

Tree Diagrams

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)

Kofi travels to college by bus and then by train.

The probability that the bus is late is 0.15

The probability that the train is late is 0.2

The two events are independent.

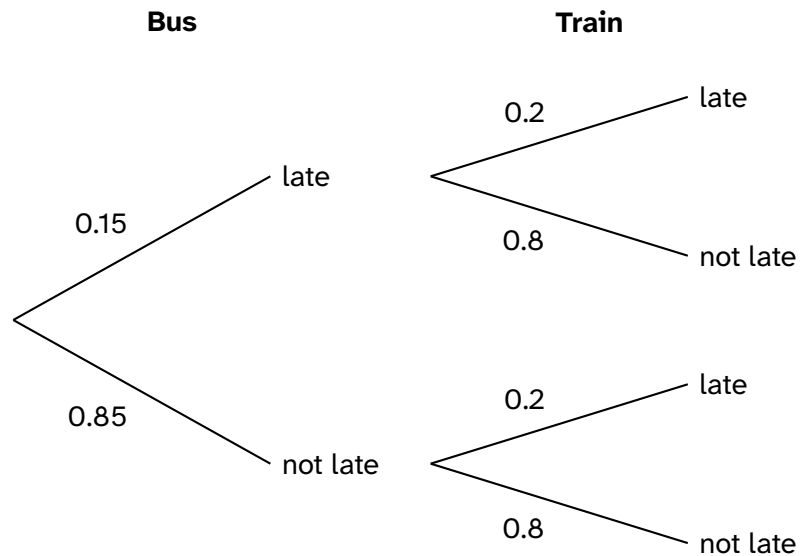
(a) Complete the tree diagram.

Each pair of branches adds up to 1.

Bus not late: $1 - 0.15 = 0.85$

Train late: 0.2. Train not late: $1 - 0.2 = 0.8$

The train does not depend on the bus, so both of the train's pairs are the same.



Answer: 0.85; 0.2, 0.8; 0.2, 0.8

Tip: $1 - 0.15 = 0.85$, not 0.95. Line up the decimal points when you subtract from 1.

Marks: 1 mark for 0.85. 1 mark for 0.2 and 0.8 on both of the train's pairs.

- (b) Work out the probability that neither the bus nor the train is late.

Follow the branches not late, then not late.

Multiply along the branches: $0.85 \times 0.8 = 0.68$

Answer: 0.68

Tip: Multiply along the branches, do not add. $0.85 + 0.8$ is more than 1, so it cannot be a probability.

2 (7 marks)

A bag contains 3 red counters and 7 blue counters.

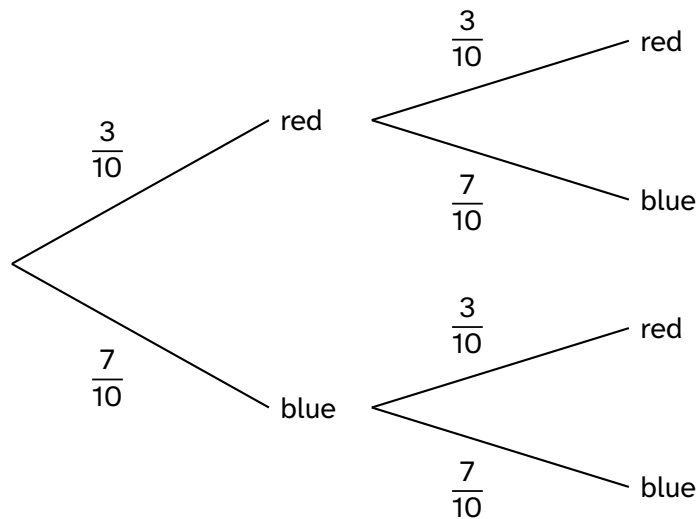
A counter is taken at random, its colour is recorded and it is put back.

A second counter is then taken at random.

- (a) Complete the tree diagram.

First pick: red $\frac{3}{10}$, blue $\frac{7}{10}$ (3 red and 7 blue out of 10).

The counter is put back, so the second pick has the same probabilities.



Answer: $\frac{7}{10}$; $\frac{3}{10}$, $\frac{7}{10}$ on each pair

Tip: Write probabilities on the branches (like $\frac{3}{10}$), not numbers of counters (like 3).

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

- (b) Work out the probability that both counters are red.

Red, then red: multiply along the branches.

$$\frac{3}{10} \times \frac{3}{10} = \frac{9}{100}$$

Answer: $\frac{9}{100}$

Marks: 1 mark for $\frac{3}{10} \times \frac{3}{10}$. 1 mark for $\frac{9}{100}$.

- (c) Work out the probability that the counters are different colours.

Different colours can happen in two ways: red then blue, or blue then red.

$$\text{Red, blue: } \frac{3}{10} \times \frac{7}{10} = \frac{21}{100}$$

$$\text{Blue, red: } \frac{7}{10} \times \frac{3}{10} = \frac{21}{100}$$

Add the two ways: $\frac{21}{100} + \frac{21}{100} = \frac{42}{100}$

Answer: $\frac{42}{100}$

Tip: Multiply **along** each path, then add the paths you want. Remember both orders: red-blue and blue-red.

Marks: 1 mark for one product. 1 mark for adding both products. 1 mark for $\frac{42}{100}$.

3 (5 marks)

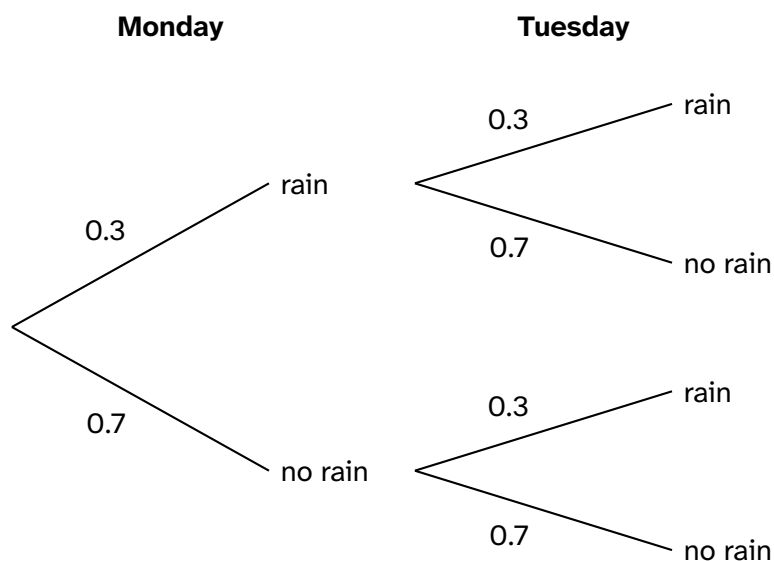
The probability that it rains on any day is 0.3

The tree diagram shows the possible outcomes for Monday and Tuesday.

(a) Complete the tree diagram.

No rain: $1 - 0.3 = 0.7$

The probability is the same every day, so every pair is 0.3 and 0.7



Answer: 0.7; 0.3, 0.7; 0.3, 0.7

Marks: 1 mark for 0.7 on the first pair. 1 mark for both second pairs.

(b) Work out the probability that it rains on at least one of the two days.

“At least one day” is everything except “no rain on either day”.

$$P(\text{no rain, no rain}) = 0.7 \times 0.7 = 0.49$$

$$P(\text{rain on at least one day}) = 1 - 0.49 = 0.51$$

(Or add the three paths: $0.09 + 0.21 + 0.21 = 0.51$.)

Answer: 0.51

Tip: “At least one” includes rain on **both** days. The quickest way is $1 - P(\text{no rain on either day})$.

Marks: 1 mark for 0.7×0.7 . 1 mark for $1 - 0.49$. 1 mark for 0.51.

4 (4 marks)

Bag *A* and bag *B* contain only red counters and white counters.

$\frac{2}{5}$ of the counters in bag *A* are red.

$\frac{1}{4}$ of the counters in bag *B* are red.

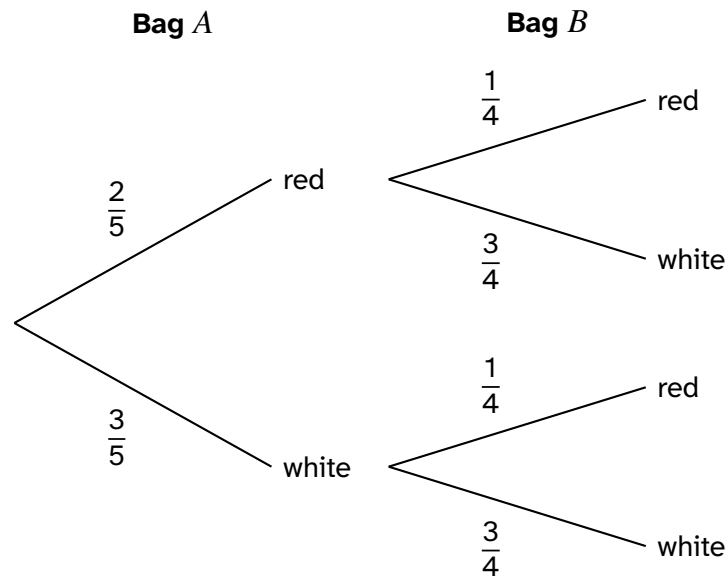
One counter is taken at random from each bag.

(a) Complete the tree diagram.

Bag *A*: red $\frac{2}{5}$, white $1 - \frac{2}{5} = \frac{3}{5}$

Bag *B*: red $\frac{1}{4}$, white $1 - \frac{1}{4} = \frac{3}{4}$

Bag *B* does not depend on bag *A*, so both of its pairs are the same.



Answer: $\frac{2}{5}$, $\frac{3}{5}$; $\frac{1}{4}$, $\frac{3}{4}$ on each pair

Marks: 1 mark for $\frac{2}{5}$ and $\frac{3}{5}$. 1 mark for $\frac{1}{4}$ and $\frac{3}{4}$ on both pairs.

- (b) Work out the probability that one counter is red and one is white.

One red and one white can happen in two ways.

Red from A , white from B : $\frac{2}{5} \times \frac{3}{4} = \frac{6}{20}$

White from A , red from B : $\frac{3}{5} \times \frac{1}{4} = \frac{3}{20}$

Add: $\frac{6}{20} + \frac{3}{20} = \frac{9}{20}$

Answer: $\frac{9}{20}$

Marks: 1 mark for $\frac{2}{5} \times \frac{3}{4} + \frac{3}{5} \times \frac{1}{4}$. 1 mark for $\frac{9}{20}$.

5 (6 marks)

Ines plays a game at a school fair.

She spins a fair spinner with 5 equal sections: 1 blue, 1 red and 3 green.

If it lands on blue she wins a prize.

If it lands on red she does not win a prize.

If it lands on green she takes a card at random from a pack of 10 cards.

3 of the 10 cards are gold. If she takes a gold card she wins a prize.

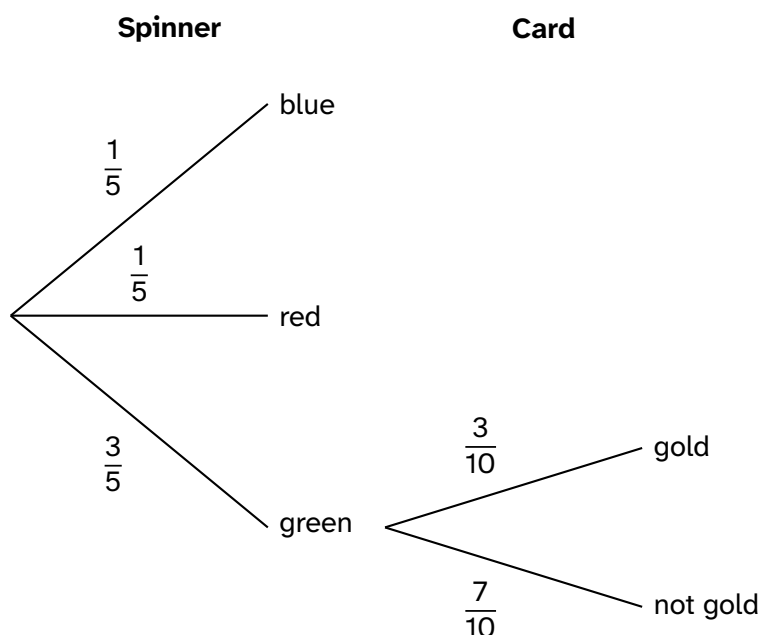
(a) Write the missing probabilities on the tree diagram.

Spinner: 1 of the 5 equal sections is red, so red = $\frac{1}{5}$

Spinner: 3 of the 5 sections are green, so green = $\frac{3}{5}$

Card: 3 of the 10 cards are gold, so gold = $\frac{3}{10}$

Card: $10 - 3 = 7$ are not gold, so not gold = $\frac{7}{10}$



Answer: $\frac{1}{5}, \frac{3}{5}, \frac{3}{10}, \frac{7}{10}$

Tip: The three spinner branches must add up to 1: $\frac{1}{5} + \frac{1}{5} + \frac{3}{5} = 1$. The card branches have a different denominator (10).

Marks: 2 marks for all four correct. 1 mark for two or three correct.

- (b) Work out the probability that Ines wins a prize.

Ines can win a prize in two ways.

Spinner lands on blue: $\frac{1}{5}$

Green, then a gold card: $\frac{3}{5} \times \frac{3}{10} = \frac{9}{50}$

Add the two ways: $\frac{1}{5} + \frac{9}{50} = \frac{10}{50} + \frac{9}{50} = \frac{19}{50}$

Answer: $\frac{19}{50}$

Tip: Only add the paths that end in a prize. Change to a common denominator before adding.

Marks: 1 mark for $\frac{3}{5} \times \frac{3}{10}$. 1 mark for adding $\frac{1}{5}$. 1 mark for $\frac{19}{50}$.

- (c) The game is played 200 times.

Work out an estimate for the number of times a prize is won.

Expected number = probability $\times$ number of games

$$\frac{19}{50} \times 200 = 19 \times 4 = 76$$

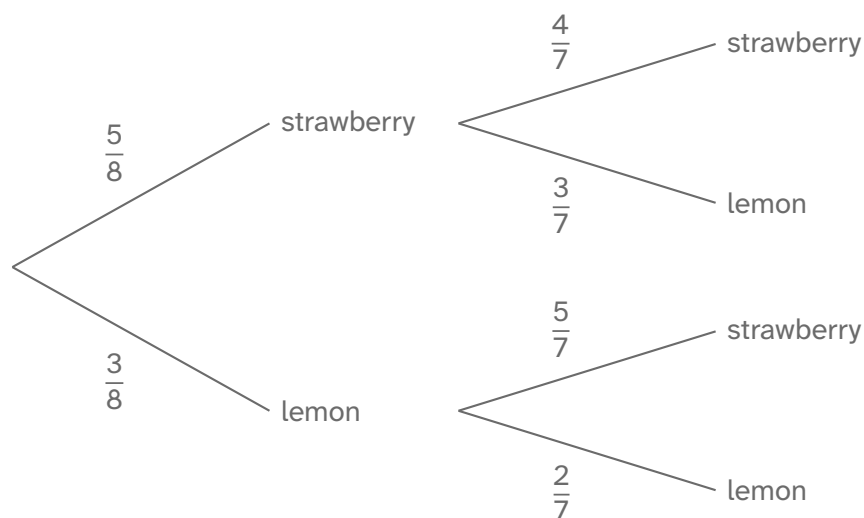
Answer: 76

6 (4 marks)

A bag has 5 strawberry sweets and 3 lemon sweets.

Jess takes a sweet at random and eats it.

She then takes another sweet at random and eats it.



You may complete the tree diagram to help you.

Work out the probability that the two sweets are the same flavour.

Jess eats the first sweet, so there are only 7 sweets left for the second pick.

If the first was strawberry, 4 strawberry and 3 lemon are left.

If the first was lemon, 5 strawberry and 2 lemon are left.

Both strawberry: $\frac{5}{8} \times \frac{4}{7} = \frac{20}{56}$

Both lemon: $\frac{3}{8} \times \frac{2}{7} = \frac{6}{56}$

Same flavour: $\frac{20}{56} + \frac{6}{56} = \frac{26}{56}$

Answer: $\frac{26}{56}$

Tip: The sweet is eaten, not put back. So the second pick is out of 7, and there is one fewer of the flavour taken first.

Marks: 1 mark for $\frac{4}{7}$ or $\frac{2}{7}$. 1 mark for one correct product. 1 mark for adding both products. 1 mark for $\frac{26}{56}$.