



eClassroom

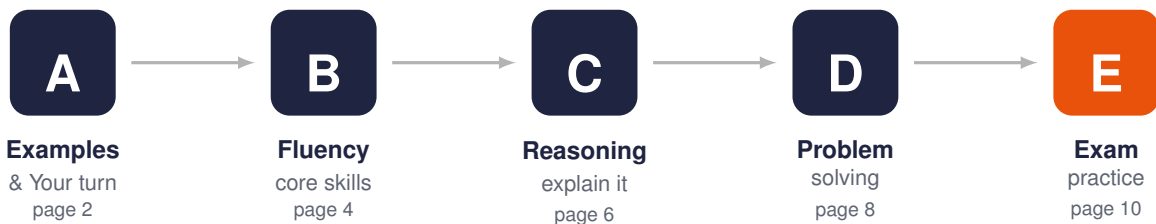
GCSE MATHEMATICS • PROBABILITY

Basic Probability

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • No calculator

Free Basic Probability worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: use the probability scale and write probabilities as fractions or decimals • find probabilities of equally likely outcomes • use the fact that probabilities add up to 1 • *Higher*: probability tables with algebra, spinner angles, totals from probabilities and probabilities from areas.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER The same skills where Higher papers use them: algebra in probability tables, spinner angles, totals from probabilities, areas and equations. Grades 6 to 9.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	23	10	14	16
Higher marks	16	14	17	14
My score				

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A**Worked examples & Your turn**

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION*Everyone starts here***Worked example A1**

A letter is chosen at random from the word PROBABILITY. Work out the probability that it is B.

Count all the letters, then the B's.

11 letters, and 2 of them are B

$$\frac{2}{11}$$

Your turn A1

A letter is chosen at random from the word STATISTICS. Work out the probability that it is T.

Worked example A2

A spinner can land on red, blue or green.

$P(\text{red}) = 0.15$ and $P(\text{blue}) = 0.4$. Find $P(\text{green})$.

The probabilities of all the outcomes add up to 1

$$1 - 0.15 - 0.4 = 0.45$$

$$0.45$$

Your turn A2

A team can win, draw or lose a match.

$P(\text{win}) = 0.28$ and $P(\text{draw}) = 0.35$. Find $P(\text{lose})$.

Worked example A3

A bag holds only red and blue counters. $P(\text{red}) = \frac{2}{5}$. There are 18 blue counters. How many red counters are there?

Blue is $\frac{3}{5}$ of the counters, and $\frac{3}{5}$ is 18

$\frac{1}{5}$ is 6, so the total is 30 $30 - 18 = 12$

$$12$$

Your turn A3

A bag holds only red and blue counters. $P(\text{blue}) = 0.35$. There are 26 red counters. How many blue counters are there?



HIGHER*Higher strategies: these are new ways of thinking, not longer sums***Worked example A4: algebra in a probability table**

The probabilities of A, B, C and D are x , $2x$, 0.3 and 0.1 . Find $P(B)$.

Add them and set the total equal to 1

$$3x + 0.4 = 1, \text{ so } x = 0.2 \quad 2 \times 0.2 = 0.4$$

0.4

Your turn A4

The probabilities of A, B, C and D are x , $x + 0.1$, $3x$ and 0.25 . Find $P(C)$.

Worked example A5: spinner angles

A spinner has three sectors with angles 120° , x° and $2x^\circ$. Find the probability it lands on the $2x^\circ$ sector.

The angles add up to 360°

$$3x = 240, \text{ so } x = 80 \quad \frac{160}{360} = \frac{4}{9}$$

$\frac{4}{9}$

Your turn A5

A spinner has sectors with angles x° , $(x + 40)^\circ$, $2x^\circ$ and 80° . Find the probability it lands on the largest sector.

Worked example A6: a difference gives the total

A bag holds red, blue and green counters. $P(\text{red}) = 0.3$ and $P(\text{blue}) = 0.45$. There are 12 more blue than red. How many green?

$0.45 - 0.3 = 0.15$ of the total is 12, so the total is 80

$$P(\text{green}) = 0.25 \quad 0.25 \times 80 = 20$$

20

Your turn A6

$P(A) = 0.15$, $P(B) = 0.55$ and the only other outcome is C. In some trials, B happened 28 times more than A. How many times did C happen?

Worked example A7: probability from areas

A point is chosen at random inside a square of side 10 cm. A square of side 4 cm inside it is shaded. Find the probability that the point is in the shaded square.

Probability = shaded area $\div$ total area

$$\frac{16}{100} = \frac{4}{25}$$

$\frac{4}{25}$

Your turn A7

A point is chosen at random inside a square of side 6 cm. A circle of radius 3 cm fits exactly inside it. Find the probability that the point is inside the circle.



B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION*Everyone starts here*

B1 A fair six-sided dice is rolled. Find the probability of rolling

- (a) a 4 (b) an even number (c) more than 4 (d) a 7

[4 marks]

B2 Twelve cards are numbered 1 to 12. One card is chosen at random. Find the probability that the number is

- (a) a multiple of 5 (b) a prime number (c) a square number (d) not a factor of 12

[4 marks]

B3 Find the probability that each event does **not** happen.

- (a) $P(A) = 0.3$ (b) $P(A) = \frac{3}{8}$ (c) $P(A) = 45\%$ (d) $P(A) = 1$

[4 marks]

B4 Each table shows every possible outcome. Find the missing probability.

- (a) 0.2, 0.3, ? (b) 0.1, 0.25, 0.3, ? (c) $\frac{1}{4}, \frac{1}{3}, ?$ (d) 0.2, x, x Find x

[4 marks]

B5 Choose from: impossible, unlikely, evens, likely, certain

- (a) Rolling a 7 on an ordinary dice (b) A fair coin landing on heads
(c) A day after Sunday being Monday (d) Rolling a number less than 6 on an ordinary dice

[4 marks]

B6 (a) A bag of 20 counters has $P(\text{red}) = \frac{1}{4}$. How many red counters are there?

(b) A bag holds only red and blue counters. $P(\text{red}) = \frac{1}{4}$ and there are 15 blue. How many red?

(c) A bag holds 12 red cubes, and $P(\text{red}) = 0.2$. $P(\text{blue}) = 0.4$. How many blue cubes are there?

[3 marks]



HIGHER*Higher tier only*

B7 Each list gives the probabilities of all the outcomes. Find x

- (a) $x, x, 0.4$ (b) $x, 2x, 3x, 0.4$ (c) $0.1, x, x+0.2, 2x$ (d) $x, 2x, \frac{1}{4}$ [4 marks]

B8 (a) A spinner has sectors of 90° and 120° , and one more sector. Find the probability of landing on the third sector.

(b) A spinner has sectors of x° , $2x^\circ$ and $3x^\circ$. Find the probability of landing on the largest sector.

(c) A spinner has sectors of x° , $(x+60)^\circ$ and $2x^\circ$. Find the probability of landing on the $(x+60)^\circ$ sector.

(d) The probability of landing on a sector is 0.35. Find the angle of the sector. [4 marks]

B9 (a) $P(A) = 0.2$ and $P(B) = 0.5$. In 60 trials, how many more times would you expect B than A?

(b) $P(A) = 0.2$ and $P(B) = 0.5$. B happened 15 more times than A. How many trials were there?

(c) A bag holds only red and blue counters, and $P(\text{red}) = \frac{3}{8}$. There are 9 more blue than red. How many counters?

(d) A bag holds only red and blue counters, and $P(\text{red}) = 0.45$. There are 18 fewer red than blue. How many counters? [4 marks]

B10 A point is chosen at random inside the larger shape. Find the probability that it lands in the smaller region.

(a) a 5 cm square inside a 10 cm square (b) a circle of radius 2 cm inside a 4 cm square

(c) a 3 cm by 8 cm rectangle inside a 12 cm by 10 cm rectangle (d) the ring between circles of radius 1 cm and 3 cm, inside the larger circle [4 marks]



C

Reasoning

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** A bag holds 3 red counters and 5 blue counters. Jo says, “The probability of red is $\frac{3}{5}$ ”

Explain Jo’s mistake, and write down the correct probability.

[2 marks]

- C2** A spinner has four colours. Sam says, “The probability of landing on red must be $\frac{1}{4}$ ”

Explain why Sam might be wrong.

[2 marks]

- C3** A spinner can land on red, blue or green. Ali writes this table.

Colour	red	blue	green
Probability	0.4	0.35	0.3

(a) Explain why Ali’s table must be wrong.

(b) The values for red and blue are correct. Find the probability of green.

[3 marks]

- C4** Bag A holds 3 red and 5 blue counters. Bag B holds 5 red and 9 blue counters.

Ali wants the bag that gives the better chance of picking a red counter. Show that he should choose Bag A.

[3 marks]



HIGHER*Higher tier only*

- C5** The probabilities of the four outcomes of a game are x , $2x$, $3x$ and 0.5 .
Kim says, " $x = 0.2$ ". Show that Kim is wrong, and find the correct value of x . [3 marks]
- C6** A fair coin is thrown 30 times.
(a) Tom says, "It will land on heads exactly 15 times." Explain why Tom is wrong.
(b) The coin lands on heads the first 5 times. Mia says, "The next throw is more likely to be tails." Explain why Mia is wrong. [3 marks]
- C7** A bag holds r red counters and b blue counters, and nothing else.
Prove that $P(\text{red}) + P(\text{blue}) = 1$ [3 marks]
- C8** Cards are numbered 1 to n . A card is chosen at random.
The probability that the number on the card is a square number is $\frac{1}{5}$
Find all the possible values of n . You must show that there are no others. [5 marks]



D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** A box of chocolates has 8 milk chocolates, 6 dark chocolates and some white chocolates.
A chocolate is taken at random. The probability that it is white is $\frac{1}{3}$
How many white chocolates are in the box? [3 marks]
- D2** Thirty cards are numbered 1 to 30. One card is chosen at random.
(a) Find the probability that the number contains the digit 2
(b) Find the probability that the digits of the number add up to 7 [4 marks]
- D3** A fair spinner has eight equal sectors numbered 1, 2, 2, 3, 4, 5, 6, 6
Sam wins if it lands on an even number. Jo wins if it lands on an odd number.
Is the game fair? You must show your working. [3 marks]
- D4** Here are ten cards.
- | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 3 | 4 | 5 | 5 | 5 | 6 | 8 |
|---|---|---|---|---|---|---|---|---|---|
- One card is chosen at random.
(a) Find the probability that the number is odd.
(b) Find the probability that the number is greater than the mean of all ten numbers. [4 marks]



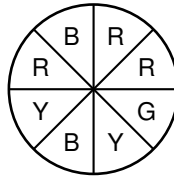
HIGHER*Higher tier only*

- D5** A spinner has three sectors, red, blue and green.
 $P(\text{red}) : P(\text{blue}) : P(\text{green}) = 2 : 3 : 4$
Work out the angle of each sector. [4 marks]
- D6** A bag holds $3x$ red counters, $(2x + 5)$ blue counters and 10 green counters.
The probability of picking a green counter is $\frac{1}{5}$. Find the probability of picking a red counter. [4 marks]
- D7** An integer x is chosen at random from the integers -5 to 5 inclusive.
Find the probability that $x^2 - 3x - 4 < 0$ [4 marks]
- D8** A game has only three outcomes, A, B and C.
 $P(A) = \frac{2}{x+1}$, $P(B) = \frac{3}{x+3}$, $P(C) = \frac{7}{24}$
(a) Show that $17x^2 - 52x - 165 = 0$
(b) Find $P(A)$ [5 marks]



E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION*Foundation and Higher crossover***E1** Here is a fair spinner with eight equal sectors.

R = red, B = blue, Y = yellow, G = green

(a) Find the probability that the spinner lands on red.

.....
(1)

(b) Find the probability that the spinner does not land on green.

.....
(1)

(c) Which colour is the spinner least likely to land on?

.....
(1)

(Total for Question E1 is 3 marks)**E2** A spinner can land on red, blue, green or yellow. The table shows some of the probabilities.

Colour	red	blue	green	yellow
Probability	0.25	0.3		0.15

(a) Work out the probability that the spinner lands on green.

.....
(2)

(b) Work out the probability that the spinner does not land on red.

.....
(1)

(Total for Question E2 is 3 marks)

- E3** A bag holds only red and blue counters. The probability of picking a red counter is $\frac{3}{8}$
There are 15 blue counters in the bag. How many red counters are in the bag?

.....

(Total for Question E3 is 3 marks)

- E4** 80 students each study one language. The two-way table shows some information.

	French	Spanish	German	Total
Boys	12		9	36
Girls		23	8	
Total	25			80

- (a)** Complete the two-way table.

(2)

- (b)** A student is chosen at random. Find the probability that the student is a girl who studies French.

.....

(1)

(Total for Question E4 is 3 marks)

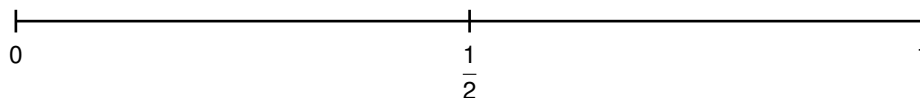
- E5** The probability that it rains tomorrow is 0.3. The probability that it snows tomorrow is 0.2
Kim says, "So the probability that it neither rains nor snows tomorrow is 0.5"
Explain why Kim may be wrong.

(Total for Question E5 is 2 marks)



E6 A fair ten-sided dice is numbered 1 to 10. It is rolled once.

On the probability scale, mark with A the probability that the dice shows an even number, and mark with B the probability that it shows a number less than 3



(Total for Question E6 is 2 marks)

HIGHER

Higher tier only

E7 The table shows the probabilities for a biased four-sided spinner.

Number	1	2	3	4
Probability	$2x$	$3x$	$x + 0.1$	0.3

Work out the probability that the spinner lands on 2

(Total for Question E7 is 3 marks)

E8 A spinner has four sectors: red 90° , blue x° , green $2x^\circ$ and yellow $(x + 30)^\circ$

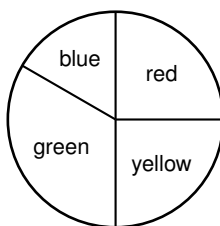


Diagram NOT accurately drawn

Work out the probability that the spinner lands on green.

(Total for Question E8 is 3 marks)



E9 A bag holds red, white and blue counters only. $P(\text{red}) = 0.35$ and $P(\text{white}) = 0.25$

There are 18 more blue counters than white counters. Work out the number of red counters in the bag.

.....
(Total for Question E9 is 3 marks)

E10 A rectangular target measures $(x+2)$ cm by $(x+4)$ cm. A square of side x cm on the target is shaded.

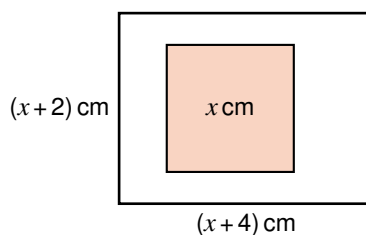


Diagram NOT accurately drawn

A dart lands at random on the target. The probability that it lands on the shaded square is $\frac{1}{3}$

(a) Show that $x^2 - 3x - 4 = 0$

(3)

(b) Work out the area of the target.

..... cm^2

(2)

(Total for Question E10 is 5 marks)

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