

# 6

## What chance?

<b>Coverage</b> In this unit learners will learn about independent events, and learn to identify the outcomes when more than one event takes place. They will record these outcomes in both sample space tables and on tree diagrams and use these to evaluate probabilities.	<b>Skills</b> <b>HD2/L2.1</b> identify the range of possible outcomes of combined events and record the information using diagrams or tables <b>N2/L2.3</b> evaluate one number as a fraction of another
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Resources needed for effective teaching of this unit:

Demonstration	Group	Pair	Individual
OHP of some of the diagrams may prove useful	Card Pencil or spindle Colours Bus/train timetable	Card Pencil or spindle Colours	Card Pencil or spindle Colours Squared paper Coloured dice

### Reminder

In the Links, H means Help, E means Extension and M means Mini-project.

### Remember

Throughout the unit, be aware of the reading needs of learners.

You may need to read out parts of the text.

Words **highlighted** in **bold** will need particular clarification.

### Context

- Discuss the scenario with the group.
- Introduce the notation  $p$  (girl) etc.
- Remind learners how to simplify  $\frac{2}{4} = \frac{1}{2}$ .

## Stimulus questions

- What are the chances that Kim will have:
  - two girls?
  - two boys?
  - a boy and a girl?
- What do you think? Are the chances all the same?

Calculating probability can help us answer questions like this.

But probability is only theoretical. For example, the sex of a baby is influenced by factors other than chance.

This unit looks at the possible outcomes of combined events – that is, the possible result of two or more things happening, where the outcome of one is not affected by the outcome of the other. These are called independent events.

## Pages 2 and 3 Outcomes

### Introduction to activity 1

- This activity introduces sample space tables.
- Make sure learners realise that one of the twins is represented across the top and the other down the side. The convention is that the top is the result of first throw, selection etc.
- Make sure learners understand that they are dealing with all possible outcomes and not one particular case that they may have in mind – these are theoretical outcomes.
- It is important to emphasise that sample space tables are only appropriate for combining events that are equally likely.
- Identify what each of the coloured squares represents.
- Remind learners that we don't always write probabilities as fractions but in some cases the probabilities are given as decimals or percentages.
- Introduce the notation  $p$  (girl) etc.
- Remind learners how to simplify  $\frac{2}{4} = \frac{1}{2}$ .

### Activity 1

- Learners complete the activity individually or in pairs.

## Introduction to activity 2

- This activity involves use of a sample space table.
- Briefly discuss the primary colours, and the fact that mixing two different primary colours makes a new colour:  $R + B$  and  $B + R$  make purple;  $R + Y$  and  $Y + R$  make orange;  $Y + B$  and  $B + Y$  make green.
- Ask questions other than the ones that are in the exercise e.g. What is the probability that the colour will still be red/ green (blue/yellow) etc?
- Revise the fact that the sum of all possible outcomes is 1. Also emphasise that the sum of answers to questions 3 and 4 is therefore 1.

### Activity 2

- Learners complete the activity individually or in pairs. Groups should then discuss their answers

### Experiment

- Explain how learners should conduct the experiment and complete the table.
- It may help to provide learners with a larger grid or to encourage them to draw out their own larger version.
- The spinners must be made as accurately as possible if the experimental probability is to reflect theoretical probability.
- Using two bags, each containing one ball of each of the three colours, could provide an alternative that does not rely on making spinners.

### After the experiment

- Discuss that as the number of spins increases, the results of the experiment (relative frequency) should get closer to the theoretical probability.
- Stress that the results only get close to the probability if a large number of trials is undertaken (several hundred).
- A larger number of results can be obtained quickly by combining the results of the whole group. This should eliminate any bias in a spinner distorting the result. (Hopefully there will not be several spinners biased towards the one colour!)

**LINKS:** H1, E2

## Pages 4 and 5

### Tree diagrams

#### Introduction to activity 3

- This activity introduces tree diagrams.
- Point out that every arm/branch on a tree diagram is labelled.
- Indicate that each event is labelled (first throw, second throw).
- Go through the outcomes shown and recorded at the ends of branches and ensure that everyone understands how they are derived.

#### Activity 3

- Go through question 1 to be sure that everyone understands what is meant by 'outcomes of the two throws'.
- Learners should do the other questions individually and then discuss the answers as a group.

#### Activities 4 and 5

- These activities provide an opportunity for learners to practise drawing sample space tables and tree diagrams.
- Discuss the format of the table/tree diagrams but allow learners to work as independently as possible.

#### Introduction to activity 6

- This activity enlarges the tree diagram to three events (three flips of a coin).
- Discuss how each branch is sub-divided.
- Discuss how each event is labelled (first, second, third row).
- Discuss the outcomes of the events.
- Identify outcomes that are similar, such as two heads and a tail in any order (i.e. HHT, HTH, THH). Why do these events have separate lines?
- What is the probability of, for example, two heads and a tail (HHT).

#### Activity 6

- Learners should work individually on the questions, then discuss the results.

#### Activity 7

- Learners only have to look up the answers to the three questions – they have them in their work.
- Some learners are likely to see weird and wonderful patterns in the fractional answers and will have to be steered towards the answer required. Most learners at this level will find it much easier to think about the series 2, 4, 8 than  $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}$ .

*LINKS: H2, E1*

## Pages 6 and 7

### What's the score?

#### Introduction to activity 8

- Discuss the sample space and how entries are derived.
- Make sure everyone has the correct table before proceeding to the questions.

#### Activity 8

- Make sure that everyone understands that there are 36 possible outcomes.
- Remind learners of work done in earlier units about probability (favourable outcomes/total outcomes).
- Ask questions on the sample space table. How many ways can 4 be scored? What is the probability of scoring 4? Can the answer be simplified? How?
- Remind learners of how to change fractions to decimals and percentages.
- Discuss prime numbers. Use the definition given in the learner material: a prime number is a number that has exactly two factors. Ask learners if they have any other definitions. They may know a prime number as a number that can be divided only by itself and 1. This second definition sometimes leads to confusion about whether 1 is a prime number. Emphasise that the smallest prime number is 2. It is special because it is the smallest and the only even prime number.
- Work through some examples where the sum of the probabilities is 1, e.g. the probability that a number is a multiple of 3 or is not a

multiple of 3. Discuss why the sum of such probabilities is 1.

**LINKS:** E1

## Pages 8 and 9 Get on and do it!

### Introduction to activity 9

- Discuss the rules for the game 'Scissors, Paper, Stone'.
- This introduces the idea of independent events – at each showing of the hands the event is random, with probabilities remaining constant.
- Discuss events that are independent, e.g. flipping a coin twice or picking a card from a pack then replacing it.

### ↑ Activity 9

- Learners complete the activity individually or in pairs.
- Discuss the wording in question 5, i.e. 'does not win' includes 'loses' and 'draws'.

### Activity 10

- Remind learners of the essential points in drawing tree diagrams and sample space tables.
- This activity provides further practice in drawing these diagrams and using the information from them. As such, learners should work individually but be able to discuss with one another what they are doing

**LINKS:** H2, E1, E2, M1, M2, M3

## Page 10 Help

### H1

- Remind learners how to complete a sample space table.
- Learners work individually or in pairs.

### H2

- Remind learners how to complete a tree diagram.
- Learners work individually or in pairs.

## Page 11 Extension

### ↑ E1

- Remind learners how to draw a tree diagram.
- Discuss how many branches are needed and the number of events.
- Learners work individually or in pairs.

### ↑ E2

- Remind learners how to draw a sample space table.
- Ensure learners understand how to complete the table.
- Remind learners what a prime number is.
- Encourage learners to mark outcomes on the table to help them answer particular questions.
- Learners work individually or in pairs.
- Discuss why there are so few prime numbers in the table and which column they come in. (NB The activity involves *multiplying* dice scores, so prime numbers occur only when one of the multiples is 1.)

## Page 12 Mini-projects

### M1

- Remind learners of the rules for 'Scissors, Paper, Stone'.
- Discuss how learners will record their results.
- Learners work in pairs.

### M2

- Discuss how learners should record their results.
- Learners work individually or in pairs.

### **M3**

- Discuss what information learners need and how they can record it. They could use a bus or train service they use themselves.
- Discuss how confident they would be relying on probabilities for catching the bus/train on future occasions.

## **Pages 13 and 14**

### **Check it**

Use these questions to assess how learners have coped with the skills in this unit. Ask learners to indicate the areas in which they would like help.

### ***How am I doing?***

Learners should complete this individually, with teacher support.