Probability

For **equally likely outcomes** the probability (P) that something will happen is:

$$\text{Probability} = \frac{\text{Number of successful outcomes}}{\text{Total number of possible outcomes}}$$

If you know the probability that an event **will** happen, you can calculate the probability that it won't happen:

P(Event doesn't happen) = 1 − P(Event happens)

The probability of rolling a 6 on a normal fair dice is $\frac{1}{6}$. So the probability of **not** rolling a 6 is $1 - \frac{1}{6} = \frac{5}{6}$

Add or multiply?

Events are **mutually exclusive** if they can't **both** happen at the same time.
For mutually exclusive events:

P(A or B) = P(A) + P(B)

Events are **independent** if the outcome of one doesn't affect the outcome of the other.
For independent events:

P(A and B) = P(A) × P(B)

Worked example

Target grade 4

Amir designs a game for his school fete. This table shows the probability of winning a prize.

Prize	badge	keyring	cuddly toy
Probability	0.35	0.18	0.07

(a) What is the probability of **not** winning a prize? **(2 marks)**

P(Win) = 0.35 + 0.18 + 0.07 = 0.6

P(Not win) = 1 − 0.6 = 0.4

(b) Amir plays the game three times. What is the probability that he does not win a prize? **(2 marks)**

0.4 × 0.4 × 0.4 = 0.064

(a) To work out the probability of winning **any** prize you need to add together the probabilities. Then you can use this rule to work out the probability of not winning a prize:

$$P\left(\begin{array}{c}\text{Not winning}\\ \text{a prize}\end{array}\right) = 1 - P\left(\begin{array}{c}\text{Winning}\\ \text{a prize}\end{array}\right)$$

(b) To work out the probability of Amir not winning on any of his three games, you need to multiply the probabilities.

Sample space diagrams

A **sample space diagram** shows you all the possible outcomes of an event. Here are all the possible outcomes when two coins are flipped.

Second coin \ First coin	H	T
H	HH	TH
T	HT	TT

There are four possible outcomes. TH means getting a tail on the first coin and a head on the second coin.

The probability of getting two tails when two coins are flipped is $\frac{1}{4}$ or 0.25
There are 4 possible outcomes and only 1 successful outcome (TT).

Now try this

Target grade 2

The table shows the probabilities of different delivery times for a first class letter.

Delivery time	next day	1 day late	more than 1 day late
Probability	$45x$	$3x$	$2x$

Work out the probability of a first class letter arriving one day late. **(3 marks)**

Don't just find x. You need to answer the question by writing the probability of the letter arriving one day late.

Worked solution video