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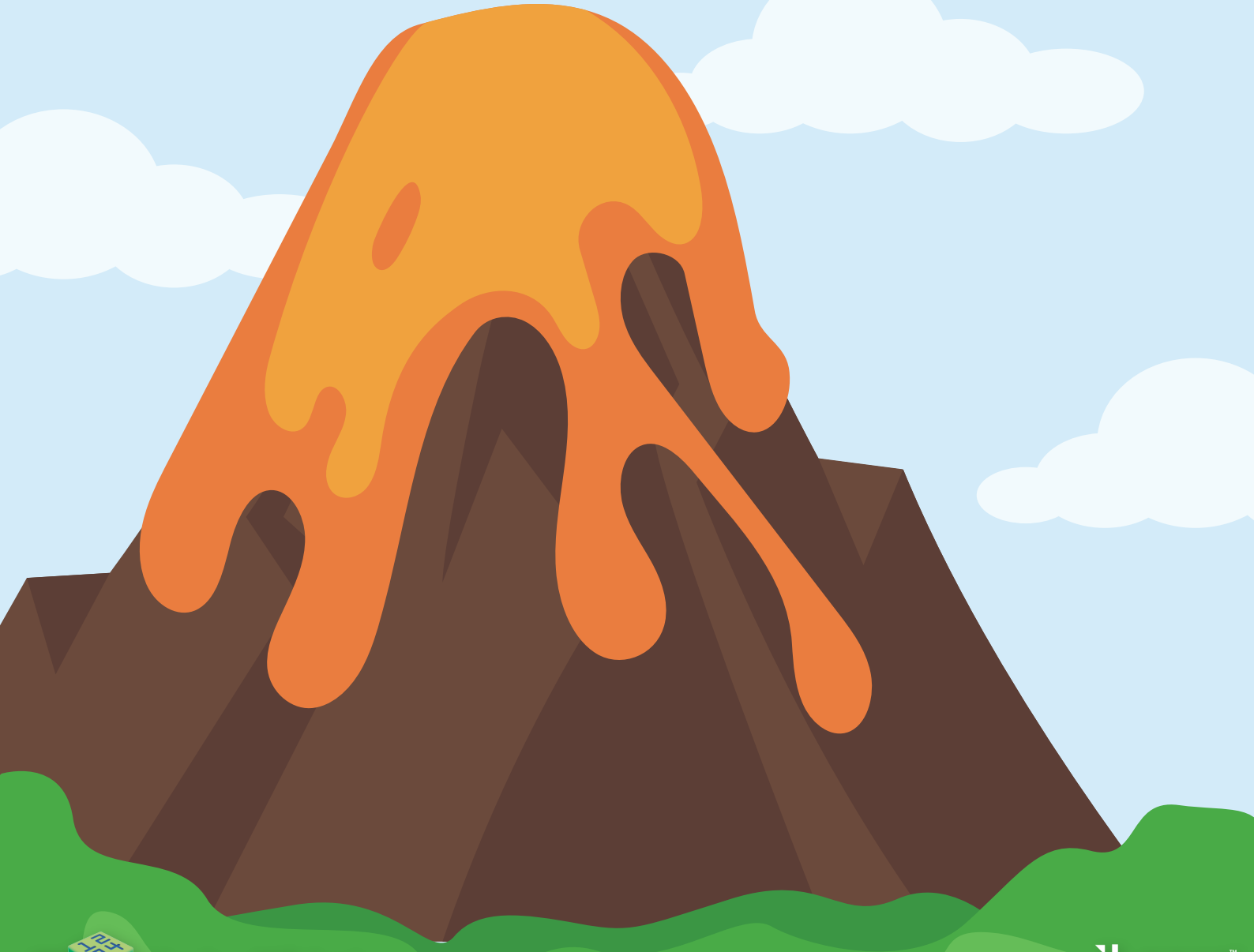
Know our Whenua

Aotearoa, New Zealand



Maths-Whizz® by whizz EDUCATION

iLearn™ EDUCATION

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Outline

Multi-level, cross-strand, mathematics activity, covering Levels 1-5 of the NZC.

Students who have a Maths-Whizz account will use their username and password to login to the supplementary interactive exercises.

For Students without a current Maths-Whizz account please email info@ilearn.co.nz for the username and password for access to the whizz supplementary interactive activities.

NZ Geography

- Volcanoes
- Road Trip

Ethnicity and Population

Weather and Atmosphere

- Rainfall
- Ozone

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NZ Geography – Volcanoes

Statistics – Tables and Graphs
Geometry – Compass directions

Maths-Whizz Links:

Level 1

Solve a given problem by sorting, classifying and organising information in simple ways, such as a block graph

Level 2

Recognise and use the four compass directions–N, S, E, and W

Answer questions about information in a block graph

Level 3

Drawing bar line graphs in 100's

Reading bar line graphs in 10's

Reading bar line graphs in 100's

Level 4

Use the eight compass directions

Use the eight compass directions giving directions

Learning about angles in a circle: compass points

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Fill in the names of the missing volcanoes

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Overall Aims:

In this activity students will be involved in researching data, drawing graphs, completing tables and reading information from tables. They will also be looking at compass directions.

Activity:

Your whanau have decided to visit all of the following active volcanoes.

1. Refer to the map to answer the following:

a. Which is the volcano that lies furthest North? Mayor Island
b. Which is the volcano that lies furthest South? Ruapehu
c. Which is the volcano that lies furthest East? White Island
d. Which is the volcano that lies furthest West? Taranaki
e. Which volcano lies NW of White Island? Mayor Island
f. Which Volcano lies SW of Ngauruhoe? Ruapehu
g. Which Volcano lies SE of Mayor Island? White Island
h. Which volcano lies NE of Tongariro? Tarawera

Questions:

Research and complete the table below of volcanoes on the North Island.

1. What is the highest volcano? Ruapehu
2. What is the difference between the highest and lowest volcanoes? 2476m
3. Which one most recently erupted? White Island
4. How many years between the two most recent eruptions? 7 years

Volcano	Elevation	Last Erupted
Ngāuruhoe	2219m	1975
Mayor Island	338m	4390 BC
Taranaki	2518m	1755
Tarawera	1111m	1886
Tongariro	1968m	2012
Ruapehu	2797m	2007
White Island	321m	2019

Graphing:

5. Draw a bar graph showing all volcanoes arranged from highest to lowest (refer to student resource sheet for a blank graph).

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NZ Geography – Road Trip

Geometry – Shapes, Tessellation
Measurement – Tables

Maths-Whizz Links:

Level 1

Use one or more shapes to make, describe and continue repeating patterns

Solve a given problem by sorting, classifying and organising information in simple ways, such as a block graph

Level 2

Use the mathematical names for common 2-D shapes

Sort 2-D shapes and describe some of their features

Identifying 2D shapes

Classify 2D shapes

Begin to name flat shapes

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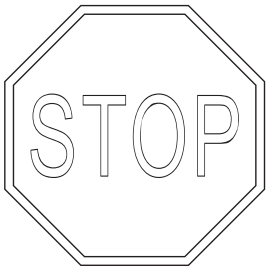
Overall Aims:

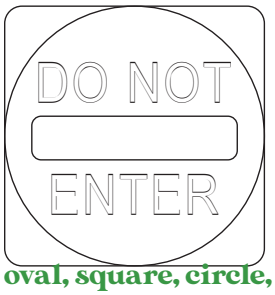
In this activity students will be involved in looking at different shapes, tessellations, and looking at efficiency of packing (shapes).

Activity:

Name the shape of each sign. If there is more than one shape in a sign identify all of them. (resource colouring sheet available)
Name the shape of each and identify if there are more shapes in the sign
What do the signs mean?



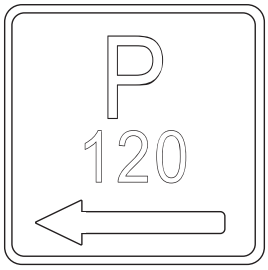
octagon, oval



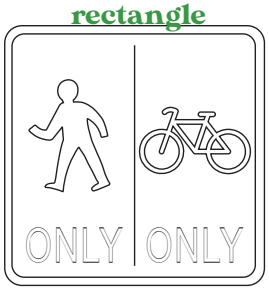
oval, square, circle, rectangle

triangle

circle



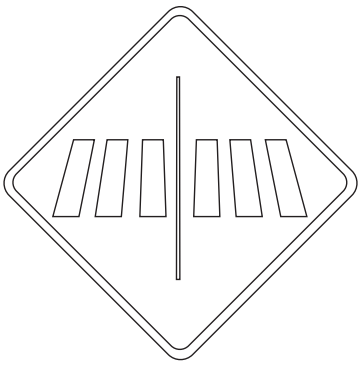
square, oval



square, oval

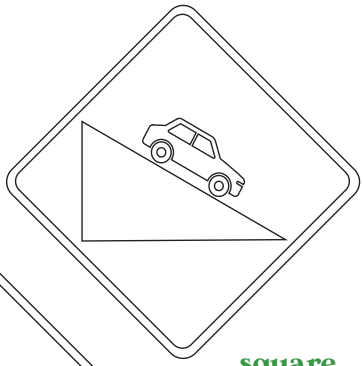
square, circle

oval

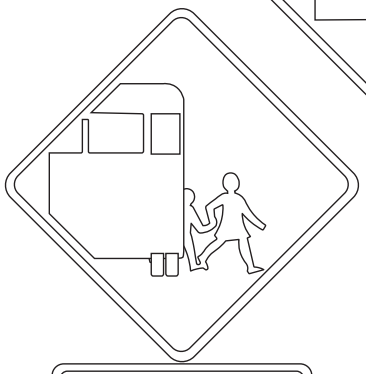


square, rhombus (accept rectangle)

square, rectangle, oval



square, triangle, circle



square, oval

rectangle, oval

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Questions:

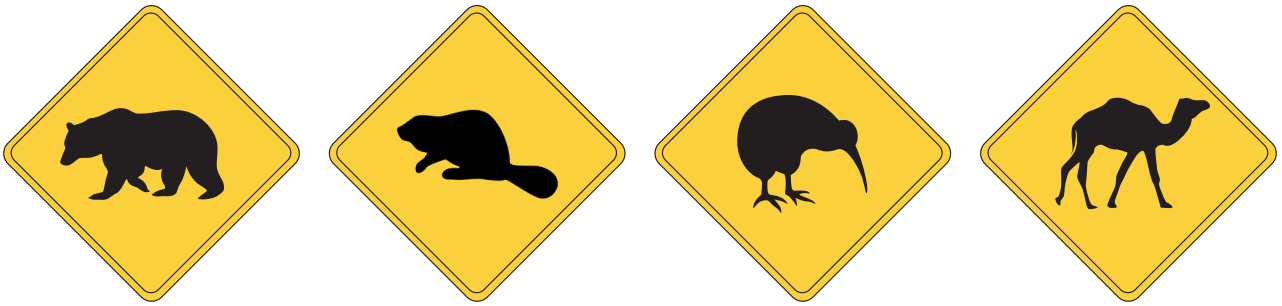
1. Write the name of the four animals. Find out the names of the countries you are likely to see these signs in.

a. Bear (North America (includes Canada)

b. Beaver (North America (includes Canada)

c. Kiwi (New Zealand)

d. Camel (Egypt, actually over 20 countries, largest population is in Somalia, they are even found in Australia)



Tessellations:

A road sign maker wants to work out how much it will cost to produce each type of sign. As such they want to have the minimum amount of wastage as possible. How many of this shape could you fit onto an A4 page? (printable masters in the 'Student Resource Sheet – Know our Whenua (land)' document).

1. Draw a tessellation pattern from your selected shape.

When laying your shapes out on a piece of A4 paper...

2. Which shape created the most wastage? circles
3. Which shape creates the least wastage? squares
4. Extension – look at the maths behind efficiency of packing – areas of shapes

Let's investigate the maths behind the efficiency of packing the shapes together.

- calculate total area of shapes laid out on your A4 paper.
- calculate the total area of an A4 page.
- calculate the percentage of waste in each scenario.

see following pages

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Area of A4 page

$A = 300 \times 210$
$= 63{,}000mm^2$

Squares – length 46mm

$A = 46 \times 46$
$= 2116mm^2$

24 squares per A4 sheet

Total area of packed squares
$A = 24 \times 2116$
$= 50{,}784mm^2$

$\frac{50{,}784}{63{,}000}$ = 80.6% efficiency of packing

Circles – 63mm diameter

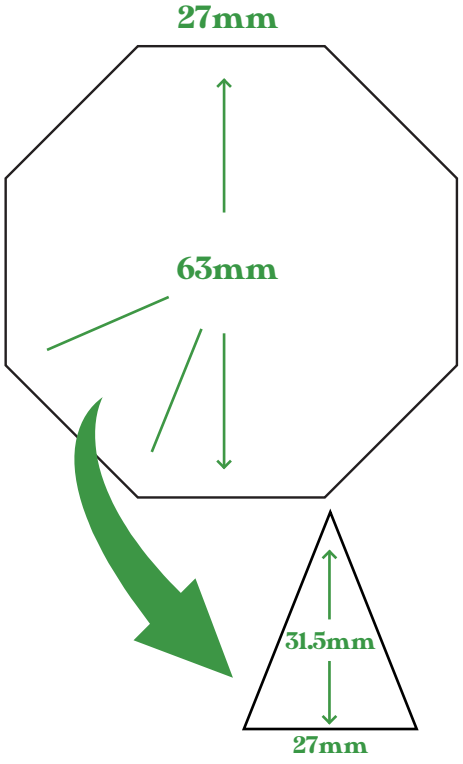
$A = \pi \left(\frac{63}{2} \right)^2$
$= 3117mm^2$

12 circles per A4 sheet

Total area of packed circles
$A = 12 \times 3117$
$= 37{,}406mm^2$

$\frac{37{,}406}{63{,}000}$ = 59.4% efficiency of packing

Octagon – length of sides = 27mm
– total distance across 63mm



Octagon is made up of 8 isosceles triangles
$A = 1/2 \times 27 \times 31.5$
$= 425.25mm^2$

8 triangles
A (octogon) $= 8 \times 425.25$
$= 3402mm^2$

12 octogons per A4 sheet

Total area of packed octagons
$A = 12 \times 3402$
$= 40{,}824mm^2$

$\frac{40{,}824}{63{,}000}$ = 64.8% efficiency of packing

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Triangle – length 63mm

$A = 1/2 (63 \times 63 \sin 60)$
$= 1718.63mm^2$

25 triangles per A4 sheet

$A = 25 \times 1718.63$
$A = 42{,}965.8mm^2$

$$\frac{42{,}966}{63{,}000} = 68.2\% \text{ efficiency of packing}$$

Note to teachers:

- Area of octagon has been measured by measuring all lengths (including heights of internal triangles).

- Area of triangle has been measured/calculated using measurement of sides and calculated height using trigonometric ratios.

- An extra extension activity could be to get students to calculate the area of triangles (using calculated heights of triangles (using trigonometry), and to calculate area of the triangle by measurement (of the height), and then comparing and discussing the two answers for each shape.
  - Are they the same?
  - Are they different?
  - Explain your answers?

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Road Trip - Places

Places to Visit

Measurement - Distance, Speed, Time, Tables
Geometry - Compass position
Statistics - Tables and Graphs
Number - Calculations, Percentages

Maths-Whizz Links:

Level 1

Solve a given problem by sorting, classifying and organising information in a pictogram

Solve a given problem by sorting, classifying and organising information in simple ways, such as a block graph

Level 2

Drawing simple frequency tables

Interpret frequency tables

Level 3

Construct frequency tables for grouped discrete data

Level 4

Use two-way tables for discrete data

Construct frequency tables with given equal class intervals for sets of continuous data

Timetables

More complex timetables

Find the outcome of a given percentage decrease

Overall Aims:

In this activity students will be involved in finding places in NZ, reading tables and finding optimal routes (minimising travel distances), reading information from tables, and doing speed, distance and time calculations. They will also look at the construction of tally charts, using the tally chart to gain information, and then transferring information on the tally chart into a histogram.

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Activity:

Visit the following places:

Christchurch

Queenstown

Nelson

Punakaiki

Franz Joseph Glacier

Invercargill

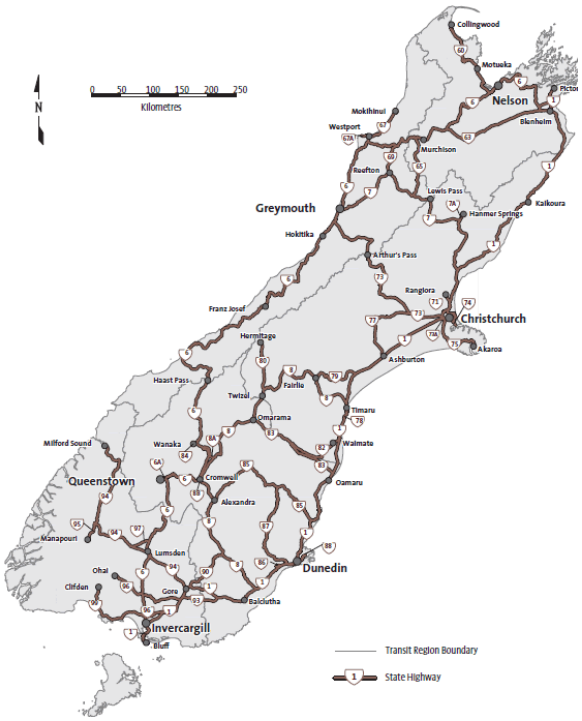
Milford

Dunedin

Kaikoura

Wanaka

Questions:



SOUTH ISLAND DISTANCES

	CHRISTCHURCH	DUNEDIN	FOX GLACIER	FRANS JOSEF	INVERCARGILL	KAIKOURA	MILFORD	MT COOK	NELSON	PICTON	PUNAKAIKI	QUEENSTOWN	TE ANAU	WANAKA
CHRISTCHURCH		361	418	395	579	183	771	330	417	336	302	487	650	428
DUNEDIN	361		540	563	217	545	410	319	790	698	595	281	289	276
FOX GLACIER	418	540		23	552	573	655	300	492	554	244	381	537	264
FRANS JOSEF	395	563	23		575	550	678	498	469	531	221	404	560	287
INVERCARGILL	579	217	552	575		762	278	444	1003	915	813	187	152	285
KAIKOURA	183	545	573	550	762		956	514	245	157	382	669	835	607
MILFORD	771	410	655	678	278	956		568	1145	1108	904	300	121	380
MT COOK	330	319	300	498	444	514	568		747	687	554	270	426	202
NELSON	417	790	492	469	1003	245	1145	747		110	246	850	1024	809
PICTON	336	698	554	531	915	157	1108	687	110		308	822	988	773
PUNAKAIKI	302	595	244	221	813	382	904	554	246	308		627	780	513
QUEENSTOWN	487	281	381	404	187	669	300	270	850	822	627		166	117
TE ANAU	650	289	537	560	152	835	121	426	1024	988	780	166		245
WANAKA	428	276	264	287	285	607	380	202	809	773	513	117	245	

1. Plan your trip so that you cover the shortest total distance to travel to all 10 places.

2. In what order do you visit the places if you start in Nelson? (Extension Students – start in Christchurch)?

– Collate class results and see who comes up with the shortest distance

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In terms of distance...

3. What is the longest day (in terms of distance travelled)?
4. What is the shortest day (in terms of distance travelled)?
5. What is the average distance travelled?

These could differ student by student depending on route taken

Distance, speed and time

6. If you are in Christchurch and it takes you 4 hours and 12 minutes to get to x, traveling at an average of 80km/hr – looking at the table of distances above, what town would you end up in? $d = 80 \times 4.2$ $= 336km$ town = Picton

7. From Christchurch if you traveled at an average of 80 km/hr and went to Mt Cook, based on this data table how long would it take you? $t = \frac{330}{80} = 4.125$ – 4hrs 7.5mins

8. From Christchurch, if you travelled to Wanaka, and it took you 6 hours, what would your average speed be? $v = \frac{428}{6} = 71.3km/hr$

9. If you leave Franz Josef at 9am and you stop for an hour for lunch at Punakaiki, and you travel at an average speed of 80 km/hr, and arrive at your destination at 4:38pm, what town do you end up in? $d = 80 \times 6.633$ $= 530.6km$ town = Picton

Cost of petrol?

10. If your car uses on average, 7L/100km, and you pay an average of $3 per litre of petrol, what will your fuel costs for the trip (just for travelling between the centres – not including extra sightseeing trips during the holiday). $\frac{\text{total distance}}{100} \times 7 \times 3$

11. Compare the cost of traveling by bus, car and plane between Nelson and Queenstown? (students present their research results in a report)
    a. Which is the most expensive?
    b. Which is the cheapest?
    c. The most expensive is ??% more expensive than the cheapest (calculate the percentage).
    d. The cheapest is ??% cheaper than the most expensive (calculate the percentage).

12. If you travelled from Christchurch to Punakaiki. – travel via Arthurs Pass to Greymouth then north to Punakaiki
    a. What is the quickest way to get from Christchurch to Punakaki?
    b. What is the highest point you will reach on the trip (and how high is it)? Arthurs Pass – 920m

13. If you were able to travel from Milford to Wanaka ...
    a. And you were able to travel in a straight line, how far is this? approx 96km
    b. And you had to travel by road, how far is this? 380km

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Taumata whakatangi hangakoauau o tamatea turi pukakapiki maunga horo nuku pokai whenua kitanatahu

Activity:

During your trip, you decide to visit 'Taumata whakatangi hangakoauau o tamatea turi pukakapiki maunga horo nuku pokai whenua kitanatahu', famous for being the place in NZ with the longest name.

1. Where is this place? Mark it on the map.

2. Construct a tally chart showing the frequency of each letter appearing.

Letter	Tally	Total
a		
e		
g		
...		
...		

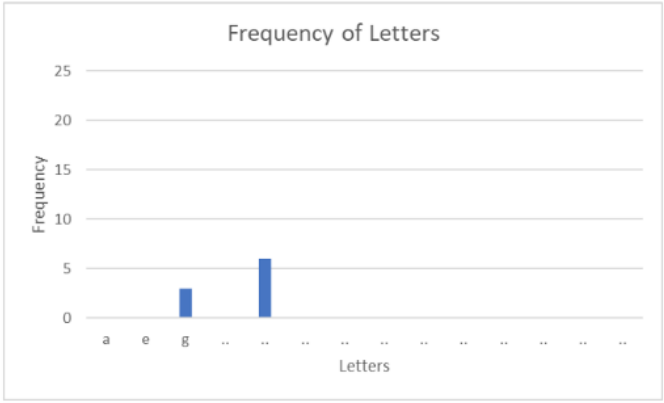
3. How many letters in the place name? 83

a. How can you find this information from your tally chart? total all the tally totals

4. Which is the most common letter in the place name?

5. Which is the least common letter? e, r, w

6. Construct a histogram, graphing all the letters. Arrange the letters (on the horizontal/x axis) in alphabetical order.



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Ethnicity and Population

Statistics – Graphs, Tables
Number – Percentages

Maths-Whizz Links:

Level 1

Solve a given problem by sorting, classifying and organising information in a pictogram

Solve a given problem by sorting, classifying and organising information in simple ways, such as a block graph

Level 2

Drawing simple frequency tables

Interpret frequency tables

Answer questions about information in a block graph

Level 3

Construct frequency tables for grouped discrete data

Drawing bar line graphs in 100's

Reading bar line graphs in 10's

Reading bar line graphs in 100's

Construct pie charts for categorical data

Interpret pie charts

Level 4

Use two-way tables for discrete data

Find the outcome of a given percentage decrease

Use ICT to generate and interpret pie charts

Overall Aims:

In this activity students will be involved in reading information from a table and applying it to a pie graph and calculating percentage increases. They will then take information from a table and use it to create a histogram, then read information from the histogram.

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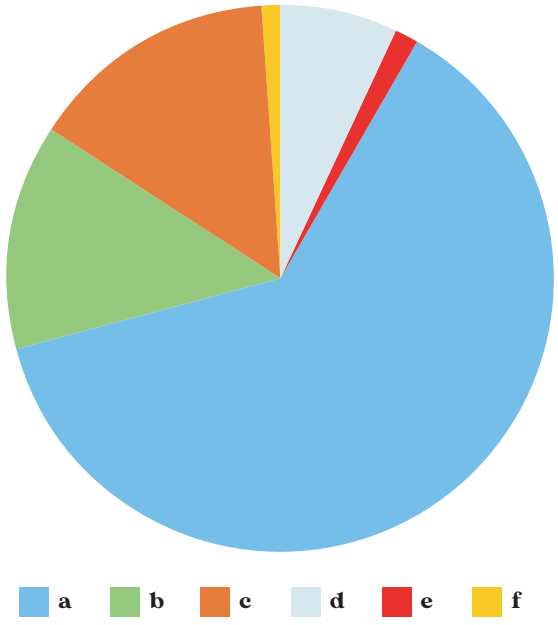
Activity:

There are six major ethnic groups often listed in New Zealand: European, Māori, Pacific peoples, Asian, MELAA (Middle Eastern / Latin American / African), and 'Other ethnicity'- 2018 Census

Ethnic Group	Ethnicity %	Match the letter
Pacifica	8.1	d
Middle Eastern/ Latin American/ African	1.5	e
European	70.2	a
Asian	15.1	b
Māori	16.5	c
Other ethnicity	1.2	f



Extension Activity:

- Population growth from 2018-2021

https://en.wikipedia.org/wiki/List_of_New_Zealand_urban_areas_by_population

Place	Population 2021	Population 2018	Percentage Growth
Auckland	1,463,000	1,346,091	8.7%
Rotorua	58,400	54,204	7.7%
Tauranga	155,200	136,713	13.5%
Queenstown	15,450	13,533	14.2%
Whangarei	54,300	50,784	6.9%
Wellington	215,900	201,786	7.0%
Dargaville	4,950	4,794	3.3%
Tokoroa	14,300	13,572	5.4%
Omokoroa	3,890	3,210	21.2%
Christchurch	380,600	358,062	6.3%
Whangamata	4,450	4,074	9.2%
Rolleston	24,700	17,352	42.3%
Morrinsville	8,410	7,758	8.4%
Greymouth	8,310	7,965	4.3%

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Questions:

1. Calculate the percentage population growth from 2018 to 2021.

2. Which is the fastest growing town/city? Rolleston

3. Create a histogram showing each centre and their growth - order biggest growth to smallest (%). What is the fastest growing city/town in NZ?

Graphing:

4. Graph the places and their populations.

5. Which place has the highest population? Auckland

6. Which place has the smallest population? Omokoroa

7. What is the average population of all of these places? 172,276

8. (Extension) What other factors could affect the population data that could influence results and need to be taken into account?
https://en.wikipedia.org/wiki/List_of_cities_in_New_Zealand

- looking at the information on this link page, the way the cities were defined changed from 2018 - 2021 meaning that the population figures can not necessarily be compared as what defined a city (its area) in 2018 could have been different in 2021.

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Weather and Atmosphere

Rainfall

Measurement – Tables and Graphs
Statistics – Data and Graphs, Statistical Enquiry Cycle

Maths-Whizz Links:

Level 3

Interpreting complex line graphs (comparisons)

Drawing line graphs

Interpreting line graphs

Construct simple line graphs for time series

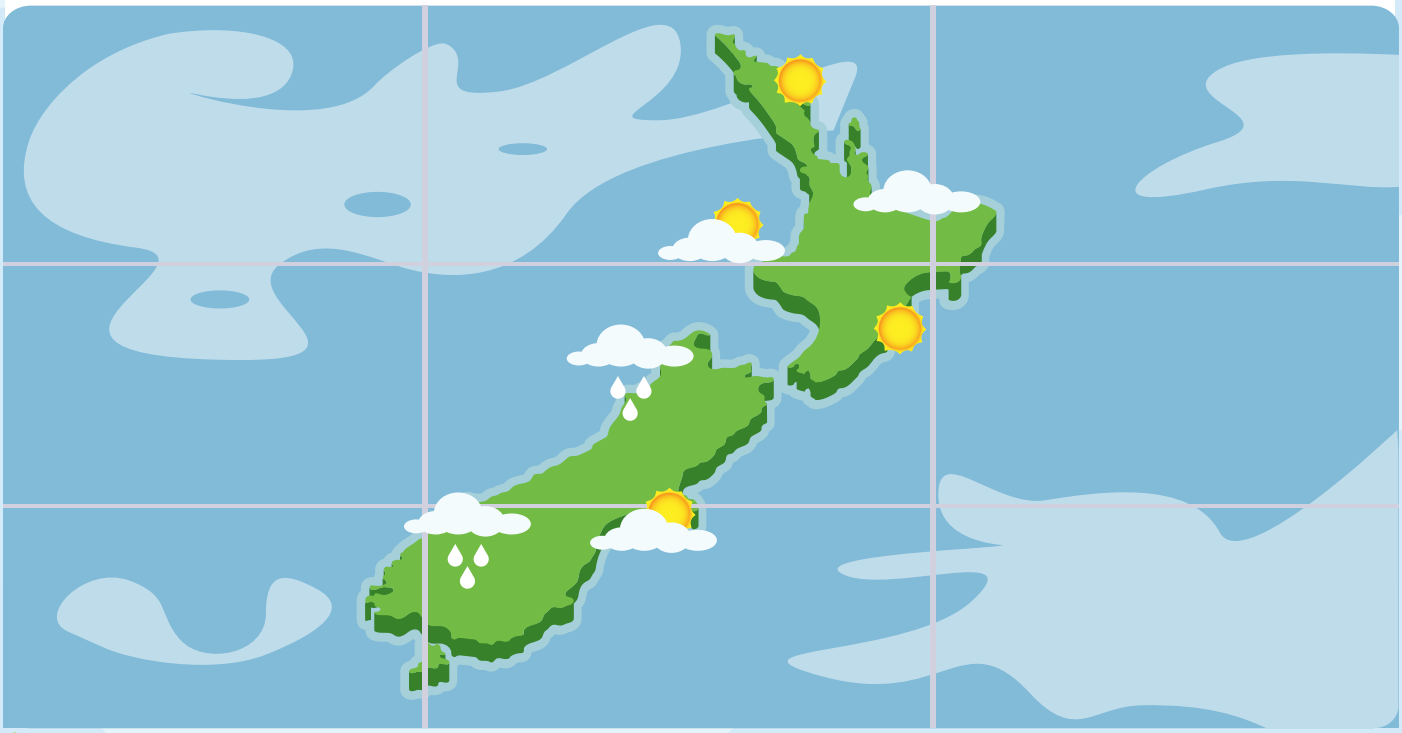
Level 4

Construct linear functions arising from real-life problems and plot their corresponding graphs; discuss and interpret graphs arising from real situations

Interpreting line graphs

Interpreting line graphs

Interpret simple line graphs



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Overall Aims:

In this activity students will be involved in looking critically at information as part of a PPDAC investigation. A question is posed and students are encouraged to take the data, analyse it and use critical evaluation to come up with their own conclusions.

Activity:

July 2022 rained a lot! Is NZ getting wetter over the years?

Rainfall in NZ – Dec/Jan/Feb (DJF), Mar/Apr/May (MAM), June/July/Aug (JJA) and Sept/Oct/Nov (SON) – 1901 – 2020

climateknowledgeportal

Period	1901–1930				1931–1960				1961–1990				1991–2020			
Season	Dec Jan Feb	Mar April May	June July Aug	Sept Oct Nov	Dec Jan Feb	Mar April May	June July Aug	Sept Oct Nov	Dec Jan Feb	Mar April May	June July Aug	Sept Oct Nov	Dec Jan Feb	Mar April May	June July Aug	Sept Oct Nov
Rainfall/ mm	231.51	396.55	415.78	426.23	246.27	396.77	430.75	410.34	222.65	402.26	432.43	413.13	215.43	392.34	436.70	412.30

1. Draw a line graph showing the information in the table.

2. Over the past 100 years, is NZ getting wetter, drier, or remaining about the same?
– each 30 year period is roughly the same

3. Predict what the Summer Rainfall (DJF) was for the period 2021 – 2040.

If the 30 years patterns were roughly the same, then the average of all the summers is 230mm. This would be a good prediction, per year.

So for 2021 – 2040, 20 years, 230mm per year or 4600mm in total

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Ozone

STEM – research and critical thinking
Statistics – Statistical Enquiry Cycle

Maths-Whizz Links:

Level 3

Interpreting complex line graphs (comparisons)

Interpreting line graphs

Level 4

Interpreting line graphs

Interpreting line graphs

Interpret simple line graphs

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Overall Aims:

In this activity students will be involved in looking critically at information as part of a PPDAC investigation. A question is posed and students are encouraged to take the data, analyse it and use critical evaluation to come up with their own conclusions.

Activity:

What is Ozone, what is the Ozone layer, why is it important, and what are the effects of holes in this layer?

Ozone is a gas that forms a naturally occurring layer in the upper atmosphere (stratosphere), protecting Earth from the sun's ultraviolet (UV) light. The ozone hole is an area of reduced stratospheric ozone. It forms in spring over Antarctica because of ozone-depleting substances produced from human activities. Ultraviolet light is what causes sunburn and some forms of cancer, so protection from this is very important. Weather reports on TV will now often quote a 'UV Index', a number which tells us how long we should be staying out in the sun, and when to make sure we cover up and put on suncream.

The hole(s) in the Ozone layer tend to be over the North and South Poles, and as NZ lies quite away South of the equator (closer to the South Pole), the Ozone hole over Antarctica is of particular interest to us in NZ as we wouldn't want the hole to get so big it extends over our country.

Here is an interesting animation that shows how the Ozone hole has changed over the past 40 years

https://earthobservatory.nasa.gov/world-of-change/Ozone

Check out this interactive graph showing how the Ozone hole has changed over the last 40 years.

https://ourworldindata.org/grapher/antarctic-ozone-hole-area?country=~OWID_WRL

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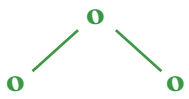
Stats on Ozone hole...

1. Is it getting bigger or smaller?
   a. Over the past 5 years smaller
   b. Over the past 10 years the same 2010 – 2015 then dropped
   c. In the 20 years from 1980 to 2000? steadily increased to around the year 2000 then started to drop

   d. What appears to be happening to the Ozone layer from around the year 2000 onwards? Why do you think this might be? It started to drop as countries stopped using the harmful chemicals that were destroying the ozone layer (chloroflurocarbons)

The chemical formula for Ozone is O_3

2. Research ozone and find out the shape of the molecule. bent



3. Draw a picture of an ozone molecule.

4. Make a model of an ozone molecule (hint: if you use marshmallows and toothpicks, you can eat the ozone when you are finished!)