

Tree Diagrams

Solutions

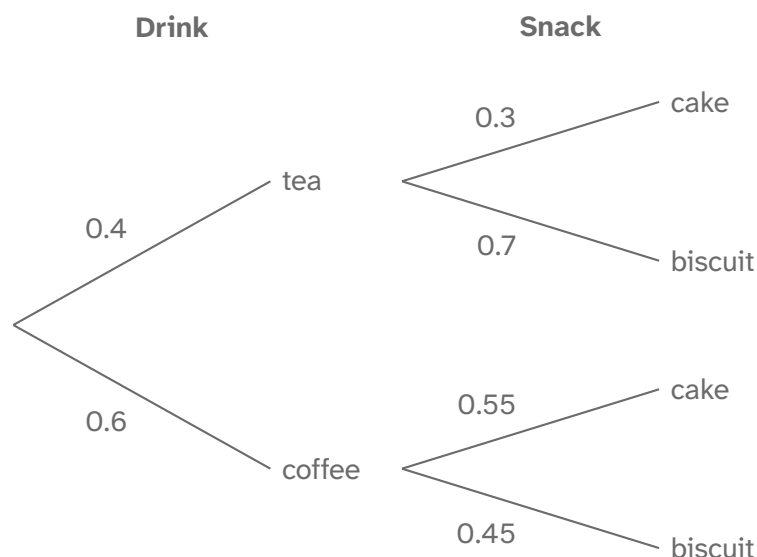
For Pearson Edexcel GCSE Mathematics (1MA1) • Foundation tier

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 (2 marks)

Tomi buys a drink and a snack at a café.

The probability tree diagram shows the probabilities of what he buys.



Work out the probability that Tomi buys coffee and a biscuit.

Follow the branches: coffee, then biscuit.

Multiply along the branches: 0.6×0.45

$6 \times 45 = 270$, so $0.6 \times 0.45 = 0.27$

Answer: 0.27

Tip: Use the biscuit branch that comes after coffee (0.45), not the one after tea (0.7).

Marks: 1 mark for 0.6×0.45 . 1 mark for 0.27.

2 (7 marks)

Amy takes a theory test and a practical test.

The probability that she passes the theory test is 0.6

The probability that she passes the practical test is 0.8

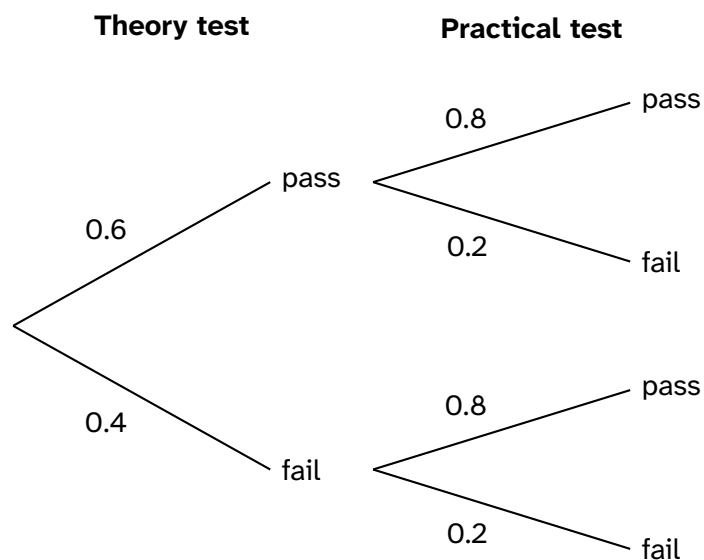
The two tests are independent.

(a) Complete the probability tree diagram.

Each pair of branches adds up to 1.

Fail theory: $1 - 0.6 = 0.4$

Fail practical: $1 - 0.8 = 0.2$ (on both pairs, as the tests are independent)



Answer: 0.4, 0.2, 0.2

Marks: 1 mark for 0.4. 1 mark for 0.2 on both second pairs.

(b) Work out the probability that Amy passes both tests.

Pass, then pass: multiply along the branches.

$$0.6 \times 0.8 = 0.48$$

Answer: 0.48

Marks: 1 mark for 0.6×0.8 . 1 mark for 0.48.

- (c) Work out the probability that Amy passes exactly one of the tests.

Exactly one pass can happen in two ways.

Pass theory, fail practical: $0.6 \times 0.2 = 0.12$

Fail theory, pass practical: $0.4 \times 0.8 = 0.32$

Add the two ways: $0.12 + 0.32 = 0.44$

Answer: 0.44

Tip: “Exactly one” has two paths: pass-fail and fail-pass. Find both and add them.

Marks: 1 mark for one correct product. 1 mark for adding both products. 1 mark for 0.44.

3 (4 marks)

Rhea plants two tomato seeds.

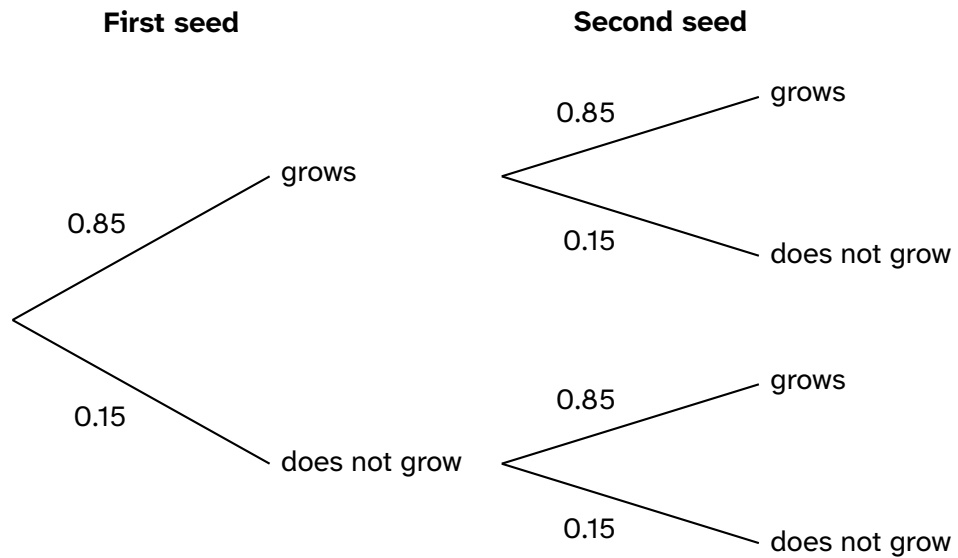
The probability that a seed grows is 0.85

The seeds grow independently.

- (a) Complete the probability tree diagram.

Does not grow: $1 - 0.85 = 0.15$

The probability is the same for each seed, so every pair is 0.85 and 0.15



Answer: 0.15; 0.85, 0.15; 0.85, 0.15

Tip: The second seed has the same probabilities as the first, in the same order, on both pairs.

Marks: 1 mark for 0.15 on the first pair. 1 mark for both second pairs correct.

- (b) Work out the probability that at least one of the seeds grows.

“At least one grows” is everything except “neither grows”.

Neither grows: $0.15 \times 0.15 = 0.0225$

At least one grows: $1 - 0.0225 = 0.9775$

Answer: 0.9775

Tip: “At least one” includes both seeds growing. The quickest way is $1 - P(\text{neither grows})$.

Marks: 1 mark for 0.15×0.15 (or for adding the three correct paths). 1 mark for 0.9775.

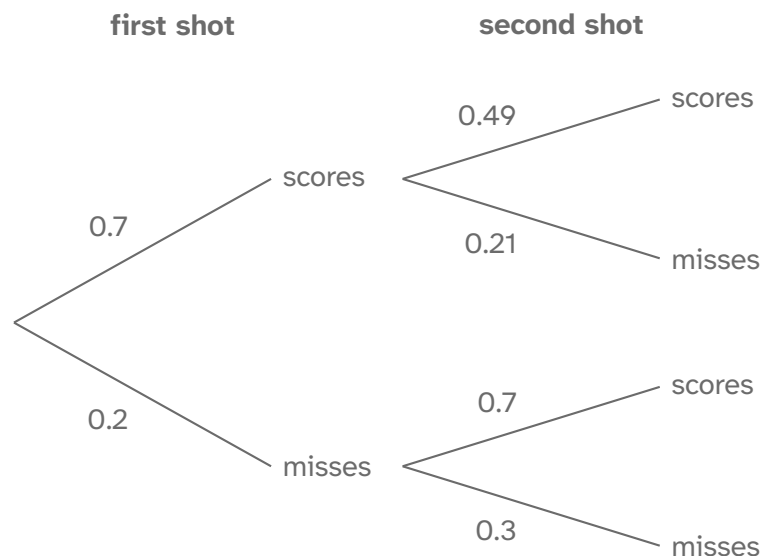
4 (2 marks)

Noor plays netball.

The probability that she scores with a shot is 0.7

Noor takes two shots.

Here is the tree diagram she draws to show the probabilities.



Noor has made **two** mistakes in her tree diagram.

Describe each mistake.

Error 1: on the first shot, the branches 0.7 and 0.2 do not add up to 1.

'misses' should be $1 - 0.7 = 0.3$.

Error 2: after 'scores', Noor has written 0.49 and 0.21.

These are the probabilities of whole paths (0.7×0.7 and 0.7×0.3), not of the second shot.

The second shot has the same probabilities as the first: 'scores' 0.7 and 'misses' 0.3.

Answer: Misses on the first shot should be 0.3 (not 0.2); after 'scores' the branches should be 0.7 and 0.3 (not 0.49 and 0.21)

Tip: On a tree diagram, each branch shows the probability for that stage only. You multiply along the branches when you work out an answer, not on the diagram.

Marks: 1 mark for each of two different correct errors.

5 (4 marks)

Ifeoma has two biscuit tins.

In tin *A* there are 6 plain biscuits and 4 chocolate biscuits.

In tin *B* there are 5 plain biscuits and 7 chocolate biscuits.

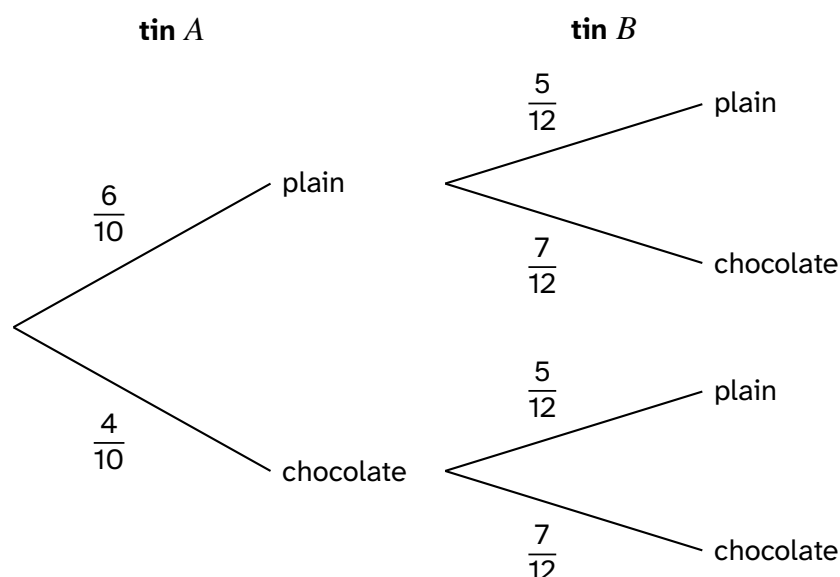
Ifeoma takes a biscuit at random from each tin.

(a) Complete the probability tree diagram.

Tin *A*: 6 plain and 4 chocolate, so chocolate = $\frac{4}{10}$

Tin *B*: 5 plain and 7 chocolate, 12 biscuits, so plain = $\frac{5}{12}$ and chocolate = $\frac{7}{12}$

Tin *B* is the same whatever comes from tin *A*, so both pairs are the same.



Answer: $\frac{4}{10}$; $\frac{5}{12}$, $\frac{7}{12}$ on each pair

Tip: Tin *B* has 12 biscuits, so its fractions are out of 12, not 10.

Marks: 1 mark for $\frac{4}{10}$. 1 mark for $\frac{5}{12}$ and $\frac{7}{12}$ on both pairs.

(b) Work out the probability that Ifeoma takes at least one chocolate biscuit.

“At least one chocolate” is everything except “plain, then plain”.

Plain, plain: $\frac{6}{10} \times \frac{5}{12} = \frac{30}{120}$

At least one chocolate: $1 - \frac{30}{120} = \frac{90}{120}$

This simplifies to $\frac{3}{4}$.

Answer: $\frac{90}{120} \left(= \frac{3}{4} \right)$

Marks: 1 mark for $\frac{6}{10} \times \frac{5}{12}$ (or for adding the three correct paths). 1 mark for $\frac{90}{120}$ or an equivalent.

6 (4 marks)

A spinner can land on green or white.

The probability that it lands on green is 0.25

Jack spins the spinner twice.

Work out the probability that it lands on the same colour both times.

You may draw a tree diagram to help you.

White: $1 - 0.25 = 0.75$

Same colour means green-green or white-white.

Green, green: $0.25 \times 0.25 = 0.0625$

White, white: $0.75 \times 0.75 = 0.5625$

Add: $0.0625 + 0.5625 = 0.625$

Answer: 0.625

Tip: "Same colour" has two paths. Do not forget white-white.

Marks: 1 mark for 0.75. 1 mark for one correct product. 1 mark for adding both products. 1 mark for 0.625.

7 (3 marks)

There are 4 red counters and 6 blue counters in a bag.

Sam takes at random a counter from the bag and does not replace it.

He then takes at random a second counter from the bag.

Show that the probability that both counters are the same colour is $\frac{7}{15}$

The first counter is not replaced, so there are 9 counters for the second pick.

Both red: $\frac{4}{10} \times \frac{3}{9} = \frac{12}{90}$

Both blue: $\frac{6}{10} \times \frac{5}{9} = \frac{30}{90}$

Same colour: $\frac{12}{90} + \frac{30}{90} = \frac{42}{90}$

Divide top and bottom by 6: $\frac{42}{90} = \frac{7}{15}$

Answer: $\frac{12}{90} + \frac{30}{90} = \frac{42}{90} = \frac{7}{15}$

Tip: No replacement: after taking a red, only 3 red are left out of 9. Using $\frac{4}{10}$ again is a common mistake.

Marks: 1 mark for $\frac{3}{9}$ or $\frac{5}{9}$. 1 mark for adding the two products. 1 mark for showing the answer is $\frac{7}{15}$.
