

# Probability 1

Chapter

1

## Section 1.4 Experimental probability – Relative frequency —

**PROJECT MATHS**  
**Text & Tests 5**  
LEAVING CERTIFICATE  
HIGHER LEVEL  
STRAND 1  
PROBABILITY & STATISTICS

19

### Experiment

John suspects that a coin is biased. In an experiment, he tossed the coin 200 times and recorded the number of heads after 10, 50, 100, 150 and 200 tosses.

The results are shown in the table on the right:

As the number of tosses increase, the number of heads divided by the number of tosses gets closer to 0.5, i.e.,  $\frac{1}{2}$ .

This value is called **relative frequency** and it gives an **estimate of the probability** that the event will happen.

Number of tosses	Number of heads	Heads ÷ tosses
10	7	0.7
50	28	0.56
100	53	0.53
150	78	0.52
200	103	0.515

Thus an estimate of the probability that an event will occur, by carrying out a survey or experiment, is given by

$$\text{Relative frequency} = \frac{\text{Number of successful trials}}{\text{Total number of trials}}$$

In general, as the number of trials or experiments increases, the value of the relative frequency gets closer to the true or theoretical probability.

### Example 1

Dara collected data on the colours of cars passing the school gate. His results are shown on the table below.

Colour	White	Red	Black	Blue	Green	Other
Frequency	24	32	14	16	10	4

- How many cars did Dara survey?
- What was the relative frequency of blue cars?
- What was the relative frequency of red cars?  
Give your answer as a decimal.
- Write down an estimate of the probability that the next car passing the school gate will be green.
- How can the estimate for the probability of green cars be made more reliable?

(i) 100

(ii) Relative frequency blue =  $\frac{16}{100} = 16\% = 0.16$

(iii) Relative frequency red =  $\frac{32}{100} = 32\% = 0.32$

(iv) estimate  $P(\text{green}) = \text{Relative frequency green} = 10\% = 0.1$

(v) Bigger survey.

### Expected frequency

A bag contains 3 red discs and 2 blue discs.

A disc is chosen at random from the bag and replaced.

The probability of getting a blue disc is  $\frac{2}{5}$ .

This means that, on average, you expect 2 blue discs in every 5 chosen or 20 blue discs in every 50 chosen.



To find the expected number of blue discs when you choose a disc 100 times,

- Work out the probability that the event happens once.
- Multiply this probability by the number of times the experiment is carried out.  
Thus the expected number of blue discs is

$$\frac{2}{5} \times \frac{100}{1} = 40.$$

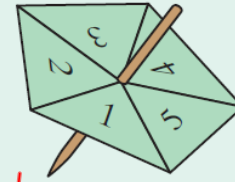
Expected frequency is  
probability  $\times$  number of trials.

### Example 2

This spinner is biased.

The probability that the spinner will land on each of the numbers 1 to 4 is given in the table below.

<b>Number</b>	1	2	3	4	5
<b>Probability</b>	0.35	0.1	0.25	0.15	$k$



*ADD to 1*  
*0.15*

The spinner is spun once.

- (i) Work out the probability,  $k$ , that the spinner will land on 5.
- (ii) Write down the number on which the spinner is most likely to land. *1*
- (iii) If the spinner is spun 200 times, how many times would you expect it to land on 3?

(iii) *Expected Value = Probability × trials*

$$= (0.25)(200) = 50$$