# Experimental probability

- Calculating experimental probabilities from experimental results
- Listing outcomes systematically

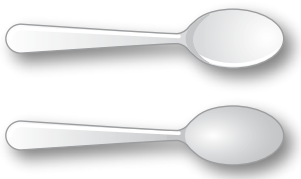
Keywords

You should know

explanation 1a | explanation 1b | online

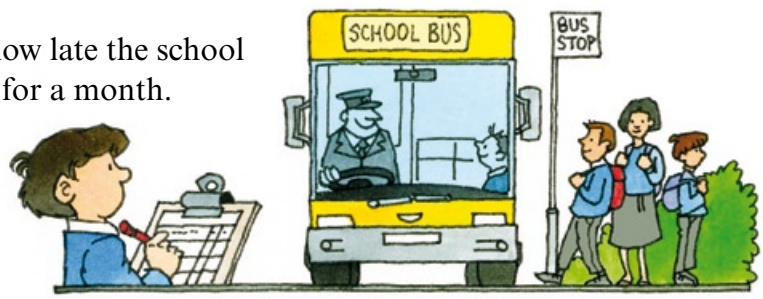
**1** This table shows the results from dropping a spoon onto the floor.

| Outcome | Frequency |
|---|---|
| Spoon facing up | 23 |
| Spoon facing down | 31 |



Find the experimental probability of the spoon landing face up on the next drop.

**2** Mal kept a record of how late the school bus was each morning for a month.




Here are his results.

| Minutes late | 0 (on time) | Less than 5 | Between 5 and 10 | Over 10 |
|---|---|---|---|---|
| Frequency | 10 | 6 | 3 | 1 |

Use Mal's results to answer these questions.

**a** Use the probability words given below to describe the likelihood of the school bus arriving at these times the next day.

certain very likely likely even unlikely very unlikely impossible

**i** on time **ii** less than 5 minutes late **iii** over 10 minutes late

**b** Calculate the experimental probability of these events for the bus's arrival.

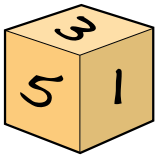
**i** on time **ii** less than 5 minutes late **iii** over 10 minutes late

**3** The table shows the lifetime of 200 batteries.

| Lifetime (hours) | Frequency |
|---|---|
| Less than 10 | 50 |
| 10 to 20 | 120 |
| More than 20 | 30 |

Jacob bought a similar battery.
What is the probability it will last more than 20 hours?
Give your answer as a fraction.

**4** Kate made a dice from a small box.
She numbered the sides 1, 2, 3, 4, 5 and 6.




She threw the dice 50 times and recorded the results.

| Number on dice | Tally | Frequency |
|---|---|---|
| 1 | 𝍸 \|\| | |
| 2 | \|\| | |
| 3 | 𝍸 𝍸 𝍸 | |
| 4 | 𝍸 𝍸 𝍸 𝍸 | |
| 5 | \| | |
| 6 | 𝍸 | |

**a** Copy the table and complete the frequency column.

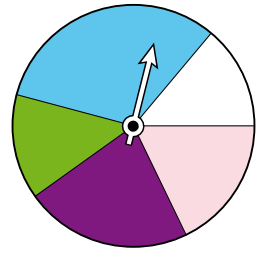
**b** Which number is Kate most likely to get when she throws the dice?

**c** Use your answers to part **a** to calculate the experimental probability that next time Kate throws the dice she gets these numbers.

**i** 6 **ii** 4 **iii** 5

**5** This spinner was spun 50 times. Here are the results.

| Colour | Frequency |
|---|---|
| White | 3 |
| Blue | 19 |
| Green | 5 |
| Purple | 16 |
| Pink | 7 |



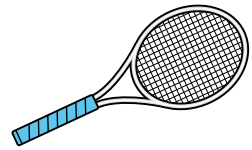
Find the experimental probability that the spinner lands on these colours.

**a** white **b** blue **c** pink

**6** Sofie spins a tennis racket.

She notes whether it lands rough side up or smooth side up.

These are her results.



| Position of racket | Tally | Frequency |
|---|---|---|
| Rough side up | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 \|\|\| | |
| Smooth side up | 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 𝍸 \|\| | |

**a** How many times did the tennis racket land these ways?

**i** rough side up

**ii** smooth side up

**b** Work out the experimental probability of the tennis racket landing these ways.

**i** rough side up

**ii** smooth side up

explanation 2

**7** There are three runners in a race Anil, Bob and Carl.

There are just two prizes, one for first and one for second.

List all the different ways the two prizes could be won.

Use A for Anil, B for Bob and C for Carl.

**8** Noni has these three number cards.


List all the different ways he can arrange them.

Start your list like this 3 5 7

3 7 5

**9** Amy has three T-shirts, a white one, a blue one and a red one.

She also has two pairs of shorts, a yellow pair and a green pair.

Copy and complete this list to show all her different choices of T-shirt and shorts.

| T-shirt | Shorts |
|---|---|
| White | Yellow |
| White | Green |
| ⋮ | ⋮ |

**10** There are four people in a Judo competition.

They are Andy, Ben, Chas and Dave.

Write down all the possible ways they could be paired.

For example **A** v **B**, **A** v **C**, ...

**11** In a sports competition competitors play football, basketball and tennis.

List all the different orders for playing the three sports.

For example, Football, Basketball, Tennis

Tennis, Football, Basketball …

explanation 3a | explanation 3b | online

**12** Some friends are playing a game with a 1p coin, a 2p coin and a 5p coin.


They spin all three coins at the same time.

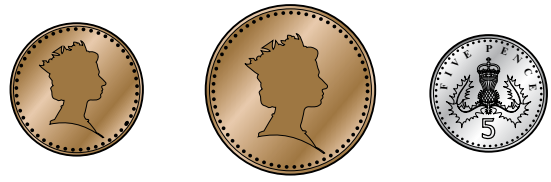
**a** Copy and complete this table showing all the possible outcomes.

H means the coin landed heads up and T means it landed tails up.

You can use three real coins to help you.

| 1p coin | 2p coin | 5p coin |
|---|---|---|
| H | H | H |
| H | H | T |
| H | T | H |
| | | |

Heads (H) Heads (H) Tails (T)




Use your table to answer these questions.

**b** What is the theoretical probability of getting two heads when the coins are spun?

**c** What are the least likely events when three coins are spun?

**d** The friends noted down the number of heads showing each time they spun the three coins.

These are their results.

2H 1H 2H 2H 3H 2H 3H 3H 2H 3H

2H 3H 1H 2H 1H 0H 2H 2H 1H 2H

What is the least likely event from their results?

Is this what you would have expected?

**e** What is the experimental probability of getting 2 heads from their results?

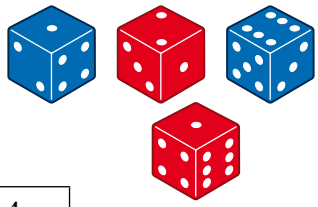
How does this compare with your answer to part **b**?

**13** A group recorded the different types of vehicle passing under a motorway bridge. Here are their results so far.

| Type of vehicle | Car | Van | Lorry | Bus |
|---|---|---|---|---|
| Tally | 𝍸 𝍸 \|\|\| | 𝍸 \|\|\|\| | 𝍸 𝍸 𝍸 \|\|\|\| | \|\|\| |

Use the results to find the experimental probability that the next vehicle passing under the bridge will be a bus.

**14** Some pupils are investigating rolling four normal dice.



They record the number of dice showing a 6 each time.

These are their results after 1000 rolls.

| Number of sixes | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Frequency | 483 | 379 | 120 | 17 | 1 |

Use the table to answer these questions.

**a** How many times did the dice show two 6s?

**b** What are these experimental probabilities?

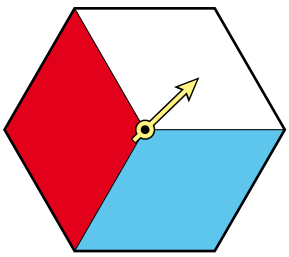
**i** All four dice show a 6.

**ii** None of the dice show a 6.

**iii** Half the dice thrown show a 6.

**15** This fair spinner has three coloured sections, white, blue and red.

The spinner is spun twice.



| First spin | Second spin |
|---|---|
| White | White |
| White | Blue |
| White | |
| ⋮ | ⋮ |

**a** Complete the table to show all the possible outcomes.

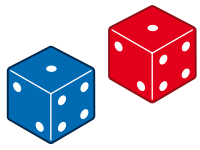
**b** How many outcomes are there?

**c** What is the probability that the same colour comes up on both spins?

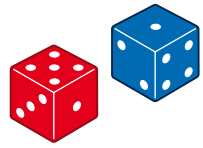
**16** In this experiment a blue and a red dice are rolled.

The larger of the two numbers on the dice is written down.

If the two numbers are the same, this number is written down.



The outcome here is 1.



The outcome here is 5.

This table shows some of the possible outcomes.

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| 1 | 1 | 2 | | 4 | 5 | |
| 2 | 2 | 2 | | | | |
| 3 | 3 | 3 | 3 | | | |
| 4 | 4 | 4 | 4 | 4 | 5 | |
| 5 | 5 | 5 | | | | |
| 6 | | 6 | | | | |

**a** Copy and complete the table.

Use your table to answer parts **b** and **c**.

**b** What is the most likely 'larger score'?

**c** Write down the 'larger scores' in the order of their theoretical probability of occurring.

Start with the least likely.

**d** Now do the experiment for yourself.
Roll 2 different coloured dice 36 times.

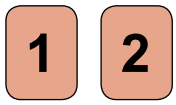
Record your results systematically.
Which is the most frequent 'larger score'?

Is this what you expected from part **c**?

You could do the experiment again and combine your results to see if 72 rolls makes a difference to the most frequent 'larger score'.

**17** Here are two sets of number cards.

One set is red the other is blue.





One card is taken at random from each set.

| Red | Blue |
|---|---|
| 1 | 1 |
| 1 | 2 |
| 1 | |
| | |

**a** Complete the table to show all the possible outcomes.

**b** How many outcomes are there?

**c** What is the probability that both cards show the same number?