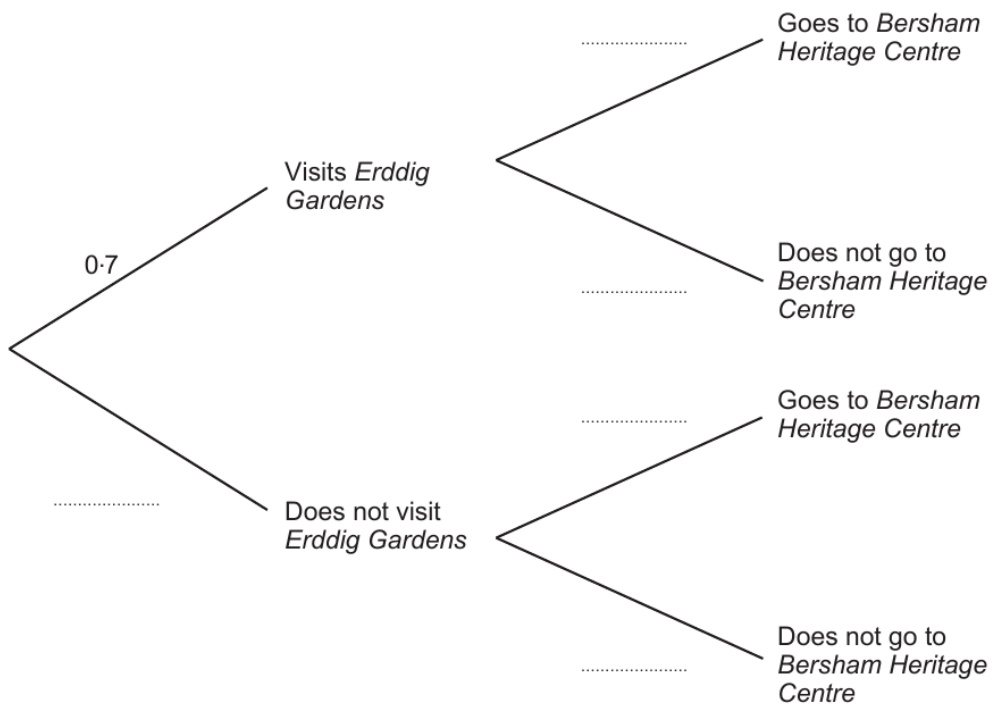
The probability that he visits *Erddig Gardens* **and** goes to the *Bersham Heritage Centre* is 0.28.

- (a) Complete the following tree diagram. [4]

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- (b) Calculate the probability that Dylan visits *Erddig Gardens* but does not go to the *Bersham Heritage Centre*. [2]

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Examiner
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7. Alice works for an engineering company.

A working day is chosen at random.

From keeping a record over the last year, Alice knows that, for this working day,

- the probability that she travels to work by car is 0.7,
- the probability that she arrives at work before 8:00 a.m. is 0.4,
- her time of arrival is independent of how she travels to work.

(a) Using the above information, draw and fully label a complete tree diagram.
You must include all probabilities.

[4]

(b) What is the probability that, on the randomly-chosen working day, Alice travels to work by car and arrives before 8:00 a.m.?

[2]

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Examiner
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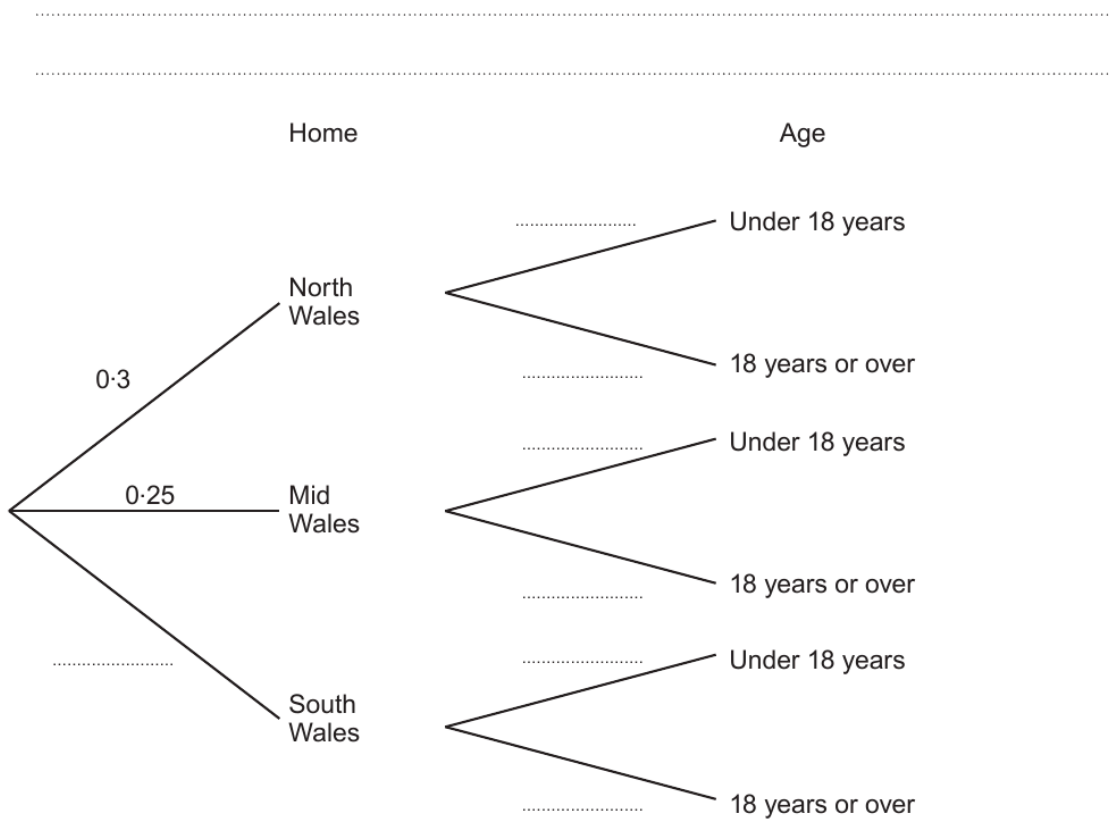
7. A group of people have put their names forward to carry the Welsh flag at a sporting event. Each person lives in North Wales, Mid Wales or South Wales.

One person from the group is chosen at random.
The probability of choosing a person who lives in North Wales is 0.3.
The probability of choosing a person who lives in Mid Wales is 0.25.

The probability of choosing a person who is under 18 years old is 0.2.

The people's ages are independent of where they live.

- (a) Complete the tree diagram shown below. [3]



- (b) What is the probability of choosing a person who lives in South Wales and is under 18 years old? [2]

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Examiner only

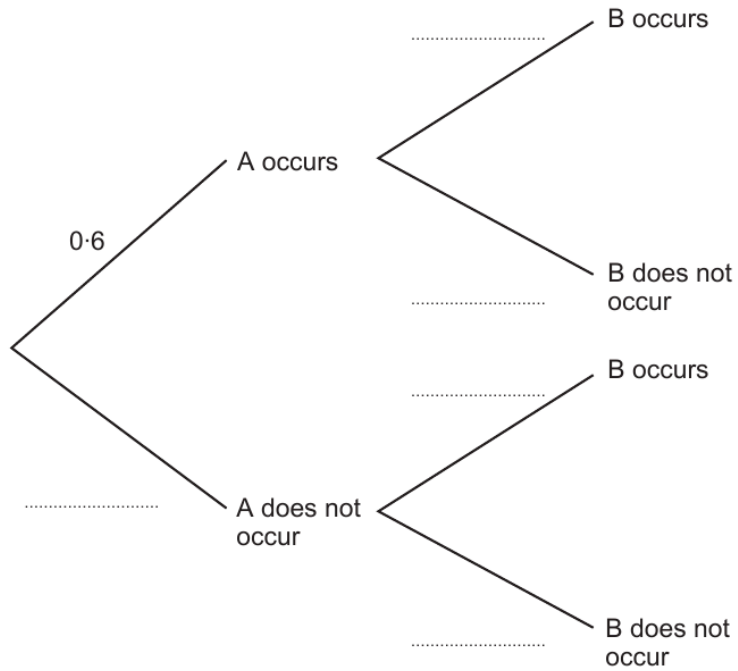
4. A and B are independent events.
The probability of event A occurring is 0.6.
The probability of event A **and** event B occurring is 0.48.

(a) Complete the tree diagram. [4]

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(b) Calculate the probability of neither event A nor event B occurring. [2]

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Examiner
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1. In a group of 200 people:
- 105 people do not have black hair and do not wear glasses
 - 20 people have black hair and wear glasses
 - 70 people have black hair.

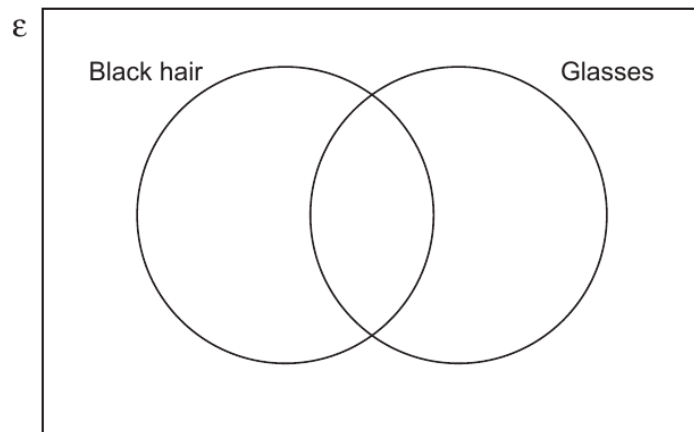
(a) Complete the Venn diagram below to show this information.
The universal set, \mathcal{E} , contains all 200 people.

[3]

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(b) One of these people is chosen at random.
What is the probability that this person wears glasses?

[2]

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03



Examiner
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2. A large number of prize tokens are placed in a box.
The tokens are identical in shape and size.

Gold, Silver, Bronze or *No Prize* is written on each token.

One token is chosen at random from the box.
The table below shows the probability of choosing a *Gold* prize token and the probability of choosing a *Silver* prize token.

Token	Gold	Silver	Bronze	No Prize
Probability	0.02	0.18		

- (a) There are three times as many *No Prize* tokens in the box as there are *Bronze* prize tokens.

Complete the table. [2]

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- (b) There are 15 *Gold* prize tokens in the box.
How many *Silver* prize tokens are there in the box? [2]

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Examiner only

7. Whitney walks, cycles or travels on the bus to work each day.

On any randomly chosen day:

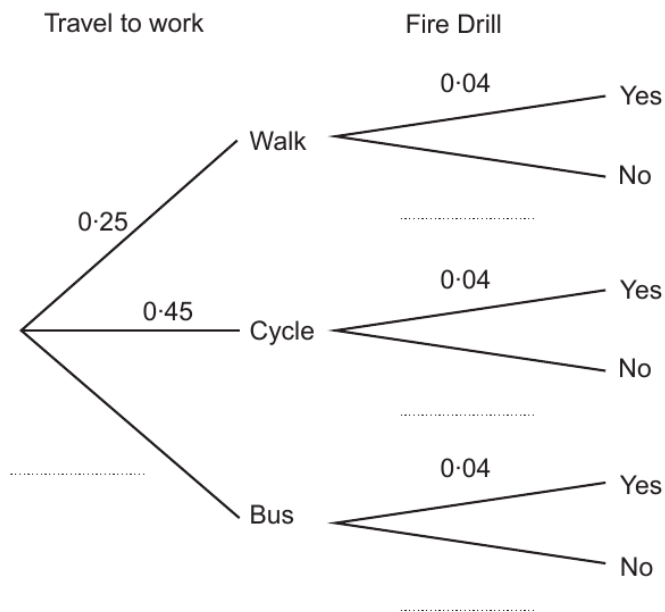
- the probability that she walks to work is 0.25
- the probability that she cycles to work is 0.45.

At work, the probability that there will be a fire drill on any randomly chosen day is 0.04.

How Whitney travels to work is independent of whether or not there is a fire drill.

(a) Complete the tree diagram shown below.

[3]



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(b) On a randomly chosen day, what is the probability that Whitney walks to work and there is a fire drill? [2]

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Examiner
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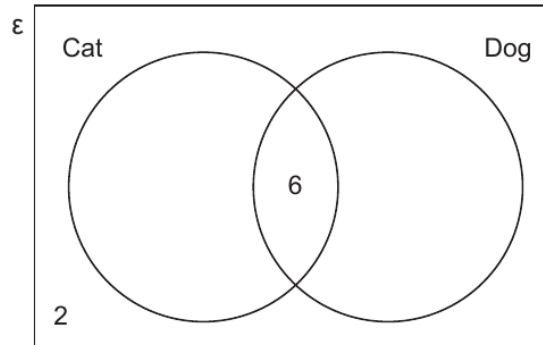
5. In a group of 40 people, some own a cat, some own a dog, and some own both a cat and a dog.
2 people in the group do not own a cat or a dog.

A person is chosen at random from the group.

The probability that the person owns a dog is $\frac{3}{5}$.

Complete the Venn diagram.

[3]



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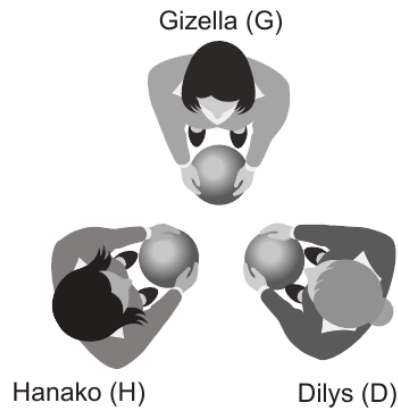
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Examiner
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17. Three children, Gizella (G), Dilys (D) and Hanako (H), stand in a triangle, as shown below.



Each child holds a ball.
 They must choose to pass their ball to the child on their left or the child on their right.
 All 3 children pass their ball at the same time.
 The probability that they pass it to their left is shown in the table below.

Name of child	Probability of passing to the left
Gizella	$\frac{1}{5}$
Dilys	$\frac{2}{7}$
Hanako	$\frac{3}{8}$

(a) Calculate the probability that every child passes their ball to the left. [2]

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(b) Calculate the probability that one of the three children does not receive a ball.

[3]

Examiner
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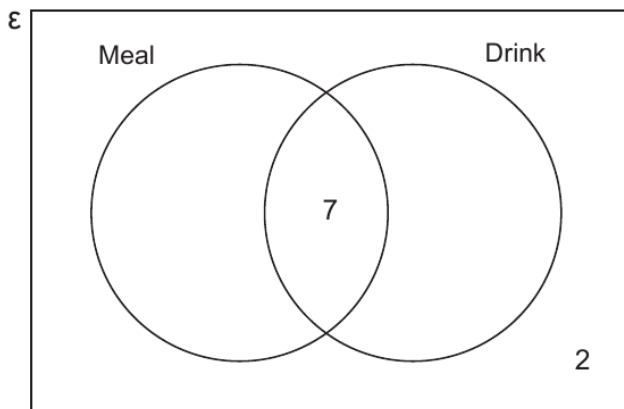


Examiner
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3. At lunchtime on Wednesday, a café had **19 customers**.

- 7 of these customers bought a meal **and** a drink.
- 2 of these customers did not buy a meal **or** a drink.
- The total number of customers who bought a meal was **twice** the total number of customers who bought a drink.

(a) Complete the Venn diagram below to show this information. [2]



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(b) One of these customers is chosen at random.
What is the probability that this customer bought a meal? [2]

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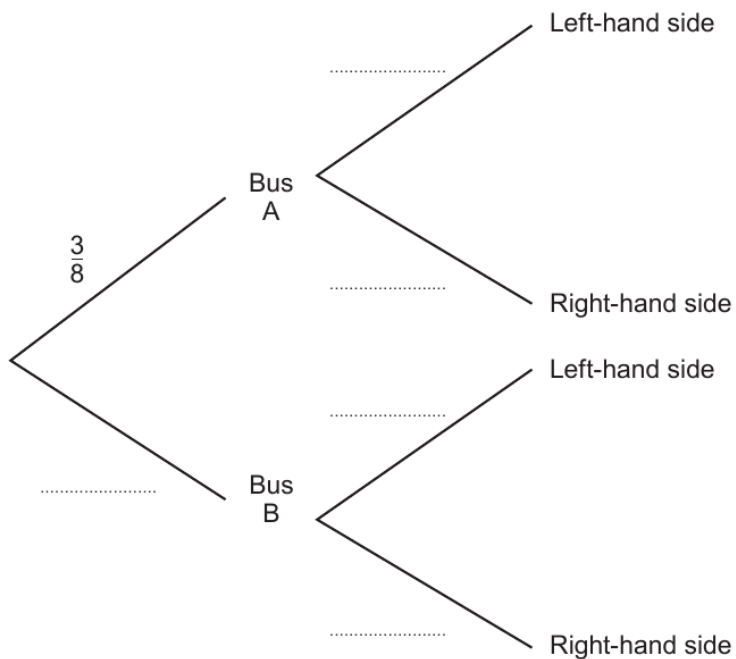
Examiner only

6. A group of people hired two buses, Bus A and Bus B, to take them home from a party. Bus A left the party at 11:00 p.m. Bus B left the party at midnight.

A person from the group is chosen at random. The probability that this person left the party on Bus A is $\frac{3}{8}$.

The probability that this person sat on the left-hand side of the bus is equal to the probability that this person sat on the right-hand side.

- (a) Complete the following tree diagram. [2]



- (b) What is the probability that this person sat on the right-hand side of the bus that left at midnight? [2]

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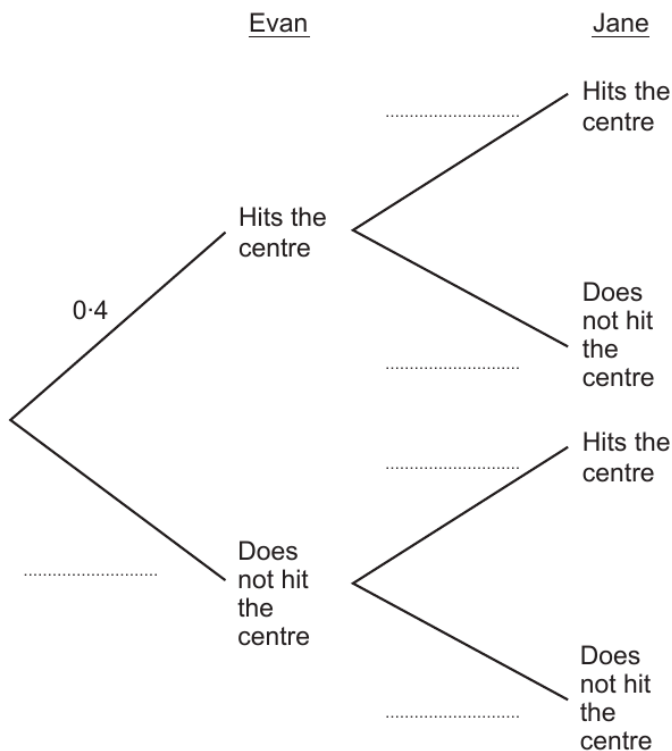
Examiner only

6. Evan and Jane each shoot one arrow at a target.
The probability that Evan hits the centre of the target is 0.4.
The probability that Jane hits the centre of the target is 0.45.



(a) Complete the tree diagram below.

[3]



(b) Find the probability that Evan and Jane both hit the centre of the target.

[2]

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