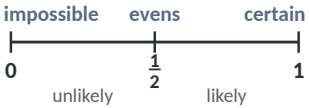
Probability: fact sheet

Planner week 3 · Learn these facts

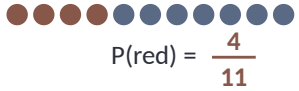
The probability scale



Every probability is between **0** and **1**

Fair coin: P(head) = $\frac{1}{2}$

Probability of one event



Number of ways it can happen ÷ total number

4 red out of 11 counters

Not happening

P(late) = 0.13

P(not late) = 1 − 0.13 = 0.87

P(not A) = 1 − P(A)

P(not blue) = 1 − P(blue)

Adding to 1

red 0.2 · blue 0.4 · green ?

1 − 0.2 − 0.4 = 0.4

all the probabilities add to 1

Find a missing probability in a table

Use 1 − the others

Which sheet do I need?

Probability of single events ▸
one thing happens: a spinner, a bag

Probability tables, relative frequency and expected results ▸
a table, "how many times would you expect"

Listing outcomes ▸
"list all the possible outcomes"

Probability tree diagrams ▸
two events, a tree diagram

Key words

- **Outcome** one thing that can happen
- **Event** the outcome(s) you are interested in
- **Trial** one go of the experiment
- **Estimate** use probability × number of goes

Expected results

P(6) = 0.3, rolled 200 times

0.3 × 200 = 60 times

Probability × number of goes

Fair coin 50 times: 25 heads

Listing outcomes

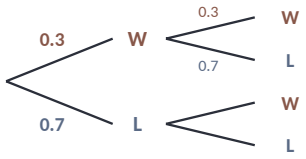
H1	H2	H3
T1	T2	T3

coin and 3-sided spinner: 6 outcomes

Be systematic: fix the first, change the second

2 × 3 = 6 outcomes

Tree diagrams



Multiply along the branches

P(win, win) = 0.3 × 0.3 = 0.09

Words to know

Fair	all equally likely
Biased	not fair
At random	same chance each
Rel. freq.	successes ÷ trials

Exam tips

- Write probabilities as **fractions, decimals or percentages**, never as "4 out of 11" or 4 : 11.
- A probability can never be **more than 1**.
- On a scale, "impossible" is 0 and "certain" is 1.
- More trials give a **better estimate**.
- Tree diagrams: each **pair** of branches adds up to 1.
- "And" → multiply along the branches.

Probability of single events: fact sheet

Probability · Planner week 3 · Learn the method

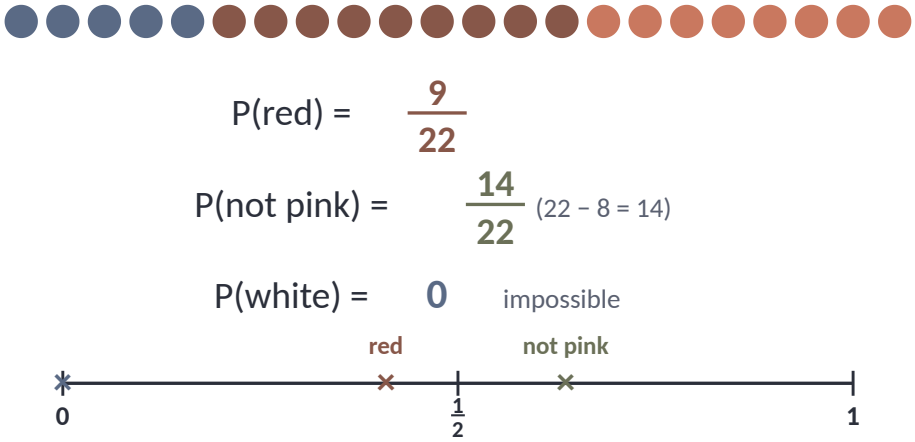
Worked example

QUESTION

A bag has 5 blue, 9 red and 8 pink counters. One counter is taken at random.

(a) Find P(red). (b) Find P(not pink). (c) Find P(white).

ANSWER



$$P(\text{red}) = \frac{9}{22}$$

$$P(\text{not pink}) = \frac{14}{22} \quad (22 - 8 = 14)$$

$$P(\text{white}) = 0 \quad \text{impossible}$$

Count the ways it can happen, and the total.

How to do it

1. Count how many ways the event can happen.
2. Count the **total** number of outcomes.
3. Write it as a fraction: ways ÷ total.
4. P(not happening) = 1 − P(happening).
5. On a scale: 0 impossible, $\frac{1}{2}$ evens, 1 certain.
6. To compare two options, turn both into decimals.

Model answer:

$$P(\text{red}) = \frac{9}{22}$$

Watch out

- Writing 9 out of 22 or 9 : 22.
- Using the wrong total (count **every** counter).
- Thinking 3 sections means $\frac{1}{3}$ each: are the sections the same size?

Probability tables, relative frequency and expected results: fact sheet

Probability · Planner week 3 · Learn the method

Worked example

QUESTION

A spinner can land on 1, 2, 3 or 4. The table shows the probabilities.

(a) Find the probability it lands on 2. (b) The spinner is spun 60 times. Estimate how many times it lands on 1.

Number	1	2	3	4
Probability	0.2		0.4	0.1

ANSWER

1. (a) The probabilities add up to 1.
2. $1 - (0.2 + 0.4 + 0.1) = 1 - 0.7 = 0.3$
3. (b) Expected number = probability × number of spins
4. $0.2 \times 60 = 12$

(a) 0.3 (b) 12 times

Missing probability, expected number, relative frequency.

How to do it

1. The probabilities in a table add up to **1**: subtract the ones you know.
2. Expected number = probability × number of trials.
3. Relative frequency = number of successes ÷ number of trials.
4. More trials give a better estimate.
5. If you know how many of one colour there are: total = number ÷ probability (18 ÷ 0.15 = 120).

Model answer:

0.3 and 12 times

Watch out

- Adding instead of subtracting from 1.
- Dividing instead of multiplying for an estimate.
- Choosing the person with fewer trials.

Listing outcomes: fact sheet

Probability · Planner week 3 · Learn the method

Worked example

QUESTION

A coin is thrown three times.

List all the possible outcomes. Use H for heads and T for tails.

ANSWER

1. Start with H first: HHH, HHT, HTH, HTT
2. Then T first: THH, THT, TTH, TTT
3. Check: 2 × 2 × 2 = 8 outcomes ✓

HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

Work in a fixed order so you don’t miss any.

How to do it

1. Fix the first item and list every option for the second.
2. Then move on to the next first item.
3. Check: number of outcomes = options × options (× options).
4. Use the table given if there is one.
5. For a probability: count the outcomes you want ÷ total outcomes.

Model answer:

HHH, HHT, HTH, HTT, THH, THT, TTH, TTT

Watch out

- Missing outcomes by listing randomly.
- Writing the same outcome twice.
- Forgetting that HT and TH are different.

Probability tree diagrams: fact sheet

Probability · Planner week 3 · Learn the method

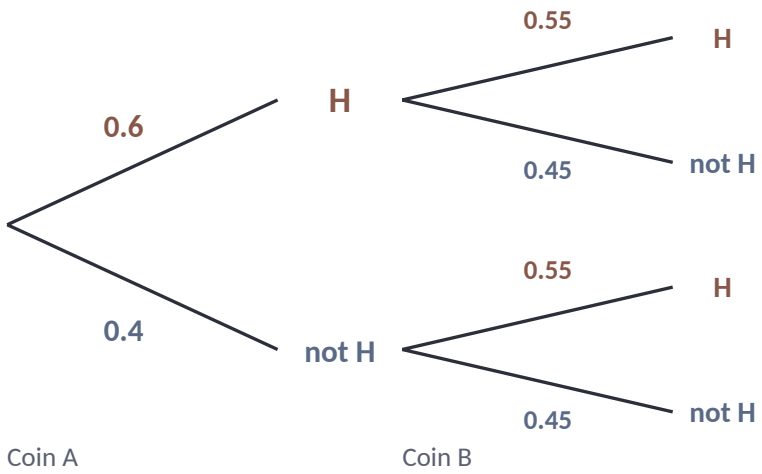
Worked example

QUESTION

The probability that coin A lands on heads is 0.6. The probability that coin B lands on heads is 0.55.
Both coins are thrown. Complete the tree diagram, then work out the probability that both coins land on heads.

ANSWER

1. Each pair of branches adds up to 1: 1 − 0.6 = 0.4 and 1 − 0.55 = 0.45
2. For "and", multiply along the branches: 0.6 × 0.55



P(both heads) = 0.33

Multiply along the branches for “and”.

How to do it

1. Write the probabilities on each branch.
2. Each **pair** of branches adds up to 1 (0.6 and 0.4).
3. Independent events: the second set of branches is the same each time.
4. For “A and B”, **multiply** along the branches.
5. For more than one route, add the answers for each route.

Model answer:

P(both heads) = 0.33

Watch out

- Adding along the branches instead of multiplying.
- Branches that don’t add up to 1.
- Forgetting to fill in **every** branch.