

Basic Probability and the Probability Scale

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (3 marks)

A fair coin is thrown and a fair six-sided dice is rolled.

- (a) Circle the word that best describes the probability that the coin lands on heads.

Options: impossible, unlikely, evens, likely, certain

A fair coin has two sides: heads and tails.

Heads and tails are equally likely.

$P(\text{heads}) = \frac{1}{2}$, which is “evens”.

Answer: evens

- (b) Circle the word that best describes the probability that the dice lands on 6

Options: impossible, unlikely, evens, likely, certain

Only one of the six numbers is a 6.

$P(6) = \frac{1}{6}$

$\frac{1}{6}$ is more than 0 but less than $\frac{1}{2}$.

Answer: unlikely

- (c) Circle the word that best describes the probability that the dice lands on a number less than 7

Options: impossible, unlikely, evens, likely, certain

The numbers on the dice are 1, 2, 3, 4, 5 and 6.

Every one of them is less than 7.

So it is sure to happen.

Answer: certain

2 (3 marks)

Here are ten cards.

1	1	2	3	3	3	4	5	5	6
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One card is taken at random.

- (a) Write down the probability that the number is 3

There are 10 cards altogether.

Three of the cards are 3

$$\text{Probability} = \frac{\text{number of 3s}}{\text{total number of cards}}$$

Answer: $\frac{3}{10}$

Tip: Write a probability as a fraction, decimal or percentage. "3 out of 10", "3 in 10" or 3:10 get no marks.

- (b) Write down the probability that the number is even.

The even cards are 2, 4 and 6

That is 3 cards out of 10.

Answer: $\frac{3}{10}$

- (c) Write down the probability that the number is 7

There is no card numbered 7

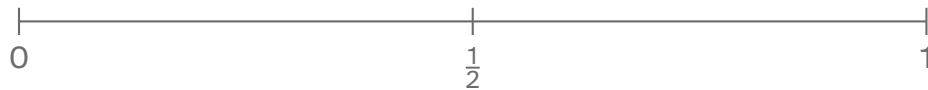
So it is impossible to get a 7

An impossible event has probability 0.

Answer: 0

3 (2 marks)

A fair six-sided dice is rolled.

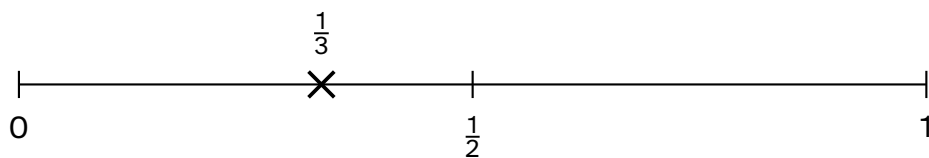


- (a) On the scale, mark with a cross (×) the probability that the dice lands on a number less than 3

The numbers less than 3 are 1 and 2

$$P(\text{less than 3}) = \frac{2}{6} = \frac{1}{3}$$

So the cross goes one third of the way from 0 to 1.



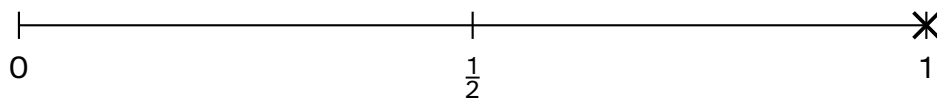
Answer: Cross at $\frac{1}{3}$

- (b) On the scale, mark with a cross (×) the probability that the dice lands on a number less than 7

Every number on the dice is less than 7

So the event is certain.

A certain event has probability 1.



Answer: Cross at 1

4 (1 mark)

A fair 8-sided dice is numbered 1 to 8

It is rolled once.

Circle the probability of getting a multiple of 3

Options: $\frac{1}{8}$, $\frac{2}{8}$, $\frac{3}{8}$, $\frac{2}{6}$

The multiples of 3 from 1 to 8 are 3 and 6

That is 2 of the 8 numbers.

$$P(\text{multiple of 3}) = \frac{2}{8}$$

Answer: $\frac{2}{8}$

Tip: This dice has 8 faces, so the bottom of the fraction is 8, not 6.

5 (4 marks)

A bag contains 4 red counters, 7 blue counters and 9 green counters.

A counter is taken at random.

(a) Write down the probability that the counter is red.

Total number of counters: $4 + 7 + 9 = 20$

4 of them are red.

$$P(\text{red}) = \frac{4}{20}$$

This simplifies to $\frac{1}{5}$ (either form is fine).

Answer: $\frac{4}{20} = \frac{1}{5}$

- (b) Write down the probability that the counter is **not** blue.

The counters that are not blue are the red and green ones.

$$4 + 9 = 13$$

So 13 of the 20 counters are not blue.

Answer: $\frac{13}{20}$

- (c) Some more red counters are put in the bag.

The probability of taking a red counter is now $\frac{1}{2}$

How many red counters were added?

A probability of $\frac{1}{2}$ means half of the counters are red.

So the number of red counters must equal the number of other counters.

Other counters: $7 + 9 = 16$

So there must now be 16 red counters.

Red counters added: $16 - 4 = 12$

Answer: 12

Tip: The question asks how many were **added**, so take away the 4 red counters that were already in the bag.

Marks: 1 mark for 16 red counters. 1 mark for 12.

6 (2 marks)

A letter is chosen at random from the word MATHEMATICS

What is the probability that the letter is a vowel?

Count the letters: M, A, T, H, E, M, A, T, I, C, S

There are 11 letters.

The vowels are A, E, A and I.

There are 4 vowels (count A twice).

Answer: $\frac{4}{11}$

Marks: 1 mark for 11 letters or 4 vowels. 1 mark for $\frac{4}{11}$.

7 (2 marks)

A fair spinner has eight equal sections numbered 1, 2, 3, 4, 5, 6, 7 and 8

Sam says,

“The spinner is more likely to land on an even number than on a prime number.”

Is Sam correct?

Tick a box.

You must show your working.

Even numbers: 2, 4, 6, 8

So $P(\text{even}) = \frac{4}{8}$

Prime numbers: 2, 3, 5, 7

So $P(\text{prime}) = \frac{4}{8}$

The probabilities are the same, so the two are equally likely.

Sam is not correct.

Answer: No, both $\frac{4}{8}$

Marks: 1 mark for both probabilities (or both counts of 4). 1 mark for No with correct working.

8 (2 marks)

A fair spinner has six equal sections.

Three sections are red, two sections are blue and one section is yellow.

(a) Write down the probability that the spinner lands on blue.

The spinner has 6 equal sections.

2 of them are blue.

Answer: $\frac{2}{6}$ (or $\frac{1}{3}$)

- (b) Kofi spins the spinner four times.

It lands on red every time.

Kofi says,

“Red has come up four times, so red is less likely on my next spin.”

Is Kofi correct?

Give a reason for your answer.

The spinner is fair and it has no memory.

Earlier spins do not change what happens on the next spin.

$P(\text{red})$ is still $\frac{3}{6} = \frac{1}{2}$ on the next spin.

Answer: No. The probability of red is still $\frac{3}{6}$ on every spin

Tip: Past results do not change the probability for a fair spinner. It is not “due” a different colour.

9 (3 marks)

There are 240 students in Year 10 at a school.

One of these students is chosen at random to meet a visiting author.

- (a) Write down the probability that the student chosen is in Year 10

Every student in the group is in Year 10

So it is certain, and the probability is 1.

Answer: 1

Tip: Give the number 1. Writing the word “certain” does not get the mark.

- (b) 58 of the students walk to school and 110 come by bus.

The rest come by car.

Work out the probability that the student chosen comes to school by car.

Walk or bus: $58 + 110 = 168$ students.

Car: $240 - 168 = 72$ students.

$$P(\text{car}) = \frac{72}{240}$$

This simplifies to $\frac{3}{10}$.

Answer: $\frac{72}{240}$ (or $\frac{3}{10}$)

Marks: 1 mark for $240 - 58 = 110$ or 72. 1 mark for $\frac{72}{240}$ or an equivalent.

10 (2 marks)

At a school fair, raffle tickets are numbered from 1 to 40
One ticket is picked at random to win a prize.

- (a) Write down the probability that the number on the ticket is a multiple of 5

The multiples of 5 up to 40 are 5, 10, 15, 20, 25, 30, 35 and 40

That is 8 of the 40 tickets.

Answer: $\frac{8}{40}$ (or $\frac{1}{5}$)

- (b) Write down the probability that the number on the ticket has two digits.

The one-digit numbers are 1 to 9: that is 9 tickets.

Two-digit numbers: $40 - 9 = 31$ tickets (10 to 40).

$$P(\text{two digits}) = \frac{31}{40}$$

Answer: $\frac{31}{40}$

Tip: 10 to 40 is 31 numbers, not 30. Count both ends, or work out $40 - 9$.

11 (4 marks)

A tin contains 36 biscuits.

Each biscuit is plain, chocolate or ginger.

A biscuit is taken at random from the tin.

$$P(\text{plain}) = \frac{1}{3} \quad P(\text{chocolate}) = \frac{5}{12}$$

- (a) Work out the number of ginger biscuits in the tin.

$$\text{Plain: } \frac{1}{3} \text{ of } 36 = 36 \div 3 = 12$$

$$\text{Chocolate: } \frac{5}{12} \text{ of } 36 = 36 \div 12 \times 5 = 15$$

$$\text{Ginger: } 36 - 12 - 15 = 9$$

Answer: 9

Tip: The three probabilities add up to 1. You could also do $1 - \frac{1}{3} - \frac{5}{12} = \frac{3}{12}$ and then find $\frac{3}{12}$ of 36.

Marks: 1 mark for 12 or 15. 1 mark for 9.

- (b) Ravi eats 2 plain biscuits and 4 ginger biscuits from the tin.

A biscuit is then taken at random from the tin.

Work out the probability that it is a chocolate biscuit.

$$\text{Biscuits left: } 36 - 2 - 4 = 30$$

No chocolate biscuits were eaten, so there are still 15.

$$P(\text{chocolate}) = \frac{15}{30}$$

This simplifies to $\frac{1}{2}$.

Answer: $\frac{15}{30}$ (or $\frac{1}{2}$)

Tip: The bottom of the fraction is the number of biscuits left in the tin now, not 36.

Marks: 1 mark for 30 biscuits left. 1 mark for $\frac{15}{30}$ or an equivalent.