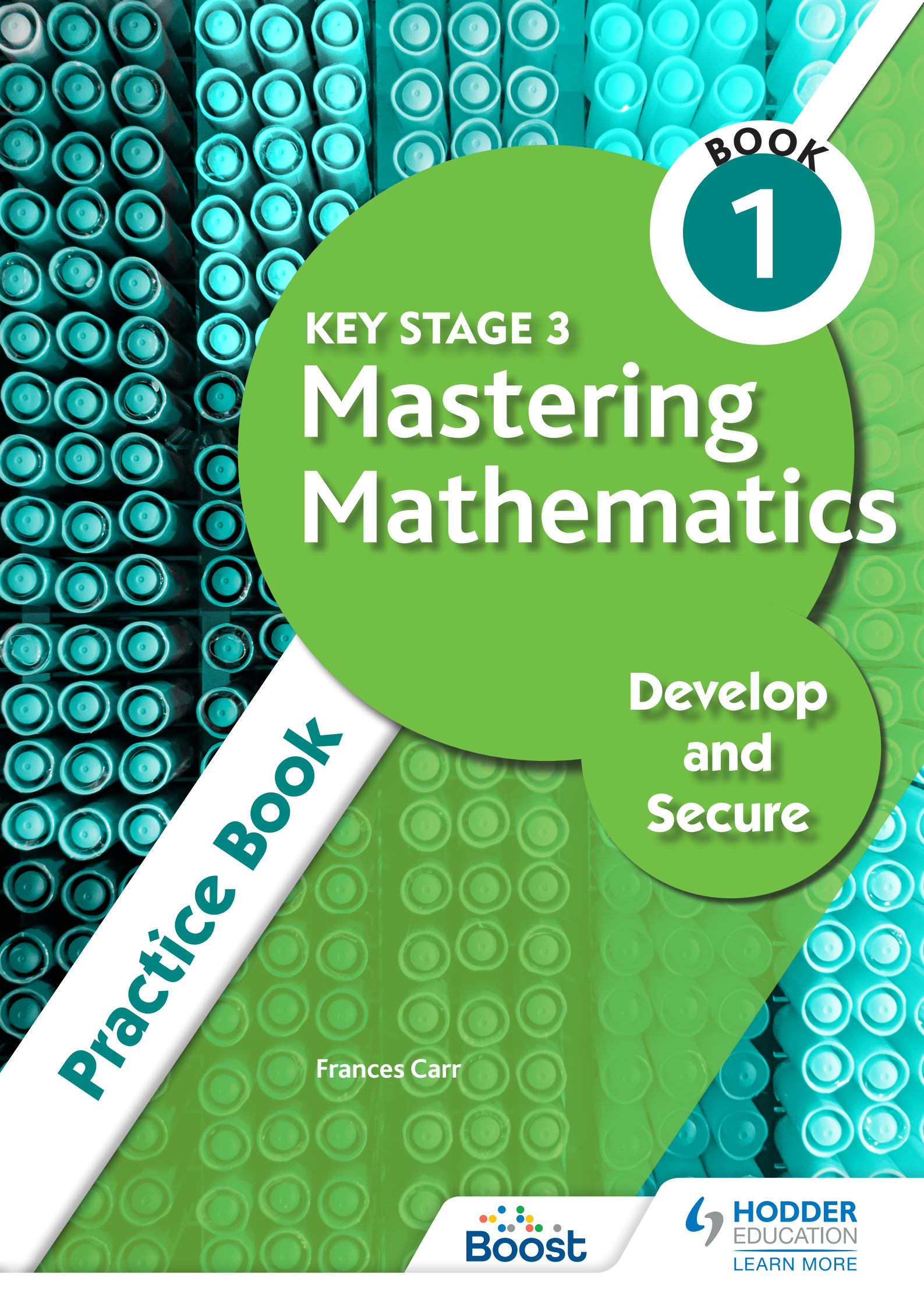
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KEY STAGE 3
Mastering Mathematics
Develop and Secure
Practice Book
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Contents

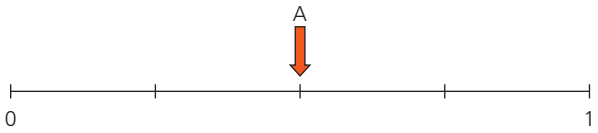
CHAPTER 1

Probability

Fluency Reasoning Problem solving

1.1 Introduction to probability

1 Copy this number line and mark each number on it. The first one has been done for you.

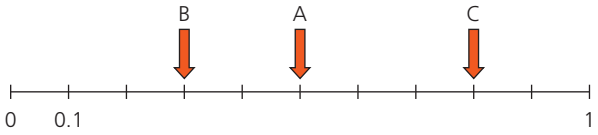


A = 0.5 **B = 0.25** **C = 0.75**

2 Match up the pairs:

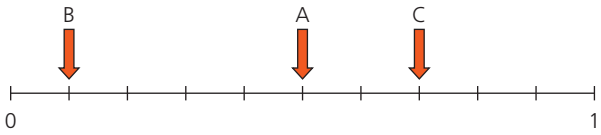
0.5 $\frac{1}{4}$ **0** **75%** **100%** $\frac{1}{2}$ **0.25** **0%** $\frac{3}{4}$ **1**

3 Write down the number that each arrow is pointing to as a decimal.



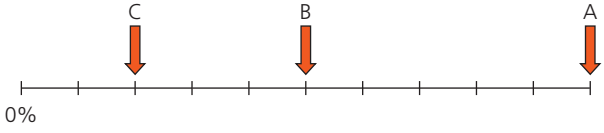
A = **B =** **C =**

4 Write down the number that each arrow is pointing to as a fraction.



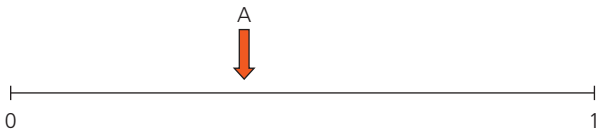
A = **B =** **C =**

5 Write down the number that each arrow is pointing to as a percentage.



A = **B =** **C =**

6 Which number cannot be placed at A? Explain your answer.



a 0.4 **b** 0.8 **c** 0.34

You can describe the likelihood or chance of something happening using **probability**.

When you roll a dice or flip a coin, you have carried out an **experiment**.

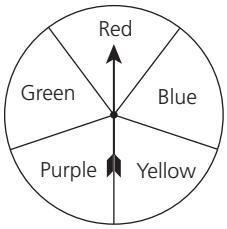
An **outcome** is the result you get after carrying out the experiment.

The possible outcomes when you flip a coin are 'heads' and 'tails'.

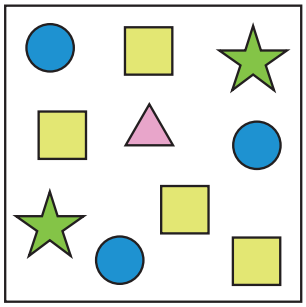
7 List all the possible outcomes of the following experiments.

a Rolling a six-sided dice.

b Spinning this spinner:

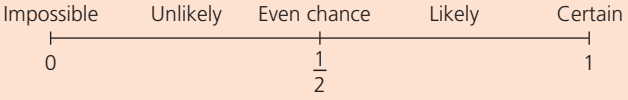


c Picking a shape from this box:



Probability tells you how likely an event is to happen. The probability of an event is given as a decimal, fraction or percentage. A **probability scale** is used to compare probabilities.

The probability scale goes from impossible (probability 0) to certain (probability 1).



An event that is **certain** to happen has a probability of 1.

You are **certain** to get either heads or tails when you flip a coin.

An event that is **impossible** has a probability of 0 or 0%.

It is **impossible** to roll a '7' on an ordinary six-sided dice.

8 True or false? Explain your answer.

a It is impossible to win the lottery if you don't buy a ticket.

b It is certain that it will rain tomorrow.

9 Give an example of an event which is

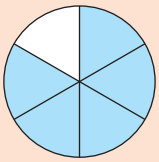
a certain **b** impossible.

An outcome with a probability of $\frac{1}{2}$, or 0.5 is sometimes called an even chance or 50–50 chance.

It is an even chance that the next baby born will be a boy.

An even chance only happens where there are two outcomes and they are both equally likely to happen.

On this spinner there are only two colours, white and blue. The spinner does not have an even chance of landing on white, because there is more blue than white.



10 Do you agree with the following statements? Explain your answers.

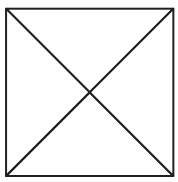
a A football team can win, lose or draw a match. The probability that they win is an even chance.

b When a dice is rolled, it can land on 6, or not land on 6. The probability of landing on 6 is an even chance.

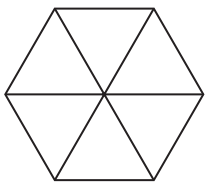
c When you flip a coin, it is an even chance of landing on tails.

11 Copy and colour these spinners so that there is an even chance they will land on blue.

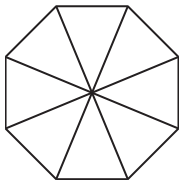
a



b

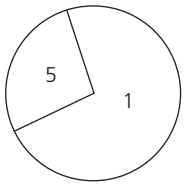


c

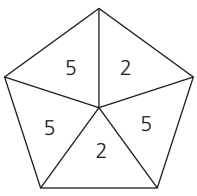


12 Do these spinners have an even chance of landing on a 5? Explain your answers.

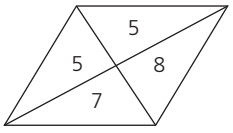
a



b



c



The closer the probability of an event is to 1, the **more likely** the event is to happen.

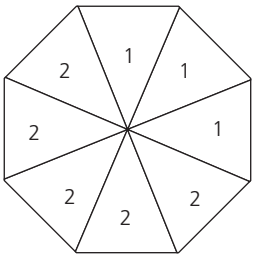
The closer the probability of an event is to 0, the **less likely** the event is to happen.

13 True or false? Explain your answers.

a An event which is unlikely can have a probability of 60%.

b An event which is likely must have a probability of $\frac{3}{4}$.

14 This spinner has eight equal sections. Fill in the blanks using the words **likely** or **unlikely**.



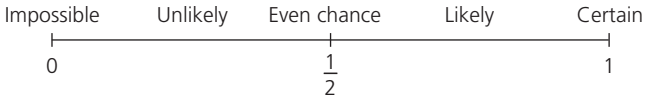
a It is ____ to land on 1.

b It is ____ to land on 2.

15 Match each word to its definition.

Impossible	Will definitely happen
Unlikely	Will probably not happen
Even chance	Will probably happen
Likely	Will never happen
Certain	Has an equal chance of happening or not happening

16 A regular six-sided dice is rolled. Place the statements below on the probability scale.



A = The dice will land on an odd number.

B = The dice will land on a two.

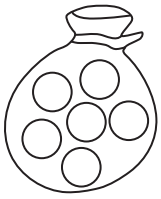
C = The dice will land on a seven.

D = The dice will land on a number less than seven.

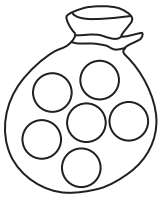
E = The dice will land on a number bigger than one.

17 A bag contains some counters. One counter is going to be picked out at random.

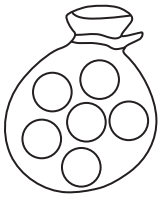
a Colour the counters so it is impossible to pick a white counter.



b Colour the counters so that there is an even chance of picking a white counter.



c Colour the counters so that it is likely a white counter is picked.



18 True or false?

a It is impossible that the day after Saturday is Wednesday.

b It is certain that the day after Monday is Tuesday.

c It is likely that it will snow in London in June.

d It is unlikely that the sun will rise tomorrow.

e It is an even chance that when a coin is flipped it will land on tails.

1.2 Single event probability

1 Complete these calculations:

a $\frac{4}{7} + \frac{\square}{\square} = \frac{7}{7}$ **b** $\frac{2}{7} + \frac{\square}{\square} = 1$

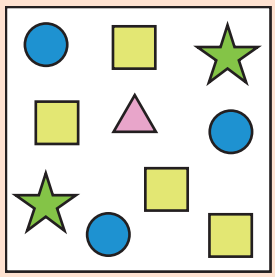
c $\frac{8}{11} + \frac{\square}{\square} = 1$ **d** $0.4 + \square = 1$

e $0.29 + \square = 1$ **f** $78\% + \square = 100\%$

For any event with **equally likely** outcomes, the probability of an event happening can be found like this:

Probability that something happens

$$= \frac{\text{total number of ways it can happen}}{\text{total number of possible outcomes}}$$



A shape is taken at random from this box. Each shape is **equally likely** to be chosen.

The probability of picking a circle is $\frac{3}{10}$ (there are three circles out of ten shapes in total).

The probability of picking a circle or a square is $\frac{7}{10}$ (there are three circles and four squares out of ten shapes in total).

An experiment is **fair** if each outcome is **equally likely** to happen, for example if a letter is picked at random from the word MATHS. If an experiment isn't fair then it is said to be **biased**.

2 A letter is picked at random from the word HAPPY. Find the probability that the letter chosen is a:

a $H = \frac{1}{5}$ ← There is 1 H out of 5 letters in total.

b P = **c** S =

3 There are 30 children in a class. There are 17 boys and 13 girls. A child is chosen at random.

What is the probability that a boy is chosen?

4 A fair six-sided dice is rolled once. Find the probability that it lands on:

a 5 = **b** 1 =

c 7 = **d** 2 or 3 =

The probability of something happening can be written using a shortcut. Instead of writing, 'The probability of rolling a 6', you can write, 'P(6)'.

5 A letter is picked at random from the word BANANA. Find these probabilities:

a $P(B) = \frac{1}{6}$ ← There is 1 B out of 6 letters in total.

b P(A) = **c** P(0) =

6 Tom has five cards numbered 1, 3, 8, 4 and 3. He picks a card at random. Find these probabilities:

a P(3) =
b P(5) =
c P(1 or 4) =
d P(odd number) =

Mutually exclusive events are events that cannot happen at the same time. For example, you cannot roll a 1 and a 6 at the same time on one dice.

The probabilities of all mutually exclusive outcomes of an event add up to 1.

For example, when you roll a fair dice, it is certain that it will either land on 6 or that it will not land on 6.

So you can say that: P(6) + P(not 6) = 1

Any event is certain to either happen or not happen, so P(happening) + P(not happening) = 1

7 The probability that it will rain tomorrow is 0.9.

What is the probability that it will not rain tomorrow?

8 The probability that a football team will win a match is 75%.

What is the probability that the team will not win the match?

9 A coin is biased. The probability that it will land on tails is $\frac{3}{10}$.

a What is the probability that it will not land on tails?
b How does this show that the coin is biased?

10 Each of the 11 letters in the word MATHEMATICS are written on a card and put in a hat.

A card is taken at random from the hat. Work out the following probabilities:

a P(M) =
b P(not M) =
c P(A or T) =
d P(not (A or T)) =

11 A dice is biased. The probability that it will land on a 5 is 0.3.

Rumi says the probability that the dice will not land on a 5 is 0.8. How do you know that Rumi is wrong?

12 In a box of pens, there are five blue pens, two red pens and eight black pens.

Sara takes a pen at random. Work out the following probabilities:

a P(red) =
b P(blue) =
c P(not blue) =
d P(blue or red) =