RICH MATHEMATICAL TASK BOOKLET

PROBABILITY

YEAR 5-6 EVEN YEARS

Teacher Booklet

Task 1

TV NZ is running a 'best catches in cricket' competition.

To enter, you need to order the catches from A to D. There are four to list:

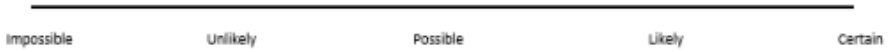
Catch A – Trent Boult
Catch B – Tom Latham
Catch C – Kane Williamson
Catch D – Tim Southee

What are all the different ways that the catches could be ordered?

How many entries would you need to cover all the possibilities?

Teacher Notes

Before you launch the task, show the students the probability continuum:



Ask the students to consider where they would think that 25% and 75% chance would go on the continuum.

Ask them to think of the weather today and arrange the weather descriptions on the continuum:
Windy Sunny Rain Snow
Cloudy Lightening

Ask different students to share their continuum and discuss why they might be different.

Notice whether students are able to systematically record the different options for the order of the best catches and work out how many different combinations are possible. It is important for students to realise that the order matters for the catches.

The possibility of each combination of order of best catches could be linked to fractions in relation to the chance of each combination.

Expect students to use the language of probability with terms such as more likely, less likely, small chance, greater chance.

Big Ideas

When there is a chance-based situation, there are sets of possible outcomes that can be arranged into events.

Probability is the chance of an event occurring. This can be represented with language or values (e.g., 0% - impossible or 100% certain).

Data visualisations can be used to show what outcomes are possible and more likely. They can also be used to represent the results of a probability investigation.

If all possible outcomes in a chance situation are equally likely, the probability of an event happening is a fraction where the numerator is the number of ways the event can happen, the denominator is the total number of possible outcomes.

Shareback

Select students to share that have worked systematically to find all the possible combinations.

Select students to share who have used a tree diagram to organise the information.

Connect

What is the probability that Catch C – Kane Williamson will be the second in the list?

How many possibilities would there be if there was also Catch E – Henry Nicholls?

Suggested Learning Outcomes

Represent the different outcomes for an event.
Use a tree diagram to represent the different outcomes for an event.
Find all of the possible outcomes for an event.
Find the probability for an event.

Independent Tasks

In the table tennis singles championships, the semi-finalists were:

Santiago, Lia, Chaewon, and Pania.

All of the players had to play each other once. How many matches were played altogether?

For the next round the semi-finalists had to partner each other for one game. How many games would have to be played?

Curriculum Links

During Year 5 and Year 6

Engage in chance-based investigations, including those with not equally likely outcomes, by:

– generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– creating data visualisations for possible outcomes

– finding probabilities as fractions

Mathematical Language

Probability, chance, unlikely, possible, likely, certain, equal chance.

Anticipations

Solutions, Misconceptions

Task 2

Read the statements below and discuss whether you agree or disagree with them.

The All-blacks will win the next Rugby World Cup	One is the hardest number to roll on a dice
A game is unfair if you don't follow the rules.	A friend will come over to your house after school.
It is easier to roll an even number on a dice than an odd number.	If you buy lots of scratch and win cards, you will win a prize.

Everyone in your group must agree and you should provide a range of reasons for your argument.

Teacher Notes

Before the launch, ask the students to record in a tally-chart the results of a trial with blue and red jellybeans. Put the beans in a feely bag and draw them out one at a time and ask the students to record with tally-marks.

During the launch of the task, establish with the students that when Tyrone or his sister take a jellybean, it is removed from the jar and data set and not returned.

Have plastic beans and feely bags available for the students to use for the trials.

Monitor for students who are able to connect fractions with their predictions (e.g., there are 8 yellow beans which is half of the total set of 16 beans).

Notice students who are able to record and represent the results of the trials accurately using tally marks.

Expect students to use the language of probability with terms such a more likely, less likely, half chance, greater chance.

For the independent task, have beans and feely bags available for the students to use.

Big Ideas

When there is a chance-based situation, there are sets of possible outcomes that can be arranged into events. Probability is the chance of an event occurring. This can be represented with language or values (e.g., 0% - impossible or 100% certain).

For some situations or games, the chance or probability of particular outcomes can be calculated (theoretical probability). Theoretical probability and what happens in an experiment will differ.
If all possible outcomes in a chance situation are equally likely, the probability of an event happening is a fraction where the numerator is the number of ways the event can happen, the denominator is the total number of possible outcomes.

Curriculum Links

During Year 5
Evaluate others' statements about chance-based investigations, with justification.

During Year 6
Identify, explain, and check others' statements about chance-based investigations, referring to evidence.

Shareback

Select students to share who indicate misconceptions such as rolling a six is more difficult so that this can be discussed.

Additionally, select students to share who qualify their statements and provide evidence for their decisions. This might include statements such as rolling a six having one sixth chance as an outcome while flipping a coin and landing on heads has a half chance as an outcome.

Connect

Create your own statements for other students to discuss.

Suggested Learning Outcomes

Agree or disagree with statements related to the probability of an event.
Provide reasons including quantification to support their argument.
Find the probability for an event (e.g., 50% chance of heads and 50% chance of tails).

Independent Tasks

Frankie is not convinced that the chance of rolling a one on a dice is the same as other numbers.

Use the dice and undertake a trial to see if you can convince her.

First roll the dice twenty times and record the results in a tally-chart. Represent these in a column graph.

For the next trial, roll the dice 100 times and record the results in a tally-chart. Represent these in a column graph.

What do you notice?

Compare your results with other students. Are they the same or different?

Combine your results with 4 other students and add up the total of rolling a dice 500 times.

What do you notice?

Mathematical Language

Probability, chance, unlikely, possible, likely, certain, equal chance.

Anticipations

Solutions, Misconceptions

Task 3

Lyric has made up the rules for a game of beanz. She asks her brother Sanjay to play it with her. Lyric puts four beans in the bag with two blue beans and two red beans.

Lyric's rules are to pick two beans from the bag without looking. If the beans are different colours then Lyric gets a point, if the beans are both red then Sanjay gets a point.

Is Lyric's game fair?

Explain your answer.

How many points do you think Lyric would get if they play the game 10 times?

Use the beans and bags and test the game by trialing picking out the beans 10 times. Record your results in the table:

	Lyric wins	Sanjay wins	No winner
Outcome of 10 trials			
Outcome of 40 trials			
Total outcome			

Now test the game by trialling picking out the beans 40 more times and record the results and total the outcomes.

Make statements about what you notice.

Big Ideas

When there is a chance-based situation, there are sets of possible outcomes that can be arranged into events. Probability is the chance of an event occurring. This can be represented with language or values (e.g., 0% - impossible or 100% certain).

For some situations or games, the chance or probability of particular outcomes can be calculated (theoretical probability). Theoretical probability and what happens in an experiment will differ.

For some situations or games using repeated testing can give a sense of which outcomes are more likely (experimental probability).
A probability experiment involves repeated trials. Results can differ in different trials.

If all possible outcomes in a chance situation are equally likely, the probability of an event happening is a fraction where the numerator is the number of ways the event can happen, the denominator is the total number of possible outcomes.

Teacher Notes

During the launch remind students how to record outcomes using a tally chart.

Have feely bags and red and blue beans available for each group to experiment with the chance situation.

Notice whether students are recording the results accurately and systematically and support them to do this.

Support students to make connections between probability and fractions.

Facilitate them to represent the chance of choosing two red beans as one quarter while the chance of choosing a red and blue bean is one half or model this if they don't represent in that way.

The connect in this task focuses attention on the difference between theoretical probability and experimental probability and a comparison of this from trials. Support the students to notice that you can have different results for the same trial.
Also, that the more trials (the greater the sample size) the more likely the distribution of the experimental probability will be closer to the theoretical probability.

Shareback

Select students to share that have worked out the possible ways that the beans could be taken from the bag and can justify why Lyric would have a 50% chance of winning.

For the second part of the task, choose students to share that have recorded their outcomes systematically. Add the results from different students to a table and collate the results.

Lyric wins	Sanjay wins	No winner

Curriculum Links

During Year 5 and Year 6

Engage in chance-based investigations, including those with not equally likely outcomes, by: generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

During Year 6

Comparing findings from the probability experiment and associated theoretical probabilities, if the theoretical model exists

Mathematical Language

Chance, unfair, fair, equal chance, trial, tally chart, variation, theoretical probability, experimental probability, sample size.

Connect

What do you notice about your prediction (introduce term theoretical probability) and the outcome of ten trials (introduce term experimental probability)?

What do you notice about the outcome when the trials are added together or the sample size is extended?

How could you design the game and number of beans so that it was an equal chance of winning?

Suggested Learning Outcomes

Identify possible outcomes in a chance situation.
Compare the likelihood of events and represent these as a fraction.
Make a prediction about a chance situation.
Collect and record data for a chance investigation.
Compare theoretical probability with experimental probability.

Independent Tasks

Hamuera has a jar with jellybeans in it.

There are 3 red jellybeans, 4 green jellybeans, and 5 yellow jellybeans.

If you could not see what colours you were taking out, how many jellybeans would you have to take out of the jar to make sure that you had two of the same colour?

If you could not see what colours you were taking out, how many jellybeans would you have to take out of the jar to make sure that you had three different colours?

Anticipations

Solutions, Misconceptions

Task 4

The money or the bag gameshow involves contestants choosing from 10 balls hidden in a bag. There are 5 red balls, 3 yellow balls, and 2 blue balls. To win you need to pull out the red balls.

Contestant Number One pulls out the first ball and it is red. This means that they win a large amount of money.

Now they have a choice:
Stop playing and take the prize money.
Pick another ball with these results:
If it is red, they double their money.
If it is yellow, they lose all the money.
If it blue, they can pick one final ball.

What should Contestant Number One do? Provide reasons for your choice.

Use the feely-bags and cubes to test your predictions. Record the results of at least 30 trials.

Does this change your advice?

Teacher Notes

Before launching this task, ask students to brain-storm games that they play that involve chance. This could include games such as Yahtzee, Monopoly, Game of Life, card games.

Ask them to brainstorm questions related to the games that they could investigate, this could include the likelihood of different outcomes in Yahtzee, the probability of rolling doubles in monopoly, the spinner landing on specific sets of numbers for Game of Life or the likelihood of turning over particular cards.

Record the questions that could be investigated on the board for the students to select from. This will be the basis of the independent activity and a probability investigation. Let students know that they can either work by themselves or with a partner for the investigation.

Big Ideas

When there is a chance-based situation, there are sets of possible outcomes that can be arranged into events. Probability is the chance of an event occurring. This can be represented with language or values (e.g., 0% - impossible or 100% certain).

For some situations or games, the chance or probability of particular outcomes can be calculated (theoretical probability). Theoretical probability and what happens in an experiment will differ.

For some situations or games using repeated testing can give a sense of which outcomes are more likely (experimental probability).

A probability experiment involves repeated trials. Results can differ in different trials.

If all possible outcomes in a chance situation are equally likely, the probability of an event happening is a fraction where the numerator is the number of ways the event can happen, the denominator is the total number of possible outcomes.

Teacher Notes - continued

During the launch, ensure that the students understand that once the ball is removed from the bag, it is not returned. This means that the overall probability changes each time a ball is removed.

Have coloured cubes and feely-bags available for students to model the situation and to undertake trials and experiments.

Notice whether students are recording the results accurately and systematically and support them to do this.

Support students to make connections between probability and fractions.

Facilitate them to represent the chance of choosing different coloured balls as a fraction.

Facilitate students to notice the difference between theoretical probability and experimental probability and a comparison of this from trials.

Shareback

Select students to share that have worked out the possible ways that the balls may be taken from the bag and probability in fractions and the consequences of the different events. If not students have used fractions to represent the probability, then model this for them.
For the second part of the task, choose students to share that have recognised the theoretical probability and experimental probability will differ.

Connect

If Contestant One was allowed to return the first red ball to the bag before selecting the next ball, how would this change the probability of the event?

What combination of balls would make it clear what Contestant One should do?

Curriculum Links

During Year 5 and Year 6 :

Engage in chance-based investigations, including those with not equally likely outcomes, by:

-anticipating and then identifying possible outcomes for the investigative question

-generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– finding probabilities as fractions

During Year 6:

Comparing findings from the probability experiment and associated theoretical probabilities, if the theoretical model exists

Mathematical Language

Chance, unfair, fair, equal chance, trial, tally chart, variation, theoretical probability, experimental probability, sample size.

Suggested Learning Outcomes

Identify possible outcomes in a chance situation.
Compare the likelihood of events and represent these as a fraction.
Make a prediction about a chance situation.
Collect and record data for a chance investigation.
Compare theoretical probability with experimental probability.

Independent Tasks

Invent your own dice games.

Design one game which you think is fair.

Design one game which you think is unfair.

Ask someone to play both games with you for ten rounds.

Record the results and represent these.

Explain whether the results support your predictions about the fairness or unfairness of the games.

Curriculum Links

During Year 5 and Year 6 :

Engage in chance-based investigations, including those with not equally likely outcomes, by:

-anticipating and then identifying possible outcomes for the investigative question

-generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– finding probabilities as fractions

During Year 6:

Comparing findings from the probability experiment and associated theoretical probabilities, if the theoretical model exists

Mathematical Language

Chance, unfair, fair, equal chance, trial, tally chart, variation, theoretical probability, experimental probability, sample size.

Anticipations

Solutions, Misconceptions

Task 5

Lucas has made up a game with dice for two players.

The rules are that you roll both dice and subtract the smaller number from the larger number.

Player One gets a point if the difference is 0, 1, 2

Player Two gets a point if the difference is 3, 4, 5.

Do you think this game is fair? Make a prediction and explain your thinking using a representation.

Test your argument using the dice and roll the dice 30 times and work out the difference. Record and represent the results.

Teacher Notes

Have dice available for the students to use.

Expect students to use a tree diagram or accurate form of listing to ensure that they map out the different possibilities when working out the differences.

Notice students who are able to record and represent the results of the trials accurately using tally marks.

Expect students to use the language of probability with terms such as more likely, less likely, greater chance, theoretical probability, experimental probability.

For the independent activity, provide students with dice to test their games.

Shareback

Select students to share who notice and explain that particular numbers are more likely to be the difference when you subtract the smaller number from the larger and list the possibilities and fractions related to this.

For the second part of the task, choose students to share that have recorded their outcomes systematically.

Connect

If you think this game is unfair, how could you improve it?

Big Ideas

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Data visualisations can be used to show what outcomes are possible and more likely. They can also be used to represent the results of a probability investigation.

Suggested Learning Outcomes

Identify possible outcomes in a chance situation.
Compare the likelihood of events and represent these as a fraction.
Make a prediction about a chance situation.
Collect and record data for a chance investigation.
Compare theoretical probability with experimental probability.

Independent Tasks

You can work with a buddy or by yourself for this activity.

Select a question about a game from the questions that were brainstormed with your teacher at the beginning of the mathematics lesson.

Begin by considering how you will investigate the question.

What outcomes are possible in relation to your question?

What is the theoretical probability of the different outcomes?
Develop a representation that shows this including a graph.

Write a plan for how you will investigate the experimental probability of the outcomes. This will need to have trials with different sample sizes. Develop representations that show these results including graphs.

Make statements about what you have found out.

Make a poster that has the following information;
An introduction including what you choose to investigate.
The theoretical probability and related representations.
The plan to investigate the probability outcomes.
The outcomes of your trials with different sample sizes and the related representations.
Statements related to your findings.
A conclusion.

Curriculum Links

During Year 5 and Year 6

Engage in chance-based investigations by:

– anticipating and then identifying possible outcomes for the investigative question

– generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– creating data visualisations for possible outcomes

– finding probabilities as fractions

– answering the investigative question

Mathematical Language

Chance, unfair, fair, more likely, less likely, trial, tally chart, variation, theoretical probability, experimental probability, sample size.

Anticipations

Solutions, Misconceptions

Task 6

Siautu and Niu like to play Suipi but they think they need a better understanding of the probability of drawing certain cards.

They list some possibilities and then marked them on the probability scale below:

A spade
An ace
A red card
A red jack
A picture card
A heart
A diamond or club.
Where would each be marked on the scale?

100% 50% 0%

Teacher Notes

Launch the task by ensuring that all students are aware that there are 52 cards in a standard deck of cards.

Have packets of cards available for the students to use if necessary and calculators available if they need these to work out the percentages.

Expect students to use the language of probability with terms such as more likely, less likely, greater chance, theoretical probability, and to connect the task with fractions and percentages.

Shareback

Select students to share who qualify their statements and provide evidence for their decisions.

This should include the related fractions and percentages for the theoretical probability.

Big Ideas

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Connect

If a card is used in the game, how does that change the probability for the next card?

Explain the impact for each of the scenarios in the task.

Suggested Learning Outcomes

Identify possible outcomes in a chance situation.
Compare the likelihood of events and represent these as a percentage
Predict the theoretical probability in a chance situation.

Independent Tasks

You can work with a buddy or by yourself for this activity.

Select a question about a game from the questions that were brainstormed with your teacher at the beginning of the mathematics lesson.

Begin by considering how you will investigate the question.

What outcomes are possible in relation to your question?

What is the theoretical probability of the different outcomes?
Develop a representation that shows this including a graph.

Write a plan for how you will investigate the experimental probability of the outcomes. This will need to have trials with different sample sizes. Develop representations that show these results including graphs.

Make statements about what you have found out.

Make a poster that has the following information;
An introduction including what you choose to investigate.
The theoretical probability and related representations.
The plan to investigate the probability outcomes.
The outcomes of your trials with different sample sizes and the related representations.
Statements related to your findings.
A conclusion.

Curriculum Links

During Year 5 and Year 6

Engage in chance-based investigations by:

– anticipating and then identifying possible outcomes for the investigative question

– generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– creating data visualisations for possible outcomes

– finding probabilities as fractions

– answering the investigative question

Mathematical Language

Chance, unfair, fair, more likely, less likely, equal chance, theoretical probability, sample size.

Anticipations

Solutions, Misconceptions

Task 7

Read the probability experiment poster.

What is interesting?

What is something you have learned from the poster?

What is a question that you have about the experiment?

Teacher Notes

To launch this task, display the posters (independent activity from earlier tasks) detailing the completed probability experiments around the classroom with a piece of paper for feedback next to them.

Put the students into groups and set up a bus-stop activity where they read the poster together and then write responses to the prompts in the paper. After the timer goes off then students go to the next poster and repeat the process.

To conclude, provide students with opportunities to read the feedback about their poster and develop a reflection.

Shareback

After the students have completed the bus-stop activity and written feedback, provide the students with time to look at the comments and feedback related to their poster.

Connect

Ask them to reflect and share on what they learned and what they would do differently if planning the experiment again.

Suggested Learning Outcomes

Identify possible outcomes in a chance situation.
Make a prediction about a chance situation.
Critique and analyse the posters produced by other students detailing their probability experiments.
Ask questions about probability experiments and chance situations.

Big Ideas

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For some situations or games using repeated testing can give a sense of which outcomes are more likely (experimental probability).

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Data visualisations can be used to show what outcomes are possible and more likely. They can also be used to represent the results of a probability investigation.

Independent Tasks

Select one or more of the following assessment tasks (attached at the end of the document) as the independent activity:

Task 1: Three coin toss

Task 2: Odd and even - three dice roll

Curriculum Links

During Year 5 and Year 6

Engage in chance-based investigations by:

– anticipating and then identifying possible outcomes for the investigative question

– generating all possible ways to get each outcome (a theoretical approach), or undertaking a probability experiment and recording the occurrences of each outcome

– creating data visualisations for possible outcomes

– finding probabilities as fractions

– answering the investigative question

Mathematical Language

Chance, more likely, less likely, trial, tally chart, variation, experimental probability, sample size, theoretical probability.

Anticipations

Solutions, Misconceptions

Assessment Task 1 - Probability - Year 5-6

What happens when you flip three coins? Show all the possible outcomes and predict what is most likely and least likely.

Now test your predictions by flipping three coins. Choose how many times you will trial the coin flip. Record and represent your results. What do you notice? Make statements.

Assessment Task 1 - Probability - Year 5-6

In odds and evens, you roll the dice and record whether it is odd (1, 3, 5) or even (2, 4, 6). What happens when you roll the three dice at the same time? Show all the possible outcomes and predict what is most likely and least likely.

Now test your predictions by rolling the dice and recording the combinations of odd and even numbers. Choose how many times you will trial the dice roll. Record and represent your results. What do you notice? Make statements.