



Maths Progressions - Statistics

This document was created by Whakarewarewa School staff using the NZC, Maths Standards and Numeracy Framework. It is indicative of the maths knowledge and strategies required to meet the curriculum expectations at different year levels. A differentiated programme will be needed to ensure all students are scaffolded to progress in their learning. The learning intentions listed in this document are not in linear order and are not intended to be used as such. The needs of the learners, as identified through formal and informal data gathering, drives learning at all times at Whakarewarewa School. The maths progressions for geometry and measurement and 'number and algebra should be used in conjunction with these progressions.

At Whakarewarewa School maths programmes are characterised by the following:

- A problem solving approach, rather than a 'number crunching' one
- Differentiated practices, based on needs, as ascertained by current and reliable data
- Integration of the various strands of maths as much as possible and integration of the numeracy domains
- Integration of maths in other subjects and in real life settings
- Teachers and students using the correct vocabulary as set out in this document to ensure students experience the same language of learning from class to class
- The development of assessment capable learners who understand and can articulate the following:
 - Where am I going? What are my goals?
 - How am I going? What progress is being made towards the goal?
 - Where to next? What activities need to be undertaken next to better progress?
- [Effective pedagogy in mathematics](#) - The International Academy of Education's research on improving student achievement in mathematics, based on Best Evidence Synthesis is used to inform classroom practice. This [short guide](#) with questions to consider when reflecting on classroom practice may be helpful.
- A strategic approach is used for teaching 'mathematical behaviours' as set out in this document. Learning intentions for mathematical behaviours must be a part of each lesson.

How to use this document:

- These progressions are not a checklist to be worked through. They can form the basis of the maths programme and should be used to inform planning. Students may be working at multiple stages in different areas of their learning.
- Data analysis, identifying of goals and any other planning will start with the maths progressions but other resources can also be drawn on.
- Progressions can be used to plan and teach a specific group and sometimes for 'clinics' i.e. students across the class with the same identified learning need.
- Share the progressions with students (age appropriate), so they know where they at, where they are going and what their next learning step is.
- All lessons must include learning intentions from the 'mathematical behaviours' section. These should be specifically planned, taught and monitored.

Maths Progressions - Statistics

Level 1

After 1 year at school

In contexts that require them to solve problems or model situations, students will be able to:

- investigate questions by using the statistical enquiry cycle (with support), gathering, displaying, and/or counting category data.

Mathematical Behaviours (what mathematicians do)

I am learning to...

Explain my mathematical thinking

Explain others' strategies by repeating or re-voicing what they have said

Use the most efficient strategy to solve a problem e.g. I know that counting on from the largest number is more efficient than counting from 1

Agree or disagree with someone else's strategy or answer, and explain why I think this

Listen actively

Say what I am good at in maths and what I need to work on

Identify maths in the world around me

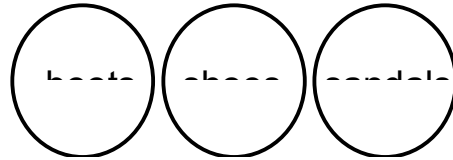
Use mathematical vocabulary

Pose problems and conduct mathematical investigations

Statistical investigation (data gathering and display)

I am learning to...

Collect and sort everyday objects into categories

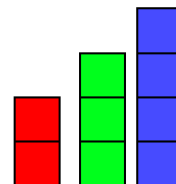


Make picture graphs



Make a block graph

(with materials e.g. blocks or unifix cubes)



Statistical literacy

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Say why everyday objects belong together	"I think the circle and the triangle should be together because they're both blue."
Count the number of objects in each category	"There are 5 blue shapes and there are 7 red shapes."
Talk about a graph and give simple reasons for the data	"There are more boots because it is cold today." "Happy faces has the most because we like them." "Most people got blue because there's more blue ones in the box."
Probability	
Classify events as: <ul style="list-style-type: none">● Certain (yes, always, will)● Possible (maybe, sometimes, might)● Impossible (no, never, won't)	"Will it be sunny tomorrow?"

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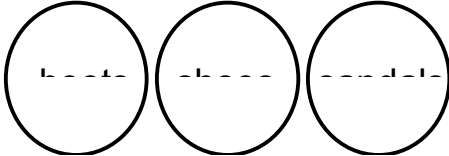
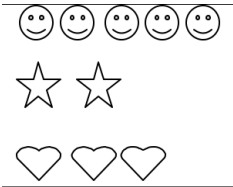
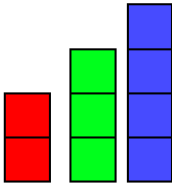
Level 1

After two years at school


In contexts that require them to solve problems or model situations, students will be able to:

- investigate questions by using the statistical enquiry cycle (with support), gathering, displaying, and/or identifying similarities and differences in category data.

Describe the likelihoods of outcomes for a simple situation involving chance, using everyday language.

Mathematical Behaviours (what mathematicians do)	
I am learning to...	
Explain my mathematical thinking	Explain others' strategies by repeating or re-voicing what they have said
Use the most efficient strategy to solve a problem e.g. I know that counting on from the largest number is more efficient than counting from 1	Agree or disagree with someone else's strategy or answer, and explain why I think this
Listen actively	Say what I am good at in maths and what I need to work on
Identify maths in the world around me	Use mathematical vocabulary
Pose problems and conduct mathematical investigations	
Statistical investigation (data gathering and display)	
I am learning to...	
Collect and sort everyday objects into categories	
Make picture graphs	
Make a block graph (with materials e.g. blocks or unifix cubes)	
Statistical literacy	

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Say why everyday objects belong together	"I think the circle and the triangle should be together because they're both blue."
Count the number of objects in each category	"There are 5 blue shapes and there are 7 red shapes."
Talk about a graphs and give simple reasons	"There are more boots because it is cold today." "Happy faces has the most because we like them." "Most people got blue because there's more blue ones in the box."
Talk about the similarities and differences in data	"The boys read 8 books and the girls read 5 books." "Oliver read two more books than Kate."
Ask questions about data that compares the data	"How many more books did Oliver read than Kate?"
Probability	
Classify events as: <ul style="list-style-type: none"> • Certain (yes, always, will) • Possible (maybe, sometimes, might) • Impossible (no, never, won't) 	"Will it be sunny tomorrow?"
Say the possible outcomes for an event (2 variables only)	 <p>"Will it be a red circle or a blue circle next time out of the bag?" "It will be a blue circle because we put more of them in the bag."</p>

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Level 2

After 3 years at school

Investigate questions by using the statistical enquiry cycle (with support):

- gather and display category and simple whole-number data
- interpret displays in context

Compare and explain the likelihoods of outcomes for a simple situation involving chance.

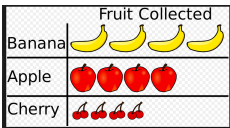
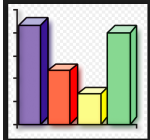

Mathematical Behaviours (what mathematicians do)

I am learning to...

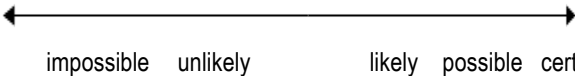
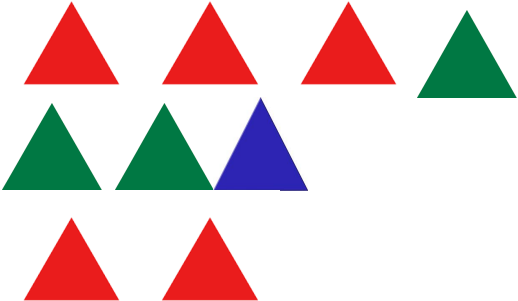
Explain my mathematical thinking orally, visually or in writing	Engage in mathematical discussions with others
Explain others' strategies by repeating or re-voicing what they have said	Use the most efficient strategy to solve a problem e.g. I know that for this problem using a place value strategy is more efficient than counting on.
Agree or disagree with someone else's strategy or answer, and explain why I think this	Listen actively
I know what I am good at in maths, what my gaps are and my next steps	Use mathematical vocabulary
Pose problems and conduct mathematical investigations	Make connections with what I am learning in maths to other curriculum areas and the world around me

Statistical investigation (data gathering and display)

I am learning to...

Ask a question for data gathering	"How many people have 2 or more pets?"										
Create a survey form	<p>Survey example could be:</p> <ul style="list-style-type: none"> Do you have any pets? How many pets do you have? What kinds of pets do you have? 										
Make a pictograph	 <table border="1"> <thead> <tr> <th colspan="2">Fruit Collected</th> </tr> </thead> <tbody> <tr> <td>Banana</td> <td></td> </tr> <tr> <td>Apple</td> <td></td> </tr> <tr> <td>Cherry</td> <td></td> </tr> </tbody> </table>	Fruit Collected		Banana		Apple		Cherry			
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Create a bar graph											
Make a tally chart	 <table border="1"> <thead> <tr> <th>Food</th> <th>Votes</th> </tr> </thead> <tbody> <tr> <td>Pizza</td> <td> </td> </tr> <tr> <td>Burger</td> <td> </td> </tr> <tr> <td>Pasta</td> <td> </td> </tr> <tr> <td>Hot Dog</td> <td> </td> </tr> </tbody> </table>	Food	Votes	Pizza		Burger		Pasta		Hot Dog	
Food	Votes										
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Statistical literacy	
Talk about the graphs and make sensible comparisons	"White is the most popular t-shirt colour, and red is the least popular because..."
Read graphs and answer questions about the data	"Which fruit did we collect most of?" "Which food is the class's favourite?"
Ask questions about the data	"Why is white the most popular?" or "Do boys prefer white or do girls prefer white?"
Analyse the raw data and generate questions	"Is the way the data has been presented fair?" "Does it really show what we want to find out?" "What does this data really show us?"
Probability	
Compare and order events	 <p>impossible unlikely likely possible certain</p> <p>"Is it going to rain today?"</p>
Say the possible outcomes for an event (3 or more variables)	 <p>"A red triangle is most likely because there are more red triangles in the bag." "A blue triangle is least likely because there are less in the bag."</p> <p>Note: If a student classifies the probability of getting each colour using fractions, e.g. there's $\frac{1}{3}$ chance of green, they exceed the expectation.</p>
Know that the more times you perform an event the closer you get to the predicted probability	Even though we got more blue triangles out of the bag, the more we do the activity the more likely we are to getting the predicted probability (which is less blue triangles)

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Level 2

By the end of year 4

Investigate questions by using the statistical enquiry cycle independently:

- gather and display category and simple whole-number data
- interpret displays in context

Compare and explain the likelihoods of outcomes for a simple situation involving chance, acknowledging uncertainty.

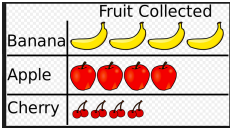
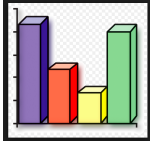

Mathematical Behaviours (what mathematicians do)

I am learning to...

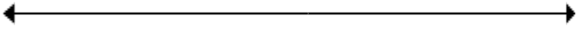
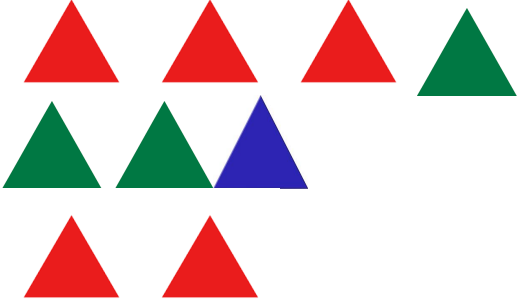
Explain my mathematical thinking orally, visually or in writing	Engage in mathematical discussions with others
Explain others' strategies by repeating or re-voicing what they have said	Use the most efficient strategy to solve a problem e.g. I know that for this problem using a place value strategy is more efficient than counting on.
Agree or disagree with someone else's strategy or answer, and explain why I think this	Listen actively
I know what I am good at in maths, what my gaps are and my next steps	Use mathematical vocabulary
Pose problems and conduct mathematical investigations	Make connections with what I am learning in maths to other curriculum areas and the world around me

Statistical investigation (data gathering and display)

I am learning to...

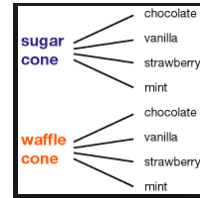
Ask a question for data gathering	"Which sport do most students in year 4 play?"										
Create a survey form to carry out a simple investigation	"Do you play any sports?" "How many sports do you play?" "Which sports do you play?"										
Make a pictograph	 <table border="1"> <thead> <tr> <th colspan="2">Fruit Collected</th> </tr> </thead> <tbody> <tr> <td>Banana</td> <td></td> </tr> <tr> <td>Apple</td> <td></td> </tr> <tr> <td>Cherry</td> <td></td> </tr> </tbody> </table>	Fruit Collected		Banana		Apple		Cherry			
Fruit Collected											
Banana											
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Create a bar graph, using digital equipment											
Make a tally chart	 <table border="1"> <thead> <tr> <th>Food</th> <th>Votes</th> </tr> </thead> <tbody> <tr> <td>Pizza</td> <td> </td> </tr> <tr> <td>Burger</td> <td> </td> </tr> <tr> <td>Pasta</td> <td> </td> </tr> <tr> <td>Hot Dog</td> <td> </td> </tr> </tbody> </table>	Food	Votes	Pizza		Burger		Pasta		Hot Dog	
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Maths Progressions - Statistics

Statistical literacy	
Talk about graphs and make sensible comparisons	"White is the most popular t-shirt colour, and red is the least popular because..."
Ask questions about the data	"Why is white the most popular?" or "Do boys prefer white or do girls prefer white?"
Read different types of graphs and answers questions about the data	Graphs types to 'read' include, pie graphs (without percentage data), bar graphs, pictographs, tally charts.
Analyse different graphs	"Is this the best kind of graph?" "Why did you choose this kind of graph to read the data?" "Which of these graphs is better for our purpose?"
Analyse the raw data and generate questions	"Is the way the data has been presented fair?" "Does it really show what we want to find out?" "What does this data really show us?"
Probability	
Compare and order events	 <p style="text-align: center;">impossible unlikely likely possible certain</p> <p>"Is it going to rain today?"</p>
Say the possible outcomes for an event (3 or more variables)	 <p>"A red triangle is most likely because there are more red triangles in the bag." "A blue triangle is least likely because there are less in the bag."</p> <p>Students should also understand that even though red is the most likely, there is still a possibility that it may not be pulled out of the bag.</p>

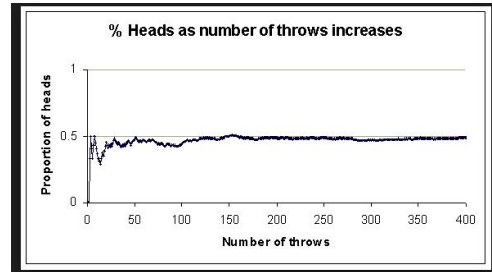
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Find possibilities of simple events using equipment



It is acceptable for equipment to be used, however some students may prefer or be ready for using a tree diagram as above.

Know that the more times you perform an event the closer you get to the predicted probability



You're more likely to get equal chance of getting heads or tails the more you toss the coin.

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Level 3

By the end of year 5

Investigate summary and comparison questions by using the statistical enquiry cycle:

- gather, display, and identify patterns in category and whole-number data
- interpret results in context

Order the likelihoods of outcomes for simple situations involving chance, experimenting or listing all possible outcomes.

Mathematical Behaviours (what mathematicians do)	
I am learning to...	
Explain my mathematical thinking orally, visually, in writing or using digital tools	Select and apply the appropriate representations to solve problems e.g. graphs, diagrams, tables, numbers etc.
Apply the most efficient strategy to solve a problem e.g. I know that for this problem a part-whole place value strategy is more efficient than compensating from tidy numbers.	Engage in mathematical discussions with others
Take or defend a position or point of view about a strategy/answer and justify with evidence e.g recognising relationships, or using counter examples	Explain others' strategies by repeating or re-voicing what they have said
Listen actively	I know where I am going, how I am going and where to next in maths
Use mathematical vocabulary	Make connections with what I am learning in maths to other curriculum areas and daily life
Pose problems and conduct mathematical investigations	Make generalisations
Statistical investigation (data gathering and display)	
I am learning to...	
Pose a question for statistical investigation (own questions and forming their own assertions)	<p>"How wide is a ten-year-old's hand span?"</p> <p>As the emphasis is on multi-variate data the questions can be of three main types:</p> <ol style="list-style-type: none"> 1. <u>Summary questions</u> e.g. What is the height of a ten year old person? 2. <u>Comparative questions or assertions</u> e.g. "Are eleven year old girls taller than eleven year old boys?" 3. <u>Relationship questions</u> e.g. "Are people's foot-lengths related to their hand spans?"
Plan an investigation and gather data	<p>Key questions for students to ask themselves in planning an investigation from a question or assertion are:</p> <ul style="list-style-type: none"> ● What information will help me answer this question? ● Who/what shall I ask/measure to get this information? ● What questions will I ask? or What measurements will I take? <p>"Boys' hand spans are larger than girls' hand spans"</p> <ul style="list-style-type: none"> ● Who/what shall I ask/measure to get this information? ● What questions will I ask?/What measurements will I take?

Maths Progressions - Statistics









	<ul style="list-style-type: none"> How will I organise the information as I collect it? 										
Plan out a process for collecting, analysing, and displaying data using flowcharts (multivariate data)	<pre> graph LR A[Question or Assertion] --> B[Survey people] B --> C[Sort data] C --> D[Display data in a tally chart] </pre>										
Carry out a survey and record results systematically e.g. using a tally chart or frequency chart (for non digital data) OR a Google form and spreadsheet (for digital data) Note: Only surveys carried out in person, should be non digital. All other information gathered and data displayed is required to be digital	<table border="1"> <thead> <tr> <th>Food</th> <th>Votes</th> </tr> </thead> <tbody> <tr> <td>Pizza</td> <td> </td> </tr> <tr> <td>Burger</td> <td> </td> </tr> <tr> <td>Pasta</td> <td> </td> </tr> <tr> <td>Hot Dog</td> <td> </td> </tr> </tbody> </table>	Food	Votes	Pizza		Burger		Pasta		Hot Dog	
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Display data with an appropriate graph (digitally) Graph types: Stem and leaf, dot plot, bar, pie, line etc.	It is expected that students at level three will use the correct terms for graph types, give graphs a suitable title, choose sensible whole number scales, and label the axis appropriately.										
Interpret results, communicating: <ul style="list-style-type: none"> my conclusions to an audience make a critical choice from the data displays I have available hypothesising about why the patterns and trends occur 	Students should make statements about the data based on the ideas of 'middle', 'spread' and 'clustering'. Example: The middle height is about 133cms. We're between 105 - 155cms tall. Most people are between 130 and 150cms.										
Analyse different graphs	<p>"Is this the best kind of graph?"</p> <p>"Why did you choose this kind of graph to read the data?"</p> <p>"Which is of these graphs is better for our purpose?"</p> <p>"What sort of data would be most suited for this type of graph?"</p>										
Analyse the raw data and generate questions	<p>"Is the way the data has been presented fair?"</p> <p>"Does it really show what we want to find out?"</p> <p>"What does this data really show us?"</p>										
Statistical literacy											
Talk about special features of a graph	<ul style="list-style-type: none"> Proportions within the total, using fractions where appropriate, "4 out of 18 are blue. That's less than $\frac{1}{4}$" Groupings (clusters) of scores Extreme or unusual scores (outliers) Spread (range) <p>It is <u>not</u> expected that they will use statistical measures like mean, median, and range to communicate their findings until level four at the earliest.</p>										
Make sensible statements about data and generate new questions	<p>Statement: "There is a cluster around 6 o'clock because that's when most parents are home from work and the children are home from school and then they can play or watch TV after dinner."</p> <p>Generate new questions:</p>										

Maths Progressions - Statistics

	<p>“Do parents come home at 6 o'clock?” “When do children have their dinner?” “Do children eat their dinner in front of TV?”</p>
Analyse the raw data and generate questions	<p>“Is the way the data has been presented fair?” “Does it really show what we want to find out?” “What does this data really show us?” “Are the way the questions are asked unbiased?”</p>
Evaluate and choose the best graph for the situation	<p>“I think the pie graph is the best way to show how much time I spend watching TV because I can see how big the slice is.”</p> <p>Note: See the number and algebra progressions for expectations around the understanding of fractions and percentages</p>

Probability

Predict the likelihood of events using words	<p>Certain, good chance, even chance, poor chance, no chance etc.</p> <p>“The numbers 3 and 8 have an equal likelihood of winning.” “4 and 6 are the least likely to win.” “1 and 9 are the most likely.”</p>
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Predict the likelihood of events using numbers	<p>Students play the following game with a pack containing 10 digit cards (0, 1, 2 ... 9).</p> <div style="display: flex; flex-wrap: wrap; justify-content: space-around;"> <div style="text-align: center;">  <p>1. Shuffle the digit cards.</p> </div> <div style="text-align: center;">  <p>2. Place them face down in a pile.</p> </div> <div style="text-align: center;">  <p>3. Pick up the top 2 cards.</p> </div> <div style="text-align: center;">  <p>4. Now pick up a third card.</p> </div> <div style="text-align: center;">  <p>5. If the number on that card is not between the other 2 numbers, you get nothing.</p> </div> <div style="text-align: center;">  <p>6. If it is, take a counter.</p> </div> <div style="text-align: center;">  <p>7. Put your 3 cards back on the pack and shuffle it. Now it's your classmate's turn.</p> </div> <div style="text-align: center;">  <p>8. When there are no more counters to take, the person who has the most counters wins.</p> </div> </div> <p>Give the student these four scenarios and ask them to compare the chances of winning.</p>
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The student compares the probabilities of winning in the various scenarios by assessing the likelihood of getting a number between the two that are exposed.

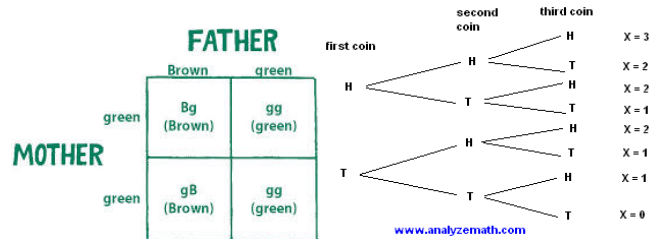
They may list the possibilities: the number 5 for between 4 and 6; 3, 4, 5, 6 for between 2 and 7; and so on. To meet the expectation, the student orders the probabilities correctly, noting that 2–7 and 3–8 have equal likelihood. 4–6 is the least likely to win and 1–9 the most likely.

If the student uses fractions to order the probabilities, they exceed the expectation (for example, 'There is a one-half (4 out of 8) chance of getting a card between 2 and 7').

Find the chances of a simple practical event by carrying out a trial and recording the results in a systematic way

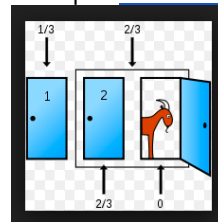
Example of a practical event:
Pulling out certain numbers in a pile of cards

Example of systematic recording:
Tally chart, list, tree diagram, table, arrow diagram



Use statistical evidence by practical experimentation to decide an argument

Example: [The Monty Hall Problem](#)



Maths Progressions - Statistics

Level 3

By the end of year 6

In contexts that require them to solve problems or model situations, students will be able to:

- investigate summary and comparison questions by using the statistical enquiry cycle:
 - gather or access multivariate category and whole-number data
 - sort data into categories or intervals, display it in different ways, and identify patterns
 - interpret results in context, accepting that samples vary
- order the likelihoods of outcomes for situations involving chance, considering experimental results and models of all possible outcomes.

Mathematical Behaviours (what mathematicians do)

I am learning to...

Explain my mathematical thinking orally, visually, in writing or using digital tools

Select and apply the appropriate representations to solve problems e.g. graphs, diagrams, tables, numbers etc.

Apply the most efficient strategy to solve a problem e.g. I know that for this problem a part-whole place value strategy is more efficient than compensating from tidy numbers.

Engage in mathematical discussions with others

Take or defend a position or point of view about a strategy/answer and justify with evidence e.g recognising relationships, or using counter examples

Explain others' strategies by repeating or re-voicing what they have said

Listen actively

I know where I am going, how I am going and where to next in maths

Use mathematical vocabulary

Make connections with what I am learning in maths to other curriculum areas and daily life

Pose problems and conduct mathematical investigations

Make generalisations

Statistical investigation (data gathering and display)

I am learning to...

Pose a question for statistical investigation

(own questions and forming their own assertions)

"How wide is a ten-year-old's hand span?"

As the emphasis is on multi-variate data the questions can be of three main types:

1. Summary questions e.g. What is the height of a ten year old person?
2. Comparative questions or assertions e.g. "Are eleven year old girls taller than eleven year old boys?"
3. Relationship questions e.g. "Are people's foot-lengths related to their hand spans?"

Plan an investigation and gather multivariate data

Key questions for students to ask themselves in planning an investigation from a question or assertion are:

- What information will help me answer this question?
- Who/what shall I ask/measure to get this information?
- What questions will I ask? or What measurements will I take?

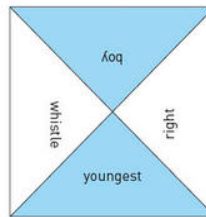
Maths Progressions - Statistics

"Boys' hand spans are larger than girls' hand spans"

- Who/what shall I ask/measure to get this information?
- What questions will I ask?/What measurements will I take?
- How will I organise the information as I collect it?

Have each student in the class create a data card with answers to the following questions:

- Are you a boy or a girl?
- Can you whistle?
- Are you the oldest, the youngest, the only, or a middle child in your family?
- Which hand do you usually write with?

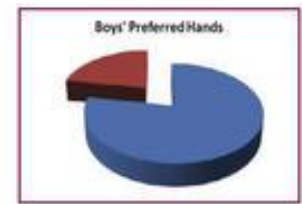
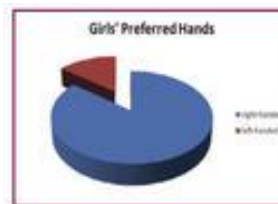


Photocopy all the data cards onto A4 paper. Organise the students into pairs, hand out a set of data cards to each pair, and have them cut out all the data cards.

Suggest some different types of questions that could be answered from the data – for example, summary questions like 'Can more people whistle than can't whistle?' or comparison questions like 'Are more boys or girls left-handed?'

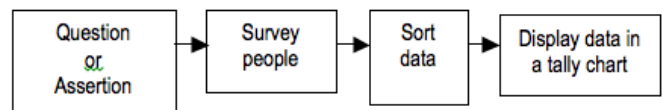
Sort the class data to find the answers to your questions and display the results using graphs so that your classmates can clearly see the answers.

The student asks summary and comparison questions that can be answered using the information provided by the data cards.

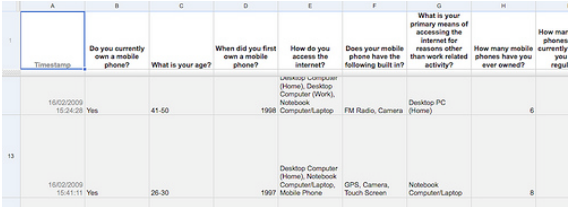


They sort and present the data in ways that clearly answer their questions and communicate their findings. To highlight differences, they use pictographs or bar graphs (made from the data cards). To highlight proportions, they might use strip graphs or pie charts.



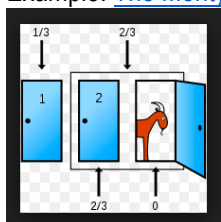
Plan out a process for collecting, analysing, and displaying data using flowcharts (multivariate data)



Maths Progressions - Statistics

<p>Carry out a survey and record results systematically</p> <p>E.g. using a tally chart or frequency chart (for non digital data) OR a Google form and spreadsheet (for digital data)</p> <p>Note: Only surveys carried out in person, should be non digital. All other information gathered and data displayed is required to be digital</p>	
<p>Sort and present data using appropriate graphs (digitally)</p>	<p>To highlight differences: Pictographs or bar graphs To highlight proportions: Strip graphs or pie charts</p> <p>Graphs at this level must clearly answer the statistical question and clearly communicate their findings.</p>
<p>Interpret results:</p> <ul style="list-style-type: none"> communicating my conclusions to an audience making a critical choice from the data displays I have available hypothesising about why the patterns and trends occur 	<p>Students should make statements about the data based on the ideas of 'middle', 'spread' and 'clustering'.</p> <p>Example: The middle height is about 133 cms. We're between 105 - 155cms tall. Most people are between 130 and 150 cms.</p>
<p>Analyse different graphs</p>	<p>"Is this the best kind of graph?" "Why did you choose this kind of graph to read the data?" "Which is of these graphs is better for our purpose?" "What sort of data would be most suited for this type of graph?"</p>
<p>Analyse the raw data and generate questions</p>	<p>"Is the way the data has been presented fair?" "Does it really show what we want to find out?" "What does this data really show us?"</p>
<p>Statistical literacy</p>	
<p>Talk about special features of a graph</p>	<ul style="list-style-type: none"> Proportions within the total, using fractions where appropriate, "4 out of 18 are blue. That's less than $\frac{1}{4}$" Groupings (clusters) of scores Extreme or unusual scores (outliers) Spread (range) <p>It is <u>not</u> expected that they will use statistical measures like mean, median, and range to communicate their findings until level four at the earliest.</p>
<p>Make sensible statements about data and generate new questions</p>	<p>Statement: "There is a cluster around 6 o'clock because that's when most parents are home from work and the children are home from school and then they can play or watch TV after dinner."</p> <p>Generate new questions: "Do parents come home at 6 o'clock?" "When do children have their dinner?" "Do children eat their dinner in front of TV?"</p>
<p>Analyse the raw data and generate questions</p>	<p>"Is the way the data has been presented fair?" "Does it really show what we want to find out?" "What does this data really show us?" "Are the way the questions are asked unbiased?"</p>

Maths Progressions - Statistics

<p>Evaluate and choose the best graph for the situation</p>	<p>"I think the pie graph is the best way to show how much time I spend watching TV because I can see how big the slice is."</p> <p>Note: See the number and algebra progressions for expectations around the understanding of fractions and percentages</p>									
<p>Probability</p>										
<p>Predict the likelihood of events using words and numbers</p>	<p>"The numbers 3 and 8 have an equal likelihood of winning." "4 and 6 are the least likely to win." "1 and 9 are the most likely." "3 out of 10 cars are white" "More than $\frac{1}{2}$ of the people chose white." "It is less likely to get heads-heads or tails-tails than that of one head and one tail."</p> <p>If the student uses fractions to order the probabilities, they exceed the expectation.</p>									
<p>Find the chances of a simple practical event by carrying out a trial and recording the results in a systematic way</p>	<p>Example of a practical event: Pulling out certain numbers in a pile of cards</p> <p>Example of systematic recording: Tally chart, list, tree diagram, table, arrow diagram</p> <div style="text-align: center;"> <p>FATHER</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">Brown</td> <td style="text-align: center;">green</td> </tr> <tr> <td style="text-align: center;">green</td> <td style="text-align: center;">Bg (Brown)</td> <td style="text-align: center;">gg (green)</td> </tr> <tr> <td style="text-align: center;">green</td> <td style="text-align: center;">gB (Brown)</td> <td style="text-align: center;">gg (green)</td> </tr> </table> <p>MOTHER</p> </div> <div style="display: flex; align-items: center; margin-top: 10px;"> <div style="margin-right: 20px;">  </div> <div style="margin-right: 20px;">  </div> <div> <p>From the model, they should explain that there is only one way of getting heads-heads or tails-tails but two ways of getting one head and one tail. If the student expresses the likelihoods as fractions, they exceed the expectation.</p> </div> </div>		Brown	green	green	Bg (Brown)	gg (green)	green	gB (Brown)	gg (green)
	Brown	green								
green	Bg (Brown)	gg (green)								
green	gB (Brown)	gg (green)								
<p>Use statistical evidence by practical experimentation to decide an argument</p>	<p>Example: The Monty Hall Problem</p> 									

Maths Progressions - Statistics

Level 4

By the end of year 8

In contexts that require them to solve problems or model situations, students will be able to:

- investigate summary, comparison, and relationship questions by using the statistical enquiry cycle:
 - gather or access multivariate category, measurement and *time-series data*
 - sort data and display it in multiple ways, identifying patterns, variations, *relationships, and trends and using ideas about middle and spread where appropriate.*
 - interpret results in context, accepting that samples vary and have no effect on one another; *identifying factors that produce uncertainty.*
- order the likelihood of outcomes for situations involving chance, checking for consistency between experimental results and models of all possible outcomes.
- *express as fractions the likelihood of outcomes for situation involving chance, checking for consistency between experimental results and models of all possible outcomes.*
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**italics indicates the additional expectations for year 8*

Mathematical Behaviours (what mathematicians do)

I am learning to...

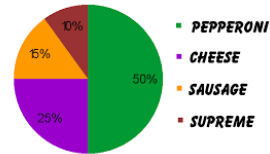
Explain my mathematical thinking orally, visually, in writing or using digital tools	Select and apply the appropriate representations to solve problems e.g. graphs, diagrams, tables, numbers etc.
Compare a variety of problem solving strategies	Engage in mathematical discussions with others
Take or defend a position or point of view about a strategy/answer and justify with evidence e.g recognising relationships, or using counter examples	Apply the most efficient strategy to solve a problem e.g. I know that for this problem a part-whole place value strategy is more efficient than compensating from tidy numbers.
Listen actively	I know where I am going, how I am going and where to next in maths
Use mathematical vocabulary	Make connections with what I am learning in maths to other curriculum areas, daily life, current events, art, culture or sport
Explain others' strategies by repeating or re-voicing what they have said	Pose problems and conduct mathematical investigations
Make generalisations	

Statistical investigation (data gathering and display)


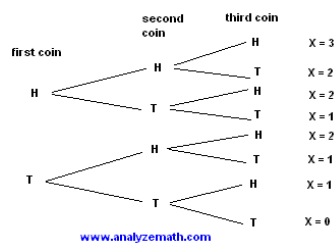
I am learning to...

Conduct a statistical investigation based on an environmental or social issue, or an experiment of interest	<p>"How does running for half an hour after school every day affect our fitness?"</p> <p>"Has the unit on Healthy Eating had an impact on year 7 and 8 students' eating habits and lifestyles?"</p> <p>Investigations must involve:</p> <ul style="list-style-type: none"> ● Designing questions that are clear and unambiguous ● Designing question that allow for easy data handling ● Choosing a sample which avoids bias ● Being aware of a representative sample ● Analysing sources of error ● Acting on the findings of the investigation
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Maths Progressions - Statistics

Organise a systematic approach to collecting data	Must ensure: that information is not lost or discarded, and (where appropriate) remains confidential																								
Sort and present data digitally, using the appropriate graphs	Use spreadsheets to collect data. Graphs can include: pictogram, bar chart, histogram, strip graph, pie graph, stem and leaf graph, dot plot																								
Calculate and make a pie graph (see number and algebra progressions for expectations around the learning of percentages)	<p style="text-align: center;">FAVORITE PIZZA TOPPINGS</p>  <p style="text-align: right;"> ■ PEPPERONI ■ CHEESE ■ SAUSAGE ■ SUPREME </p>																								
Compare sets of data	<p>Pulse rates <i>before</i> and <i>after</i> exercise</p> <table border="1" data-bbox="829 737 1057 989"> <thead> <tr> <th colspan="2">Student Heart Rates after doing 1 minute of jumping jacks</th> </tr> <tr> <th>Stem</th> <th>Leaf</th> </tr> </thead> <tbody> <tr><td>6</td><td>1</td></tr> <tr><td>7</td><td></td></tr> <tr><td>8</td><td>4 6 8</td></tr> <tr><td>9</td><td>2 9 9 9</td></tr> <tr><td>10</td><td></td></tr> <tr><td>11</td><td>3 4</td></tr> <tr><td>12</td><td>1 2 4 4 7 9</td></tr> <tr><td>13</td><td>8</td></tr> <tr><td>14</td><td>4 7 8</td></tr> <tr><td>15</td><td>1</td></tr> </tbody> </table> <p style="font-size: small;">Key: 6 1 = 61</p>	Student Heart Rates after doing 1 minute of jumping jacks		Stem	Leaf	6	1	7		8	4 6 8	9	2 9 9 9	10		11	3 4	12	1 2 4 4 7 9	13	8	14	4 7 8	15	1
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Collect and present data on: <ul style="list-style-type: none"> ● frequency distribution tables ● histograms ● <i>time-series data</i> 	<p style="text-align: center;"> Frequency distribution tables tutorial Histogram tutorial Time series data tutorial </p>																								
Statistical literacy																									
Report on the distinctive features of data displays	<p>The distinctive features of data displays:</p> <ul style="list-style-type: none"> ● Outliers, clusters, and shape of data distribution ● Identify the mode and calculate the mean (median, average) using calculators where appropriate ● Write a report about the implications based on the conclusions ● Discuss possible actions e.g. present findings to the Board of Trustees 																								
Make sensible statements about data and generate new questions	<p>Statement: “There is a cluster around 6 o'clock because that's when most parents are home from work and the children are home from school and then they can play or watch TV after dinner.”</p> <p>Generate new questions: “Do parents come home at 6 o'clock?” “When do children have their dinner?” “Do children eat their dinner in front of TV?”</p>																								
Analyse the raw data and generate questions	<p>“Is the way the data has been presented fair?” “Does it really show what we want to find out?”</p>																								

Maths Progressions - Statistics

	<p>“What does this data really show us?”</p> <p>“Are the way the questions are asked unbiased?”</p>																
Evaluate statements made by others about the findings of statistical investigations and probability activities																	
Probability																	
Find all the possible outcomes for simple chance events using an organised list	 <p>Show the student a bucket containing 2 red balls and 2 blue balls. What are all the possible outcomes when you randomly draw 2 balls from the bucket?</p> <p>Red 1 Blue 1 Red 1 Blue 2 Red 2 Blue 2 Red 2 Blue 1 Blue 1 Blue 2</p>																
Find all the possible outcomes for simple chance events using a table	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td>Red 1</td> <td>Red 2</td> <td>Blue 1</td> <td>Blue 2</td> </tr> <tr> <td>Red 2</td> <td>Red 1</td> <td>Blue 1</td> <td>Blue 2</td> </tr> <tr> <td>Blue 1</td> <td>Red 1</td> <td>Red 2</td> <td>Blue 2</td> </tr> <tr> <td>Blue 2</td> <td>Red 1</td> <td>Red 2</td> <td>Blue 1</td> </tr> </table> <p style="text-align: center;">“2 out of 12 will give 2 red balls”</p>	Red 1	Red 2	Blue 1	Blue 2	Red 2	Red 1	Blue 1	Blue 2	Blue 1	Red 1	Red 2	Blue 2	Blue 2	Red 1	Red 2	Blue 1
Red 1	Red 2	Blue 1	Blue 2														
Red 2	Red 1	Blue 1	Blue 2														
Blue 1	Red 1	Red 2	Blue 2														
Blue 2	Red 1	Red 2	Blue 1														
Find all the possible outcomes for simple chance events using a tree diagram	 <p style="text-align: center;">www.analyzemath.com</p>																
Describe the probabilities using simple fractions	<p>“2 out of 12. That’s a probability of one sixth.”</p> <p>Convert fractions to percentages</p> <p>“1 in 6 is a probability of 66%”</p>																

Maths Progressions - Statistics

Compare predictions with trial distributions, and recognise when the variation from trial samples are reasonable or unreasonable

Example 1 - by the end of year 7

Show the student a bucket containing 2 red balls and 2 blue balls.

What are all the possible outcomes when you randomly draw 2 balls from the bucket?

What is the probability of getting 2 red balls?

How many times would you expect to get 2 red balls in 60 draws?

Now trial the situation by drawing 2 balls 60 times and recording your results on a tally chart. Then summarise your results on a frequency table, like this:

Red-red	Red-blue	Blue-blue
12	41	7

How do your results compare with your prediction of how often you'd draw 2 red balls? Do the results make you change your prediction?

If you repeated the trial with 60 draws, how many times would you get 2 red balls?



Red 1 Red 2
 Red 1 Blue 1
 Red 1 Blue 2
 Red 2 Blue 2
 Red 2 Blue 1
 Blue 1 Blue 2

The student creates a model of all the possible outcomes when 2 balls are removed from the bucket. From this, they identify that 2 red balls is one of 6 possible outcomes, and they predict that this outcome should occur about 10 times in 60 draws.

The student accepts that the experimental results are consistent with their prediction despite any variation from 10 red-red occurrences. They predict that in a second trial, 2 red balls will be drawn approximately 10 times. They also recognise that the results are unlikely to be identical to those in the first trial, that is, they accept the variability and independence of samples.

Example 2 - by the end of year 8

In this is a game you might use at the school gala.

Put 2 red balls and 2 blue balls in a bucket. Without looking, a player takes out 2 balls. If the balls are the same colour, they win. If the balls are different, they lose.

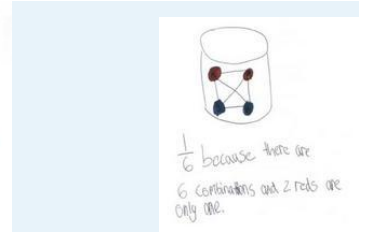
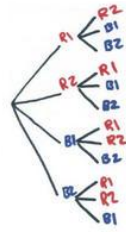
Carry out an experiment by playing 30 games and recording how often the player wins and loses. Draw a diagram to show all the possible outcomes when you draw 2 balls from the bucket. Does this help explain your results? How?

Win: Blue-Blue, Red-Red	Loss: Red-Blue

If you played 30 more games, would the results be the same as or different from your first experiment? If they would be different, how?

The student plays 30 games and organises their results systematically, for example, by using a table or tally chart. They notice that there are more losses than wins. (The results will generally be around 10 wins and 20 losses.)

Maths Progressions - Statistics



The student creates a model of all possible outcomes, for example, a network or tree diagram.

From the model, the student concludes that the chances of winning and losing are one-third and two-thirds respectively. They accept that their results may not exactly reflect these likelihoods (for example, 12 wins from 30 games is slightly more than one-third).

The student understands that the first experiment does not influence the second. They explain that the results are likely to be around 10 wins and 20 losses but unlikely to be identical to the results from the first experiment – that is, they accept the variability and independence of samples. (In this case, the sample consists of 30 games.)

Maths Progressions - Statistics

Use statistical evidence by practical experimentation to decide an argument

Example: [The Monty Hall Problem](#)

