EDEXCEL FUNCTIONAL SKILLS PILOT

Maths Level 2

Chapter 7

Working with probability

EDEXCEL FUNCTIONAL SKILLS: INTERIM SUPPORT MATERIAL

Maths Level 2

Su Nicholson

Chapter 7: Working with probability

Use these free pilot resources to help build your learners' skill base
We are delighted to continue to make available our free pilot learner resources and teacher notes, to help teach the skills learners need to pass Edexcel FS Mathematics, Level 2.

But use the accredited exam material and other resources to prepare them for the real assessment
We developed these materials for the pilot assessment and standards and have now matched them to the final specification in the table below. They'll be a useful interim measure to get you started but the assessment guidance should no longer be used and you should make sure you use the accredited assessments to prepare your learners for the actual assessment.

New resources available for further support
We're also making available new learner and teacher resources that are completely matched to the final specification and assessment – and also providing access to banks of the actual live papers as these become available. We recommend that you switch to using these as they become available.

Coverage of accredited specification and standards
The table below shows the match of the accredited specification to the unit of pilot resources. This table supersedes the pilot table within the teacher notes.

Coverage and Range	Exemplification	Learner Unit
Use probability to express the likelihood of an outcome	• Calculate theoretical probabilities • Compare probabilities • Put events in order of likelihood on a probability scale • Single events only • List outcomes of events	**K1** Measuring probability **K2** Experimental probability **K3** Using tables to find the probability of combined events **K4** Using tree diagrams to find the probability of combined events Compare probabilities and Put events in order of likelihood on a probability scale are covered in our new publishing (see below)
		K5 Remember what you have learned

Where to find the final specification, assessment and resource material
Visit our website **www.edexcel.com/fs** then:
- **for the specification and assessments:** under **Subjects**, click on **Mathematics (Levels 1–2)**
- **for information about resources:** under **Support**, click on **Published resources**.

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K Working with probability

You should already know how to:

✓ use probability to show that some events are more likely to occur than others.

By the end of this section you will know how to:

- use a numerical scale from 0 to 1 to express and compare probabilities
- identify the range of possible outcomes of combined events and record the information in tree diagrams or tables.

1 Measuring probability

Learn the skill

Probability is regularly used as part of everyday life. Questions such as:

- What are the **chances** of winning the lottery?
- What is the **likelihood** of rain today?
- What are the **odds** on Manchester United winning the European Cup?

all involve probability and answers can be calculated if you are given sufficient background information.

Probability is the chance, or likelihood, that a certain event might happen.

- The probability of an event happening lies between 0 and 1
- Probabilities can be measured in fractions, decimals or percentages
- Probability of an event = $\frac{\textit{Number of ways the event can happen}}{\textit{Total number of possibilities}}$

Remember

If an event is certain the probability is 1, if an event cannot happen the probability is 0. For example, when throwing a die
Prob(getting a number between 1 and 6) = 1.
Prob(getting a 7) = 0.

Example 1: What is the probability that a person chosen at random was born in April? Give your answer as a fraction in its lowest terms.

There are 365 days in a year and 30 days in April, so the probability is $\frac{30}{365} = \frac{6}{73}$.

Remember

Fractions should be written in their lowest terms.

The probability of an event happening + probability of an event not happening = 1 (or 100%)

Example 2: The probability that it will rain tomorrow is 0.4. What is the probability it will not rain tomorrow?

The sum of the probabilities is 1 so that the probability it will not rain tomorrow = 1 – 0.4 = 0.6

Answer: 0.6

The sum of the probabilities of all possible outcomes equals 1 (or 100%)

Example 3: There is a 60% chance that a football team will win their next match. The probability that they will lose is 30%. What is the probability they will draw their next match?

When a football match is played there are three possible outcomes; win, lose or draw so the sum of the probabilities must be 100%. As 60% + 30% = 90%, this means the probability of a draw = 100 – 90 = 10%.

Answer: 10%

Try the skill

1. There are 20 female and 12 male students in a psychology group. What is the probability that a student chosen at random will be male? Give your answer as a fraction in its lowest terms.

2. A Mori Poll showed the probability that Labour will win the next General election was 34%. What was the probability that Labour will **not** win the next General election?

3. A survey into train reliability showed that the probability the London to Manchester train was on time was 0.779 and the probability the train was early was 0.02. What was the probability the train was late?

2 Experimental probability

Learn the skill

Experimental probability is calculated from the results of an experiment.

The manufacturing industry uses **experimental probability** to assess the reliability of their products, so that they can inform their customers and use in advertising.

Example: A quality control engineer at Glow-Right Bulbs factory tested 400 bulbs and found 6 bulbs defective. What is the experimental probability that the bulbs are defective?

If 6 out of the 400 tested are defective, then you can say:

Probability a bulb is defective = $\frac{6}{400} = \frac{3}{200}$ (or 0.015 as a decimal).

The probability can also be expressed as a percentage:

$\frac{3}{200} \times 100 = 1.5\%$.

This means that in any sample of bulbs, you would expect 1.5% to be defective.

Answer 1.5%

Remember

To change a fraction or decimal to a percentage you **multiply** by 100.

Tip

The probability the bulb is **not** defective is $1 - \frac{3}{200} = \frac{197}{200}$
Or 100 – 1.5% = 98.5%

Try the skill

1. A clothing company finds that 12 in every 200 pairs of jeans do not meet their quality standards. What is the experimental probability that a pair of jeans does not meet the quality standards?

2. 389 out of every 1000 cars tested in 2004/5 failed the MoT test the first time they were tested. What is the experimental probability that a car will fail the first MoT test?

3. A retailer samples 3 bags of Best Buy sweets to check the consistency of the number of different varieties of sweets in a bag.

	Bag no.	Variety					
Bestbuy 400 g		Devon	Mint	Rum & Butter	Coconut	Banana	Total
	1	10	13	9	4	15	51
	2	3	9	8	18	13	51
	3	6	18	7	5	12	48

a Use the table to work out the probability of getting more than 50 sweets in a bag.

b Complete the table below to show the probability of selecting each variety of sweet from each bag as a percentage, to the nearest whole number. For example, the probability of getting a Devon sweet in bag 1 is

$\frac{10}{51} \times 100 = 19.6\%$ i.e. 20%

%	Bag no.	Variety				
Bestbuy 400 g		**Devon**	**Mint**	**Rum & Butter**	**Coconut**	**Banana**
	1	20				
	2					
	3					

c Use the probability table to decide which variety of sweet is the most inconsistent i.e. has the largest variation in probability.

3 Using tables to find the probability of combined events

Learn the skill

Two events are said to be **independent** if the first has no effect on the second.

For example, when throwing dice, the number you get on the first throw has no effect on the number you get on the second throw.

Tables can be used to show all the possible outcomes of two combined events.

Many games involve the use of two dice and you need to be able to consider whether or not they are fair. To do this you should look at all the possible outcomes, which can be easily set out in a table and work out the probabilities.

Example: A game involves throwing a pair of dice and multiplying the two numbers together to find the score. If the number is odd you score a point, if the number is even you lose a point. The dice are thrown 20 times. If you have a positive number of points at the end of 20 throws you win. Is the game fair?

You first need to set up a table to show all the possible outcomes from throwing the two dice.

		Score on 1st dice					
		1	**2**	**3**	**4**	**5**	**6**
Score on 2nd	**1**	1	2	3	4	5	6
	2	2	4	6	8	10	12
	3	3	6	9	12	15	18
	4	4	8	12	16	20	24
	5	5	10	15	20	25	30
	6	6	12	18	24	30	36

The table shows there are $6 \times 6 = 36$ possible outcomes.

Of those 36 outcomes, 9 are odd and 27 are even, (highlighted in yellow).

Probability of getting an odd number = $\frac{9}{36} = \frac{1}{4}$

Probability of getting an even number = $\frac{27}{36} = \frac{3}{4}$

Out of 20 throws of the dice you would expect to get:

$\frac{1}{4} \times 20 = 5$ odd numbers scoring 5 points

$\frac{3}{4} \times 20 = 15$ even numbers scoring –15 points

Total expected number of points at the end of 20 throws = 5 – 15 = –10

Answer: the game is not fair

Tip

Total is either odd or even so: Prob(odd) + prob(even) = 1

Try the skill

1. A game involves throwing a pair of dice and adding the scores.

a Complete the table to show the possible scores.

		1st dice					
		1	2	3	4	5	6
2nd dice	1						
	2						
	3						
	4						
	5						
	6						

b Calculate the probabilities for each of the possible scores.

c What do you notice about the sum of the probabilities of all the possible scores?

d What is the most likely score?

e What is the probability of getting a score more than 8?

f What is the probability of getting a score which is an even number?

2. Another game involves tossing two coins.

H = throw heads **T** = throw tails

a Complete the table to show all the possible outcomes when 2 coins are tossed.

		1st coin	
		H	T
2nd coin	1		
	2		

b What is the probability of getting a head and a tail?

c What is the probability of both coins showing the same face?

3. Football teams in the premier league play fixtures at home and away. The result can be win (W), lose (L) or draw (D).

a Complete the table to show all the possible outcomes when a football team plays a home and away fixture.

		Home		
		H	L	D
Away	W			
	L			
	D			

b The football team scores 3 points for a win, 1 point for a draw and 0 points if they lose. Complete the table below to show the points for each possible outcome.

		Home		
		W	L	D
Away	W			
	L			
	D			

c If it is equally likely that the football team wins, loses or draws, work out the probabilities of obtaining each of the possible scores.

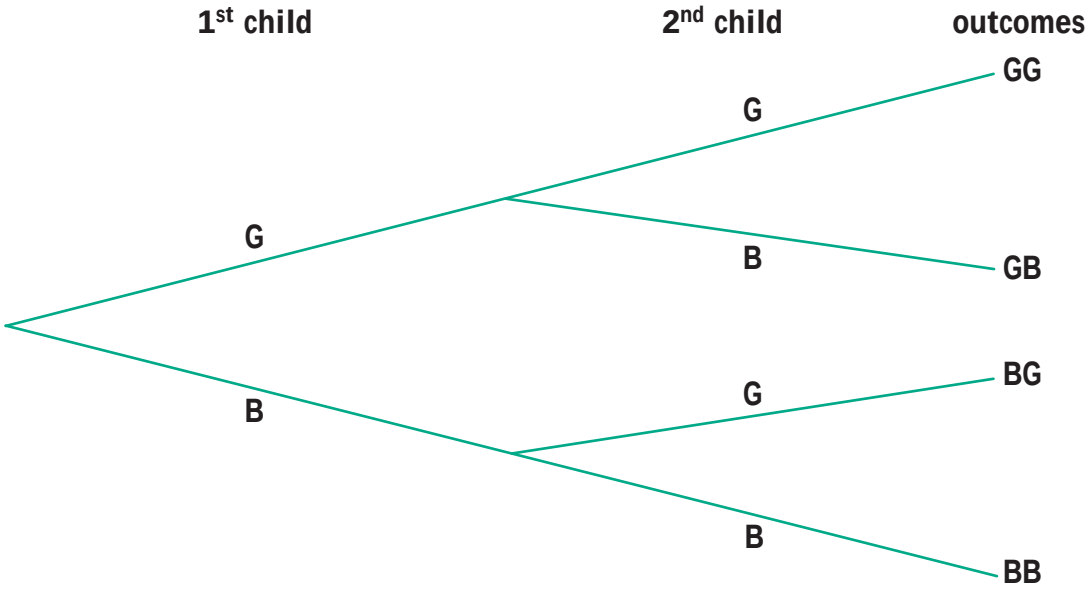
4 Using tree diagrams to show the outcomes of combined events

Learn the skill

Tree diagrams can be used to show the outcomes of combined events.

Example 1: A couple have two children. Draw a tree diagram to show all the possible outcomes for the gender of the two children.

If they have two children the gender of the first child has no effect on the gender of the second and so the events are independent. Let B = boy and G = girl.



If a couple have a child it is equally likely to be a boy or a girl.

Probability of having a boy = $\frac{1}{2}$

Probability of having a girl = $\frac{1}{2}$

There are four possible outcomes and all are equally likely.

GG means girl then girl

GB means girl then boy

BG means boy then girl

BB means boy then boy.

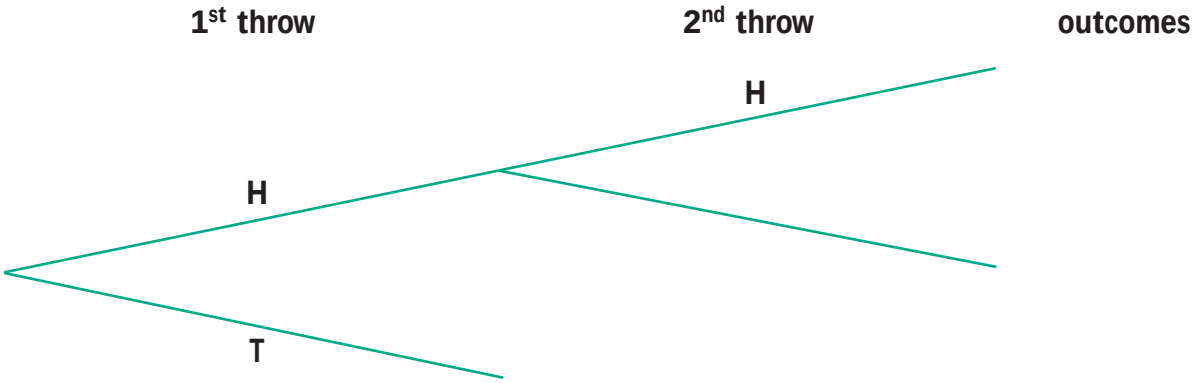
Two out of the four outcomes mean the couple have a boy and a girl. In one the girl is born first and then the boy (GB), in the other the boy is born first, (BG).

This means you would expect that for couples who have two children:

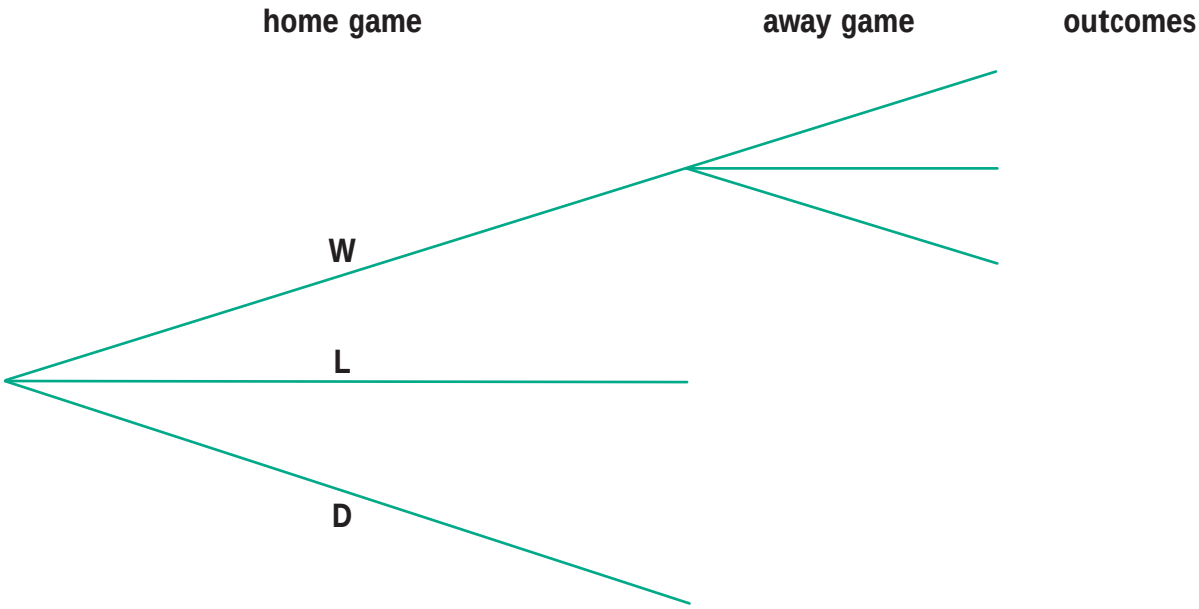
- half will have a boy and a girl
- a quarter will have two boys
- a quarter will have two girls

Try the skill

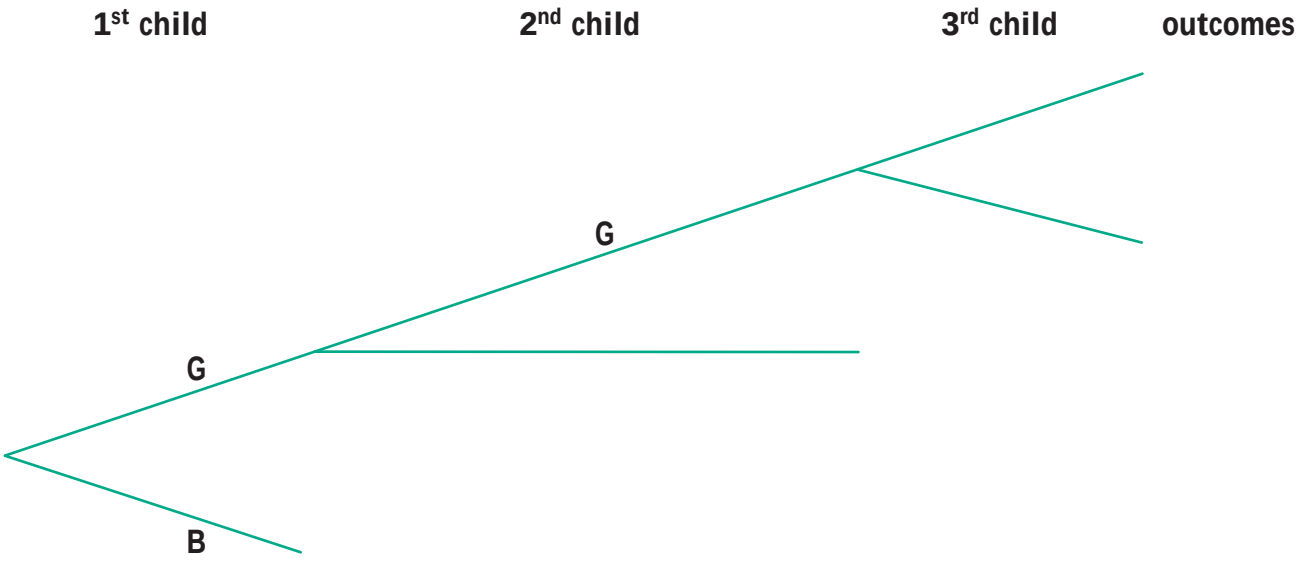
1. Complete the tree diagram to show all the possible outcomes when two coins are tossed. Let H = throw heads and T = throw tails.



2. When a football team plays a match, they can either win(W), lose (L) or draw D). Complete the tree diagram below to show all the possible outcomes when a football team plays a home and away fixture against another team.



3. Complete the tree diagram below to show all the possible outcomes when a couple have 3 children.



5 Remember what you have learned

First complete this ...

- The probability of an event happening lies between _____ and _____
- Probabilities can be measured in _____, _____ or _____
- Probability of an event =
- Prob (event happens) _____ prob (event doesn't happen) = _____ or _____
- The sum of the probabilities of all possible outcomes = _____ or _____
- _____ probability is calculated from the results of an experiment.
- Two events are said to be independent if the probability of _____ has no effect on _____
- Tables can be used to show all the possible outcomes of _____ combined events
- Tree diagrams can be used to show the possible outcomes of _____

Use the skill

1. An athlete is predicted to have a 1 in 8 chance of winning a race. What is the probability the athlete does not win the race?

A. 12.5% **B.** 18% **C.** 62.5% **D.** 87.5%

2. An Ipod stores songs by four different artists. When on shuffle, the probability the Ipod plays songs by artist 1 is 0.41, by artist 2 is 0.23 and by artist 3 is 0.16. What is the probability the Ipod plays a song by artist 4?

A. 0.2 **B.** 0.39 **C.** 0.64 **D.** 0.8

3. In a group of students, 32 travel to college by bus, 12 travel by train and 16 walk to college. What is the probability a student chosen at random travels to college by train?

A. $\frac{1}{5}$ **B.** $\frac{1}{4}$ **C.** $\frac{3}{11}$ **D.** $\frac{3}{7}$

4. In 2003 the number of live births in the UK by gender was:

Male	Female	Total
356 578	338 971	695 549

a Calculate the experimental probability that a baby born in the UK is a male

b Calculate the experimental probability that a baby born in the UK is a female

c What do you notice about your answers to (a) and (b)?

5. A game involves throwing two 8 sided poly-dice and adding the numbers to get the score.

a Complete the table to show all the possible outcomes from throwing the two poly-dice.

		1st dice							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
2nd dice	**1**								
	2								
	3								
	4								
	5								
	6								
	7								
	8								

b How many possible outcomes are there?

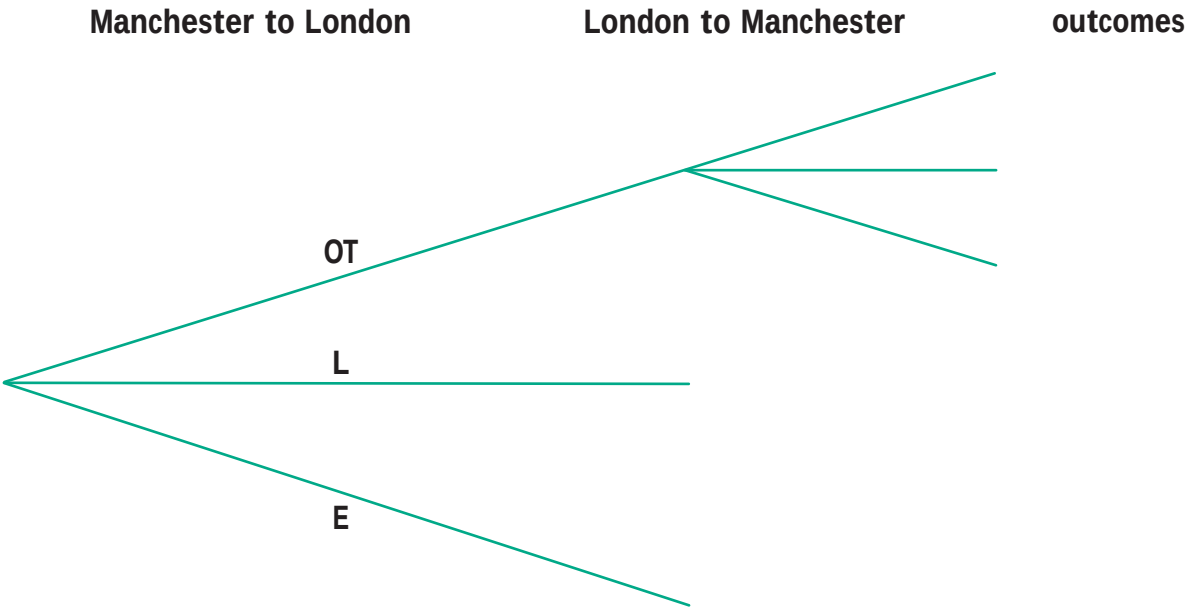
c Use the table to find the most likely score.

d What is the probability of scoring a number less than 10?

6. The probability that the train travelling between Manchester and London in either direction is on time, (OT) is 0.779 and the probability it is early, (E) is 0.02.

a What is the probability it is late, (L)?

b Complete the tree diagram to show all possible outcomes for a return trip between London and Manchester.



7. The long range weather forecast predicts a 12% chance of rain, (R), on any day in June.

a What is the probability that it will **not** rain, (NR), on any day in June?

A theatre company plans to put on an open air play in June.

b Complete the tree diagram to show all the possible outcomes for the weather for the 3 days.