

Basic Probability and the Probability Scale

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 bag contains 5 green balls, 4 white balls and 1 red ball.
Theo is going to take at random a ball from the bag.

- (a) Choose the word that best describes the probability that Theo takes a green ball.
- impossible unlikely evens likely certain

There are $5 + 4 + 1 = 10$ balls.

5 of them are green.

$$P(\text{green}) = \frac{5}{10} = \frac{1}{2}$$

A probability of exactly $\frac{1}{2}$ is “evens”.

Answer: evens

Tip: Exactly $\frac{1}{2}$ is “evens”, not “likely”. “Likely” means more than $\frac{1}{2}$.

- (b) Choose the word that best describes the probability that Theo takes a red ball.
- impossible unlikely evens likely certain

Only 1 of the 10 balls is red.

$$P(\text{red}) = \frac{1}{10}$$

$\frac{1}{10}$ is more than 0 but less than $\frac{1}{2}$.

Answer: unlikely

- (c) Choose the word that best describes the probability that Theo takes a blue ball.

impossible unlikely evens likely certain

There are no blue balls in the bag.

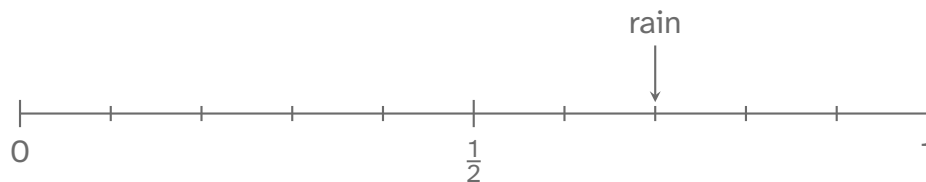
So it cannot happen.

Answer: impossible

2 (2 marks)

The arrow on this probability scale shows the probability that it will rain tomorrow in a town.

The scale is marked in steps of 0.1



- (a) Choose the word that best describes the probability that it will rain tomorrow.

impossible unlikely evens likely certain

The arrow is at 0.7

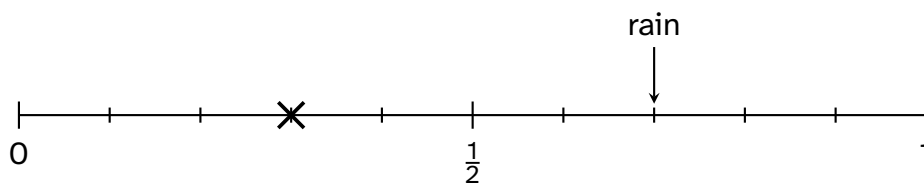
0.7 is more than $\frac{1}{2}$ but less than 1.

Answer: likely

- (b) On the probability scale, mark with a cross (x) the probability that it will **not** rain tomorrow.

It either rains or it does not, so the two probabilities add up to 1.

$$P(\text{not rain}) = 1 - 0.7 = 0.3$$



Answer: Cross at 0.3

Tip: The cross for “not rain” is the same distance from 0 as the arrow is from 1.

3 (2 marks)

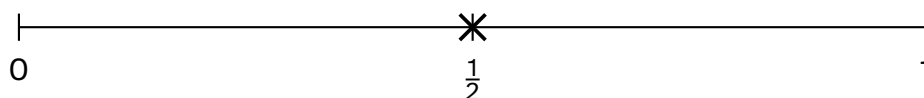
Tom throws a fair coin and rolls an ordinary fair dice.

- (a) On the probability scale below, mark with a cross (x) the probability that the coin lands on tails.

Heads and tails are equally likely.

$$P(\text{tails}) = \frac{1}{2}$$

So the cross goes exactly halfway.



Answer: Cross at $\frac{1}{2}$

- (b) On the probability scale below, mark with a cross (x) the probability that the dice lands on a multiple of 3

The multiples of 3 on a dice are 3 and 6

$$P(\text{multiple of 3}) = \frac{2}{6} = \frac{1}{3}$$

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



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

Tip: Work out the probability as a number first, then mark it. $\frac{1}{3}$ is less than $\frac{1}{2}$, so the cross must be to the left of the middle.

4 (3 marks)

The table shows the fruit in a bowl.

Fruit	apple	banana	orange	pear
Number	6	4	5	5

Mo takes at random a piece of fruit from the bowl.

- (a) Write down the probability that Mo takes an orange.

Total pieces of fruit: $6 + 4 + 5 + 5 = 20$

5 of them are oranges.

Answer: $\frac{5}{20}$ (or $\frac{1}{4}$)

- (b) Write down the probability that Mo does **not** take an apple.

The fruit that is not an apple: $4 + 5 + 5 = 14$ pieces.

So 14 of the 20 pieces are not apples.

Answer: $\frac{14}{20}$ (or $\frac{7}{10}$)

Tip: Read the question carefully: it asks for **not** an apple. $\frac{6}{20}$ is the probability of an apple.

- (c) Write down the probability that Mo takes a plum.

There are no plums in the bowl.

So it is impossible, and the probability is 0.

Answer: 0

Tip: Write the number 0. The word “impossible” or 0:20 does not get the mark.

5 (2 marks)

Each letter of the word PROBABILITY is written on a card.
One of the cards is taken at random.

- (a) Write down the probability that the letter is B.

P, R, O, B, A, B, I, L, I, T, Y has 11 letters.

2 of the letters are B.

Answer: $\frac{2}{11}$

- (b) Write down the probability that the letter is **not** I.

2 of the letters are I.

So $11 - 2 = 9$ letters are not I.

Answer: $\frac{9}{11}$

6 (2 marks)

A fair 5-sided spinner has sections labelled 2, 3, 3, 5 and 8

- (a) Write down the probability that the spinner lands on an odd number.

The spinner has 5 equal sections.

The odd numbers are 3, 3 and 5

That is 3 of the 5 sections.

Answer: $\frac{3}{5}$

(b) Jake says,

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

Is Jake correct?

You must give a reason for your answer.

The even numbers are 2 and 8

So $P(\text{even}) = \frac{2}{5}$

From part (a), $P(\text{odd}) = \frac{3}{5}$

$\frac{2}{5}$ is less than $\frac{3}{5}$, so even is **less** likely than odd.

Answer: No, $\frac{2}{5} < \frac{3}{5}$

Tip: Give both probabilities as numbers and compare them. Just saying “there are more odd numbers” may not be enough.

7 (3 marks)

There are 40 tiles in a bag.

25% of the tiles are red.

$\frac{1}{8}$ of the tiles are blue.

9 of the tiles are white.

The rest of the tiles are black.

Zainab takes at random a tile from the bag.

Work out the probability that the tile is black.

Red tiles: 25% of 40 = $40 \div 4 = 10$

Blue tiles: $\frac{1}{8}$ of 40 = $40 \div 8 = 5$

White tiles: 9

Black tiles are the rest: $40 - 10 - 5 - 9 = 16$

$P(\text{black}) = \frac{16}{40}$

This simplifies to $\frac{2}{5}$.

Answer: $\frac{16}{40}$ (or $\frac{2}{5}$)

Tip: Change the percentage and the fraction into numbers of tiles first, then take them all away from 40.

Marks: 1 mark for 10 red or 5 blue. 1 mark for 16 black. 1 mark for $\frac{16}{40}$ or an equivalent.

8 (3 marks)

Nia can play one of two games at a school fair.

Spinner game: a fair spinner has 12 equal sections. 3 of the sections say WIN.

Card game: there are 40 cards face down. 9 of the cards say WIN. Nia takes one card at random.

Which game gives Nia the greater probability of winning?

You must show how you get your answer.

Spinner game: $P(\text{win}) = \frac{3}{12} = 0.25$

Card game: $P(\text{win}) = \frac{9}{40} = 0.225$

0.25 is bigger than 0.225.

Answer: The spinner game ($0.25 > 0.225$)

Tip: The card game has more winning cards, but that does not make it more likely. Compare the probabilities, e.g. as decimals or percentages.

Marks: 1 mark for $\frac{3}{12}$ or $\frac{9}{40}$. 1 mark for both written in a form you can compare (decimals, percentages or a common denominator). 1 mark for the spinner game with correct values.

9 (3 marks)

A box contains 30 chocolates.

12 of the chocolates are milk chocolates.

The rest are dark or white chocolates.

There are twice as many dark chocolates as white chocolates.

A chocolate is taken at random.

Work out the probability that it is a white chocolate.

Dark and white together: $30 - 12 = 18$ chocolates.

Twice as many dark as white means dark : white = 2:1

That is $2 + 1 = 3$ equal parts.

One part: $18 \div 3 = 6$

So there are 6 white (and 12 dark).

$$P(\text{white}) = \frac{6}{30} = \frac{1}{5}$$

Answer: $\frac{6}{30} = \frac{1}{5}$

Tip: "Twice as many" splits the 18 into 3 parts, not 2. Check: 12 dark is twice 6 white, and $12 + 6 = 18$.

Marks: 1 mark for 18. 1 mark for 6 white. 1 mark for $\frac{6}{30}$ or an equivalent.

10 (2 marks)

A bag contains 8 blue counters and some red counters.

A counter is taken at random.

The probability that the counter is blue is $\frac{2}{5}$

Work out the number of red counters in the bag.

$\frac{2}{5}$ of the counters are blue, and there are 8 blue counters.

So $\frac{2}{5}$ of the total is 8.

$\frac{1}{5}$ of the total is $8 \div 2 = 4$.

The total is $4 \times 5 = 20$ counters.

Red counters: $20 - 8 = 12$

Answer: 12

Marks: 1 mark for 20 counters in total. 1 mark for 12.

11 (4 marks)

There are 18 green counters and 12 yellow counters in a bag.

Leo puts some more green counters and some more yellow counters in the bag.

He puts in twice as many yellow counters as green counters.

Leo is then going to take at random a counter from the bag.

The probability that the counter will be green is now $\frac{1}{2}$

How many yellow counters did Leo put in the bag?

You must show all your working.

$P(\text{green}) = \frac{1}{2}$ means there are the same number of green and yellow counters.

At the start there are $18 - 12 = 6$ more green counters than yellow counters.

For every green counter Leo adds, he adds 2 yellow counters, so each set closes the gap by 1.

He needs to close a gap of 6, so he adds 6 green and $6 \times 2 = 12$ yellow counters.

Check: green $18 + 6 = 24$, yellow $12 + 12 = 24$, so $P(\text{green}) = \frac{24}{48} = \frac{1}{2}$ ✓

Answer: 12

Tip: Check your answer by working out the new probability. It must come to exactly $\frac{1}{2}$.

Marks: 1 mark for seeing that green and yellow must be equal. 1 mark for a gap of 6 (or a correct trial). 1 mark for 6 green added. 1 mark for 12 yellow.
