



### Activity description

In this activity, students use relative frequency to estimate probability. They find theoretical probabilities including probabilities of combined events, such as outcomes when two fair coins are tossed. They will also use probabilities to predict the expected number of trials in which an event will occur.

### Suitability

Level 2 (Intermediate/Higher) and Level 3 (Advanced)

### Time

1 hour (approximately)

### Resources

Student information sheet, worksheet  
Optional: slideshow

### Equipment

Optional: calculators

### Key mathematical language

Probability, estimate, relative frequency, trial, event, equally likely, probability line, expectation, sample space diagram, tree diagram

### Notes on the activity

This set of resources could be used to introduce or revise probability in Level 2 courses. It is expected that most of the students who start a Level 3 course will previously have done some work on probability, and there are a variety of ways in which you could use this set of resources at Level 3.

For example, the slideshow could be used to aid class discussion and provide a quick reminder of previous work, with the Information sheet given as a hand-out – this includes the same methods.

Alternatively you could start by asking groups of students to discuss probability, and produce a poster giving examples of what they already know. The slideshow and information sheets could then be used to provide a quick summary of the basic methods before students attempt the worksheet.

### During the activity

Depending on how the resources are being used, students could work individually or in small groups.

## Points for discussion

Ensure that students realise the importance of having equally likely events when calculating theoretical probabilities, using the formula

$$P(E) = \frac{\text{Number of ways E can happen}}{\text{Total number of possibilities}}$$

Do this by asking questions such as ‘Why is it important to assume that dice and coins are fair when you are calculating theoretical probabilities?’

Ask students to think about whether they are using the formula above and/or the formula  $P(\bar{E}) = 1 - P(E)$  when they are considering questions in the worked examples and on the Worksheet.

## Extensions

Two extension questions are suggested.

The first asks students to relate the probabilities involving three coins being tossed to those about families with three children. In each case the probability in a single event is assumed to be  $\frac{1}{2}$ , so combinations will also have the same probabilities.

Discuss the assumption that a boy and girl are equally likely. If you have internet access students can search for information about this. In fact the probability of a boy is slightly higher than that of a girl.

The second asks students to make up and solve a probability question similar to Question 2 about the difference in the scores when two dice are thrown. If several students have completed the other work, they could try answering each others’ questions.

## Answers

### 1 Lost luggage

a i 0.0265 (to 3sf) ii 0.0170 (to 3sf) b i 0.15 ii 12 iii 2

### 2 Dice differences

a		2 <sup>nd</sup> dice					
		1	2	3	4	5	6
1 <sup>st</sup> dice	1	0	1	2	3	4	5
	2	1	0	1	2	3	4
	3	2	1	0	1	2	3
	4	3	2	1	0	1	2
	5	4	3	2	1	0	1
	6	5	4	3	2	1	0

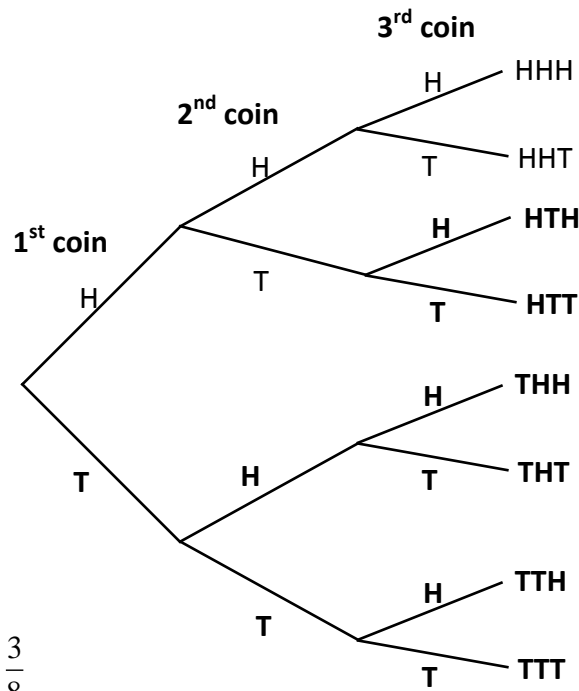
**b**

<b>Difference</b>	0	1	2	3	4	5
<b>Probability</b>	$\frac{1}{6}$	$\frac{5}{18}$	$\frac{2}{9}$	$\frac{1}{6}$	$\frac{1}{9}$	$\frac{1}{18}$

**c** i  $\frac{1}{6}$     ii  $\frac{2}{3}$

### 3 Three coins

**a**



**b** i  $\frac{1}{8}$     ii  $\frac{1}{4}$     iii  $\frac{3}{8}$

### 4 Children

**a** BBB, BBG, BGB, BGG  
GBB, GBG, GGB, GGG

**b** i  $\frac{1}{4}$     ii  $\frac{3}{8}$     iii  $\frac{1}{2}$

**c** BBBB, BBBG, BBGB, BBGG  
BGBB, BGBG, BGGB, BGGG  
GBBB, GBBG, GBGB, GBGG  
GGBB, GGBG, GGGB, GGGG

**d**  $\frac{3}{8}$