

Helping Your Child with Probability

Probability · Year 7 to Year 10 · Australian Curriculum Mathematics

Probability is the mathematics of chance — how likely something is to happen. It appears in weather forecasts, sports predictions, insurance, medicine, and gambling. Your child learns to move from **experimental probability** (what actually happened in trials) to **theoretical probability** (what should happen based on equally likely outcomes), and eventually to combining probabilities of multiple events.

Year	What your child learns	What this looks like at home
Year 7	Probability as a number — the scale from 0 to 1 probability — a number from 0 to 1 showing how likely an event is: 0 = impossible 0.5 = equally likely 1 = certain event — an outcome or set of outcomes we are interested in theoretical probability: $P(\text{event}) = \text{favourable outcomes} \div \text{total equally likely outcomes}$ P(heads) = $\frac{1}{2} = 0.5 = 50\%$ P(6 on a die) = $\frac{1}{6} \approx 0.167 = 16.7\%$ complementary event — the opposite of the event: $P(\text{not } A) = 1 - P(A)$ P(not getting a 6) = $1 - \frac{1}{6} = \frac{5}{6}$	Coin flip: 'What is the probability of getting heads?' ($\frac{1}{2}$) Dice roll: 'What is the probability of rolling less than 3?' (Outcomes: 1, 2 → $P = \frac{2}{6} = \frac{1}{3}$) 'What is the complementary event of rolling a 6? What is its probability?' ($P = \frac{5}{6}$)
Year 8	Experimental probability and relative frequency experimental probability — found by running trials: $P(\text{event}) \approx \text{number of times event occurred} \div \text{total trials}$ relative frequency — same thing: how often an event happened as a fraction law of large numbers — the more trials you run, the closer experimental probability gets to theoretical probability e.g. flip a coin 10 times → might get 7 heads (70%) flip 1,000 times → will be very close to 50% Your child designs and conducts probability experiments, records results in tables, and compares experimental to theoretical values.	Flip a coin 20 times. Record results. How close is it to 50%? Roll a die 30 times. Record how often each number comes up. Compare to the theoretical $\frac{1}{6}$ for each. 'Why do casinos always win in the long run?' (Law of large numbers — probability works against the gambler over time.)
Year 9	Sample spaces and combined events sample space — the set of all possible outcomes: Rolling a die: {1, 2, 3, 4, 5, 6} combined events — two or more events happening together tree diagram — a diagram showing all possible outcomes in branches: Flip a coin AND roll a die → 12 possible outcomes two-way table — a grid showing combined outcomes for two variables Your child finds probabilities of combined events: P(heads AND a 4) = $\frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$ (for independent events — one doesn't affect the other) $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$ (for any events)	Tree diagram: 'If we flip two coins, draw all possible outcomes.' (HH, HT, TH, TT — 4 outcomes) 'What is the probability of getting two heads?' ($\frac{1}{4} = 25\%$) Card game: 'If I draw a card from a standard deck (52 cards), what is the probability of getting a red ace?' ($\frac{2}{52} = \frac{1}{26}$)
Year 10	Conditional probability and independence conditional probability — the probability of A given that B has already happened: $P(A B) = P(A \text{ and } B) \div P(B)$ independent events — one event does not affect the probability of the other: $P(A \text{ and } B) = P(A) \times P(B)$ dependent events — the outcome of one event affects the next: Drawing cards WITHOUT replacement — fewer cards remain e.g. P(2nd card is Ace 1st was Ace) = $\frac{3}{51}$ (one ace gone) Venn diagrams — used to show overlapping events and calculate combined probabilities	'If a family has two children, and the first is a girl, what is the probability the second is also a girl?' ($\frac{1}{2}$ — events are independent) 'Draw cards without replacement. P(1st is King) = $\frac{4}{52}$. If that happens, P(2nd is King) = ?' ($\frac{3}{51}$ — one king gone) Medical testing: discuss false positives. 'If a test is 99% accurate, is a positive result definitely correct?'

★ Probability at a glance — scale and common events

0	$\frac{1}{4}$ (0.25)	$\frac{1}{2}$ (0.5)	$\frac{3}{4}$ (0.75)	1	
Impossible (never happens)	Unlikely (less than 50%)	Even chance (50/50)	Likely (more than 50%)	Certain (always happens)	

Examples: $P(\text{impossible}) = 0$ | $P(\text{rolling a 7 on a standard die}) = 0$ | $P(\text{rolling 1–6 on a standard die}) = 1$ | $P(\text{rolling an even number}) = \frac{3}{6} = 0.5$ | $P(\text{rolling a number} > 4) = \frac{2}{6} = \frac{1}{3} \approx 0.333$

Tree diagram — flipping two coins: First flip $\rightarrow$ H or T. Second flip $\rightarrow$ H or T for each. Outcomes: HH, HT, TH, TT (4 equally likely).
 $P(\text{at least one head}) = \frac{3}{4}$ | $P(\text{two tails}) = \frac{1}{4}$ | $P(\text{exactly one head}) = \frac{2}{4} = \frac{1}{2}$.

Helping at Home — Probability

Worked examples and questions to ask · Year 7 to Year 10

How it works — worked examples

Year 7 — Theoretical probability

A bag has 3 red, 2 blue, and 5 green marbles. Find the probability of picking (a) red (b) not green.

Total marbles	$3 + 2 + 5 = 10$ marbles
(a) P(red)	3 red out of 10 total $\rightarrow P(\text{red}) = \frac{3}{10} = 0.3 = 30\%$
P(green)	5 out of 10 $\rightarrow P(\text{green}) = \frac{5}{10} = \frac{1}{2}$
(b) P(not green)	$1 - P(\text{green}) = 1 - \frac{1}{2} = \frac{1}{2} = 50\%$

Year 9 — Combined events

A spinner has Red, Blue, Green (equal sections). A coin is flipped. What is P(Red AND Tails)?

List outcomes	R-H, R-T, B-H, B-T, G-H, G-T (6 equally likely outcomes)
Favourable	Only R-T (Red AND Tails) = 1 outcome
Probability	$P(\text{Red AND Tails}) = \frac{1}{6} \approx 0.167$
Multiply method	$P(\text{Red}) \times P(\text{Tails}) = \frac{1}{3} \times \frac{1}{2} = \frac{1}{6}$ (independent events $\rightarrow$ multiply)

Year 10 — Conditional probability

In a class of 30: 18 play sport, 12 play music, 5 do both. A student is chosen. Given they play sport, what is the probability they also play music?

Given	We know the student plays sport (18 students)
Both sport AND music	5 students do both
Conditional formula	$P(\text{music} \mid \text{sport}) = \frac{P(\text{music AND sport})}{P(\text{sport})}$
Calculate	$= \frac{5}{30} \div \frac{18}{30} = \frac{5}{18} \approx 0.278 = 27.8\%$

Questions to ask your child

You don't need to solve these. Ask them and let your child explain their thinking!

7 Year 7

- $\rightarrow$ A standard die is rolled. What is the probability of rolling an odd number?
- $\rightarrow$ What is the probability of rolling a number less than 5?
- $\rightarrow$ A deck has 52 cards. What is P(picking a heart)?
- $\rightarrow$ If $P(\text{rain tomorrow}) = 0.7$, what is $P(\text{no rain tomorrow})$?

8 Year 8

- $\rightarrow$ You flip a coin 100 times and get 43 heads. What is the experimental probability of heads?
- $\rightarrow$ Is $\frac{43}{100}$ close to the theoretical probability? Why might it not be exactly $\frac{1}{2}$?
- $\rightarrow$ If you flip it 10,000 times, what would you expect? Why?
- $\rightarrow$ You roll a die 60 times. About how many times would you expect to roll a 3?

9 Year 9

- $\rightarrow$ Draw a tree diagram for rolling a die and flipping a coin together.
- $\rightarrow$ How many outcomes are in the sample space?
- $\rightarrow$ What is $P(\text{an even number AND heads})$?
- $\rightarrow$ What is $P(\text{a number less than 3 OR tails})$?

10 Year 10

- $\rightarrow$ Two cards are drawn without replacement. What is $P(\text{both are aces})$? $(\frac{4}{52} \times \frac{3}{51})$
- $\rightarrow$ Are drawing two cards independent or dependent events? Why?
- $\rightarrow$ In a medical test, 1 in 100 people has a disease. The test is 95% accurate. If you test positive, are you definitely sick? Discuss.
- $\rightarrow$ What does $P(A \mid B)$ mean in everyday language? Give an example from real life.

Things to try at home

Year 7: Make a bag of coloured counters (e.g. 5 red, 3 blue, 2 yellow). Ask: 'Without looking, what is the probability of drawing red?'	Year 7: Weather app: find the probability of rain tomorrow. Ask: 'Does 30% rain mean it will rain 30% of the day, or on 30% of days like today?'
Year 8: Flip a coin 50 times and record results. Graph the running percentage of heads. Watch it move closer to 50%.	Year 8: Card game probability: 'What fraction of a standard deck is hearts? Red cards? Face cards?' Verify by sorting the deck.
Year 9: Roll two dice together 20 times. Record the sum each time. Which sum comes up most? (Should be 7 — it has the most combinations.)	Year 10: Look up the probability of winning a lottery. Calculate: if you played every week for 50 years, how many weeks would that be? Is a win expected?

Key words to learn together

probability: a number from 0 to 1 showing how likely an event is: 0 = impossible, 1 = certain	event: an outcome or set of outcomes we are interested in
theoretical probability: $P(\text{event}) = \frac{\text{favourable outcomes}}{\text{total equally likely outcomes}}$	experimental probability: $\frac{\text{found from trials: times event happened}}{\text{total trials}}$
complementary event: the opposite of the event: $P(\text{not } A) = 1 - P(A)$	sample space: the set of all possible outcomes (e.g. rolling a die: {1,2,3,4,5,6})
relative frequency: how often something happened as a fraction of total trials	law of large numbers: more trials → experimental probability gets closer to theoretical
independent events: one event does not affect the other: $P(A \text{ and } B) = P(A) \times P(B)$	dependent events: one event affects the probability of the other (e.g. drawing without replacement)
conditional probability: $P(A B)$ — probability of A given that B has already happened	tree diagram: a branching diagram showing all possible outcomes of combined events
two-way table: a grid showing combined outcomes for two variables	Venn diagram: overlapping circles showing the relationship between two (or more) events