Experiment

- Using experimental data to estimate probability
- Understanding the difference between theoretical and experimental probability
- Understanding the effect of repeating an experiment many times

Keywords

You should know

explanation 1a explanation 1b

1 Linda puts some red, yellow and blue counters in a bag. She takes a counter at random from the bag. She records the colour of the counter and then puts the counter back in the bag. Linda repeats this experiment 80 times.
The table shows her results.

Colour of counter	Red	Yellow	Blue
Frequency	36	20	24
Experimental probability			

a Copy and complete the table to show the experimental probabilities.

b Which colour counter are there likely to be most of in the bag?

c If Linda repeated her experiment 200 times, how many times is she likely to get a blue counter?

2 Ali carried out an experiment. He asked 40 people to taste two different makes of chocolate. He asked which chocolate they thought was the cheaper of the two makes. He recorded whether or not they got the answer right. 24 of the people who tasted the chocolate could identify the cheaper chocolate.

a What is the probability that the next person he asks will be able to tell which is the cheaper chocolate?

b If Ali asks 100 people, how many are likely to be able to tell which is the cheaper chocolate?

3 Susan rolls a dice 210 times. She gets a four 60 times.
Is the dice likely to be fair? Give a reason for your answer.

4 A bag contains eight coloured counters. The counters are blue, red or yellow. Helena takes a counter at random from the bag. She records the colour of the counter and then puts the counter back in the bag. She repeats this experiment 400 times. The table shows her results.

Colour of counter	Red	Yellow	Blue
Frequency	210	98	92

a Estimate the number of blue counters in the bag.

b Estimate the number of yellow counters in the bag.

explanation 2 online

5 Work with a partner. Carry out an experiment to work out the experimental probability of getting a tail when spinning a coin.

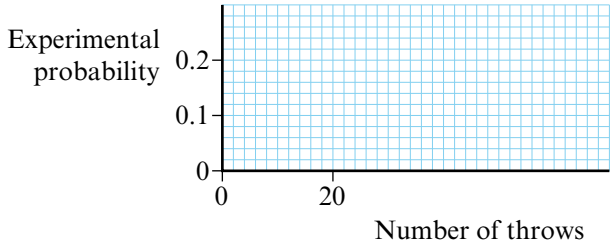
a Spin a coin 20 times. Count the number of tails.
Copy the table and fill in the number of tails for the first 20 spins.

Total number of spins	20	40	60	80	100
Total number of tails					
Experimental probability of a tail					

b Repeat the experiment four times.
Each time, fill in the row for the total number of tails.

c Work out the experimental probabilities for the numbers of tails.

d Draw a graph with the x-axis going from 0 to 100 and the y-axis going from 0 to 1. Scale your axes as shown. Label the horizontal axis 'Number of throws' and the vertical axis 'Experimental probability'. Plot the values in your table to draw a graph.



e What do you notice about the points on your graph?

f What would happen if you repeated the experiment more times?

6 Prateek carries out an experiment. He spins three coins and records the number of heads he gets. He repeats the experiment several times. The table shows his results.

Number of heads	0	1	2	3
Frequency	8	25	21	6
Experimental probability				

a How many times did Prateek carry out his experiment?

b Copy and complete the table to show the experimental probabilities. Give your probabilities as decimals correct to 3 decimal places.

Alan carries out the same experiment. The next table shows his results.

Number of heads	0	1	2	3
Frequency	18	54	59	19
Experimental probability				

c How many times did Alan carry out his experiment?

d Copy and complete the table to show the experimental probabilities. Give your probabilities as decimals correct to 3 decimal places.

e Whose experimental probabilities are likely to be more accurate? Give a reason for your answer.

f Write down all the different combinations that can be obtained when spinning three coins.

g Use your answer to part **f** to work out the theoretical probabilities for getting 0, 1, 2 and 3 heads when spinning three coins.

h Were Alan's or Prateek's results actually more accurate?

7 Work with a partner. Carry out an experiment using a dice to work out the experimental probability of rolling the number 5.

a Roll the dice 20 times, counting the number of 5s. Copy the table below. Fill in the number of 5s for the first 20 rolls.

Total number of rolls	20	40	60	80	100
Total number of 5s					
Experimental probability of rolling a 5					

b Repeat the experiment four times.
Each time, fill in the row for the total number of 5s.

c Work out the experimental probabilities for rolling a 5.

d What do you notice about the experimental probabilities?

e What is the theoretical probability of rolling a 5?
How does this compare with your final experimental probability?

8 Work with a partner.

a Put a total of 10 counters in a bag. There should be some of each of three different colour counters in the bag.
Do not let your partner see how many of each colour there are.
Ask your partner to take a counter at random from the bag, record its colour in a frequency table and then put the counter back. Repeat this 20 times.

b Work out the experimental probability of taking each colour.
Your partner should use this to estimate how many of each colour counter there are in the bag.

c Ask your partner to take out a counter another 20 times, recording its colour and returning it.

d Work out the new experimental probabilities. Your partner should again estimate how many of each colour counter there are in the bag.

e Take out a counter a final 20 times and allow your partner one more estimate.

f Empty the bag. Was your partner correct?
Was their final estimate more accurate than their first estimate?

g Change roles and repeat the whole process with you estimating this time.