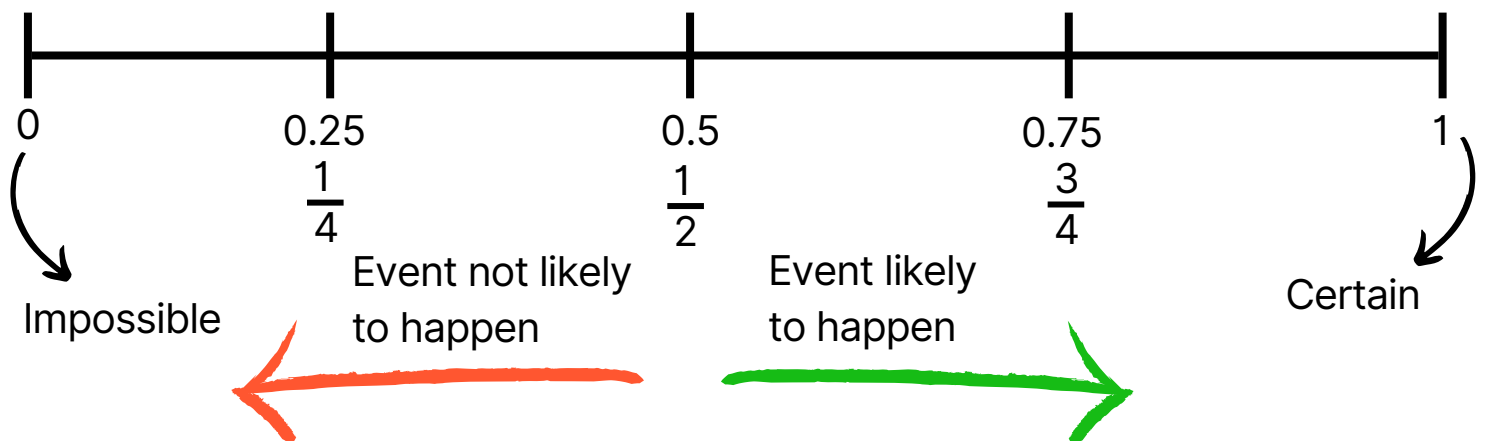Probability is the way of expressing the likelihood of an event happening on a scale from impossible to certain. You can write probability as a fraction, a decimal or a percentage

One way you can represent probability is on a probability scale

The further to the left, the less likely an event is. When it reaches 0 it is impossible.

An event in the middle has a 50/50 chance of happening.

The further to the right the event is, the more probable it becomes

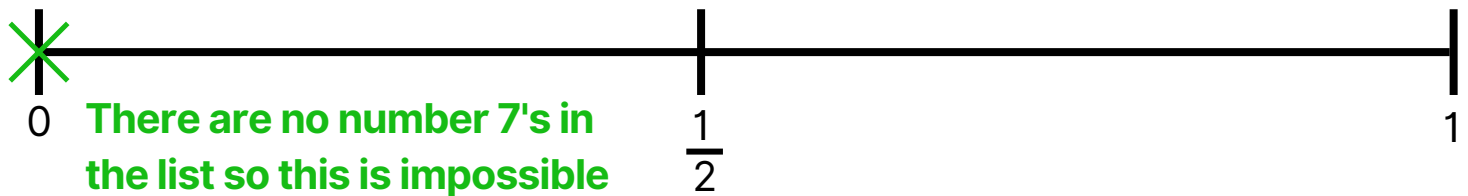When an event, reaches 1 (100%), this means it is certain.

Example:

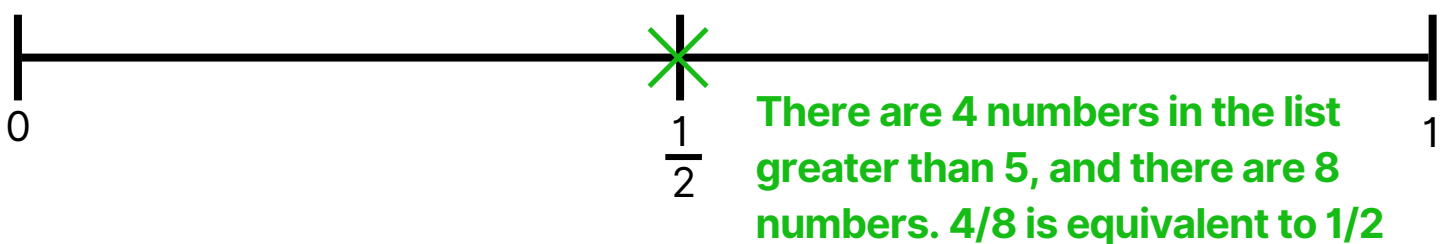Here is a list of 8 numbers.

2   2   3   5   6   6   8   9

Kim picks at random one of these numbers.

On the probability scale below, marks with a cross (X) the probability that Kim picks a number 7

There are no number 7's in the list so this is impossible

0          $\frac{1}{2}$ 1

On the probability scale below, marks with a cross (X) the probability that Kim picks a number greater than 5

0          $\frac{1}{2}$ 1

There are 4 numbers in the list greater than 5, and there are 8 numbers. 4/8 is equivalent to 1/2

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Calculating Probability

$$\text{Probability} = \frac{\text{number of ways an outcome can happen}}{\text{total number of possible outcomes}}$$

If the numbers 1 to 10 are put into a draw, the odds of getting a 9 or a 10 is 2 out of 10. This can be shown as a fraction simplified, a decimal or percentage

$$\frac{2}{10} = \frac{1}{5} = 0.2 = 20\,\%$$

If a question doesn't specify how to show probability, it is nearly always simplest to show it as a fraction as by simply writing out the equation, you have already done this.

An exception to this is if you are given one of two possible events as a decimal and are asked to give the other one. As we know total probability will always equal 1 (certainty), we can subtract the other outcome from 1 to find a second one.

Example:

If the probability it rains tomorrow is 0.7
The probability it won't rain = 1 - 0.7 = 0.3

This is because in this case, there are only two possible outcomes. It either has to rain or it doesn't.

Pobability - Class 8

Questions:

There are 15 sweets in a jar.

4 of the sweets are red.

Jill takes at random a sweet from the jar.

Write down the probability that the sweet is red

There are only green counters and blue counters in a bag.

A counter is taken at random from the bag.
The probability that the counter is green is 0.3

Find the Probability that the counter is blue

Listing Outcomes

You may get a question where you are given some events and you need to list all the possible outcomes.

Example:

Three fair coins are tossed. List all the possible outcomes.

In this case, we know each coin can be heads (H) or tails (T).

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

Question:

There are three cards in bag A and two cards in bag B.
There is a letter on each card.

Bag A: E, F, G
Bag B: J, K

James takes a card from bag A and then a card from bag B.

List all the possible outcomes.

Two-Way Tables

Two-way tables are a way of displaying information in a way that is fast and easy to understand. These are linked to probability as a topic and will also often finish with a probability question.

While the tables look different, how they work is similar. You simply follow the instructions and use the information you are given to fill out the missing boxes. These tend to come in the middle of the exam and are usually quite popular with students because the logic of them is easy to follow:

Example:

Vadim has **56** clocks.
The clocks are only red, only blue or only black.

32 of the clocks are plastic.
5 out of the **14** blue clocks are plastic.
8 out of the **12** red clocks are not plastic.

The numbers in colour are extracted from the question and the black numbers are found by making sure the row and column totals are all balanced!

Use this information to complete the two-way table.

	Red	Blue	Black	Total
Plastic	4	5	23	32
Not Plastic	8	9	7	24
Total	12	14	30	56

a star equivalency
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What is the probability of randomly selecting a red clock? $\frac{12}{56}$

What is the probability of randomly selecting a blue plastic clock? $\frac{5}{56}$

A red clock is picked.
What is the probability that the clock isn't plastic? $\frac{8}{12}$

Frequency Trees

Frequency Trees are also a way of displaying information in a way that is fast and easy to understand. These are linked to probability as a topic and will also often finish with a probability question.
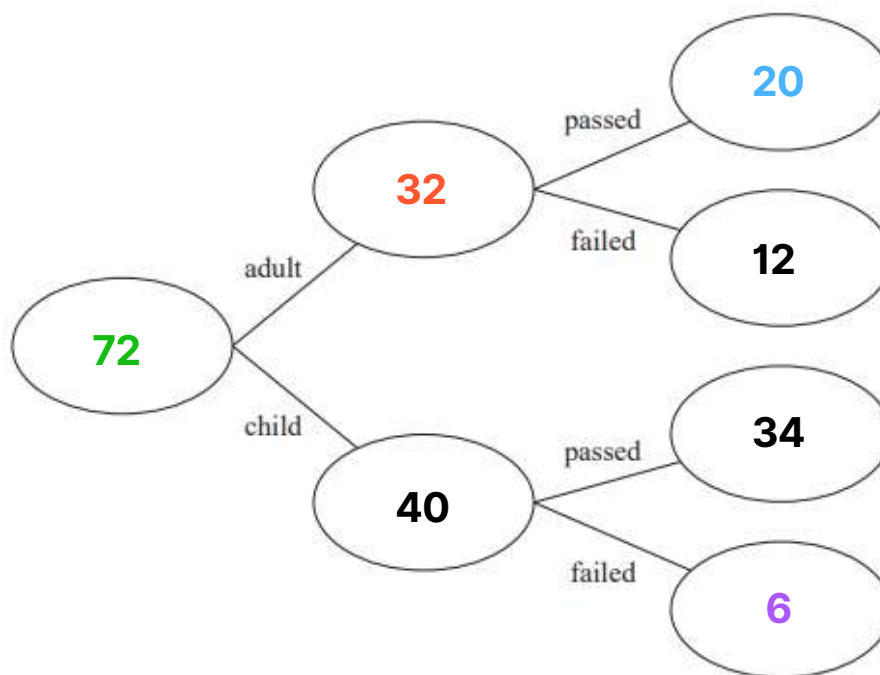
Example:

72 people did a test.

20 of the 32 adults who did the test passed.
6 of the children who did the test failed.

The numbers in colour are extracted from the question and the black numbers are found by making sure the totals are all balanced!

Use this information to complete the frequency tree

One of these people is picked at random.

Find the probability that this person is an adult who failed the test.

$$\frac{12}{72}$$

Probability Trees

These questions look just like frequency trees but show probability instead. They tend to come near the end of the exam. They are a way of showing different events which happen back to back. For each individual event on a probability tree, the probability must add up to one.

The probability of two events on the tree happening back to back is the probability of A x the probability of B
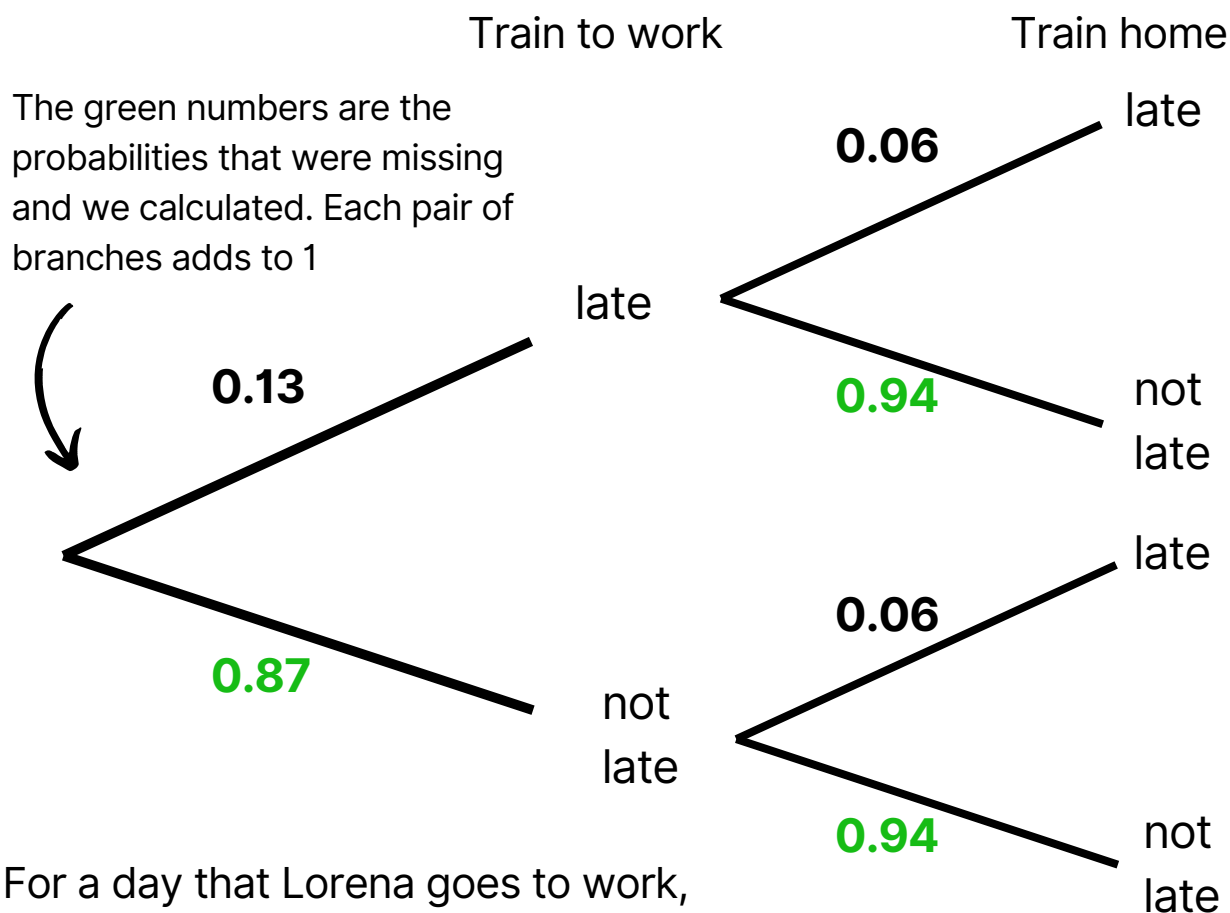
When there are two separate routes for an event to happen, to find the probability that the event will happen, work out the probability for the two routes individually and then add them together.

Example:

Lorena gets a train at the same time each morning to go to work.
She gets a train at the same time each evening to come home.

The probability tree shows the probabilities of each train arriving late.

Complete the probability tree diagram.

The green numbers are the probabilities that were missing and we calculated. Each pair of branches adds to 1

Train to work — Train home

0.06 → late
late
0.13
0.94 → not late

0.87
not late
0.06 → late
0.94 → not late

For a day that Lorena goes to work,

Work out the probability that the train to work and home will both arrive late.
0.13 x 0.06 = 0.0078

Work out the probability that one train is late and the other is on time.
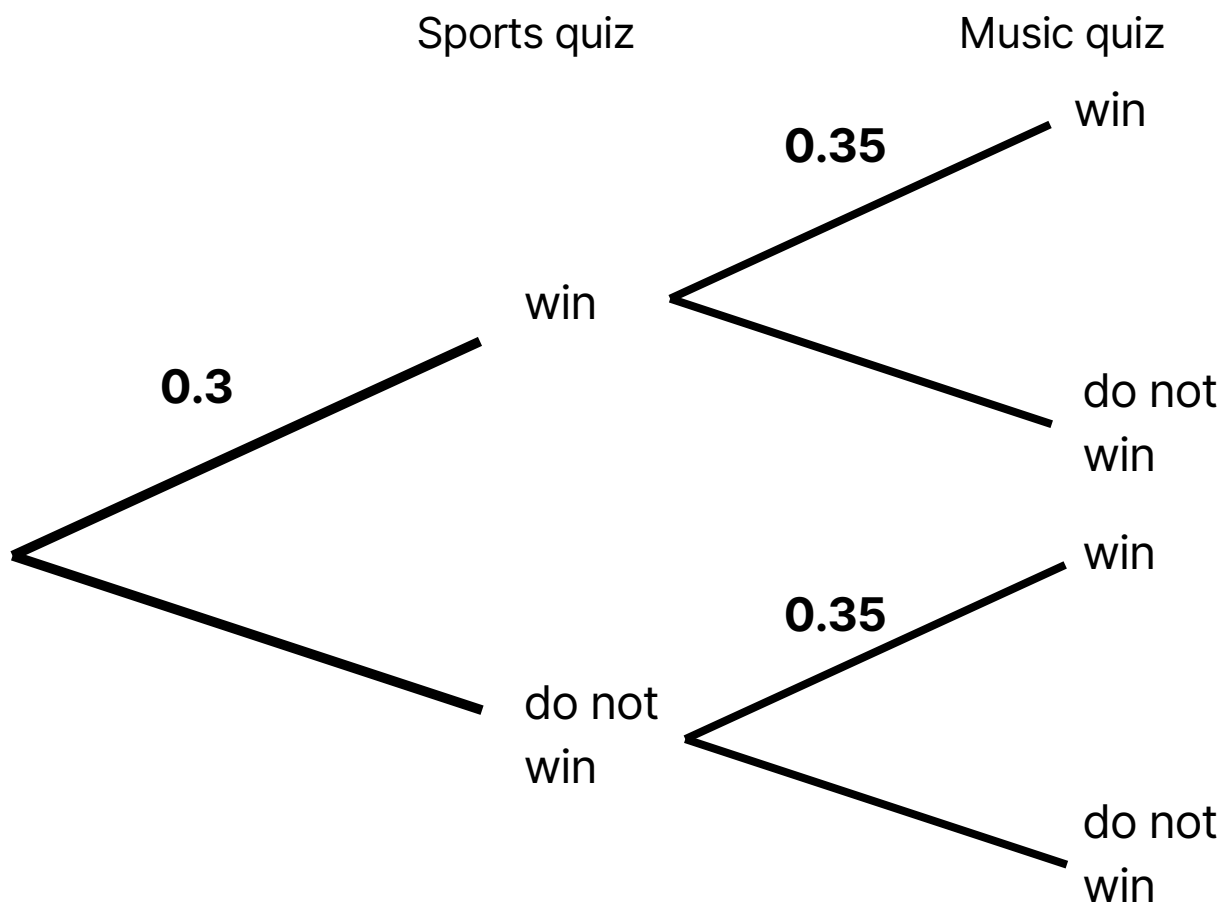0.13 x 0.94 + 0.87 x 0.06 = 0.1744

Question:

One weekend the Keddie family is going to do a sports and music quiz.

The probability that the family will win the sports quiz is 0.3
The probability that the family will win the music quiz is 0.35

Complete the probability tree diagram.

Sports quiz   Music quiz

0.35 — win

win

0.3

do not win

0.35 — win

do not win

do not win

Work out the probability that the Keddie family will win both the sports quiz and the music quiz.

Problems - Combining Topics

There are only blue, green, red and yellow counters in a bag.

The table shows the number of blue counters in the bag.

Colour	Blue	Green	Green	Yellow
Number of Counters	30			

There is a total of 100 counters in the bag.
Ashin takes at random a counter from the bag.

Find the probability that the counter is not blue.

The ratio of the number of blue counters to the number of green counters is 2:3

Work out the number of green counters in the bag.

Bradley says,

'The number of red counters in the bag is the same as the number of yellow counters in the bag'

Can Bradley be correct?
Give a reason for your asnswer.

In a bag there are only red, blue, green and pink counters.
A counter is going to be taken at random from the bag.

The table shows the probabilities of taking a red counter or a blue counter.

Colour	Blue	Green	Green	Yellow
Probability	0.05	0.15		

The probability of taking a green counter is 0.2 more than the probability of taking a pink counter.

Complete the table.

There are 18 blue counters in the bag.

Work out the total number of counters in the bag.