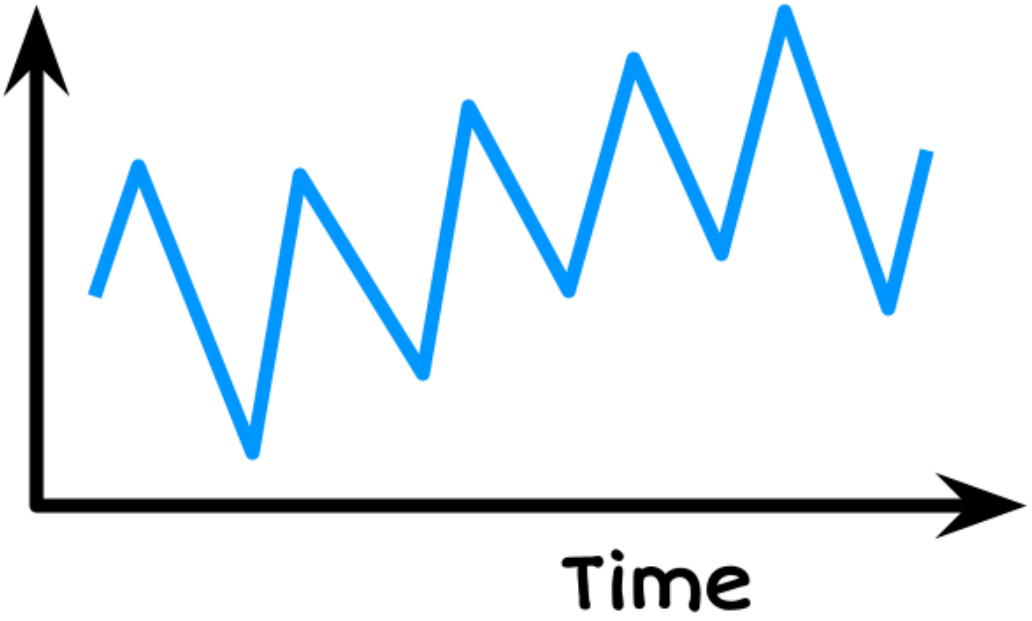
Level 1 Timeseries Workbook

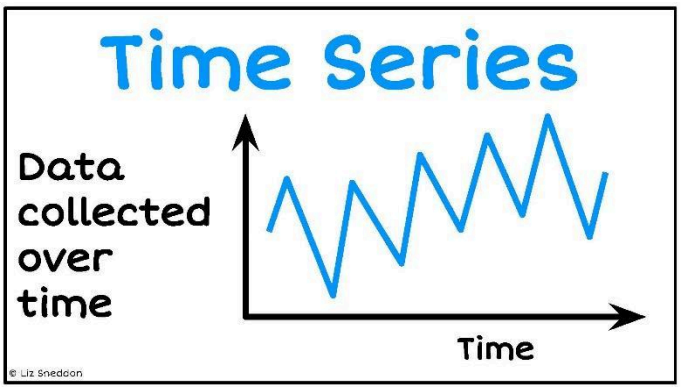


Name:

By Liz Sneddon

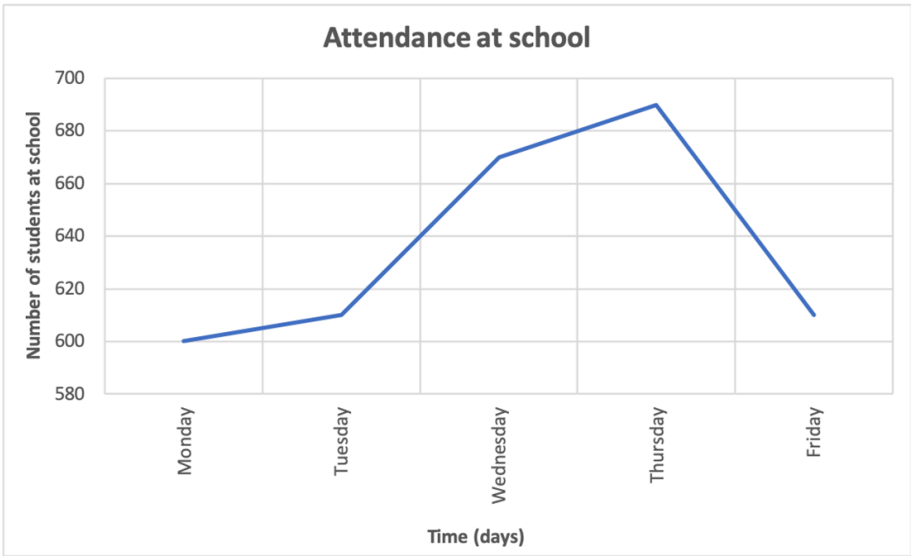
Introduction

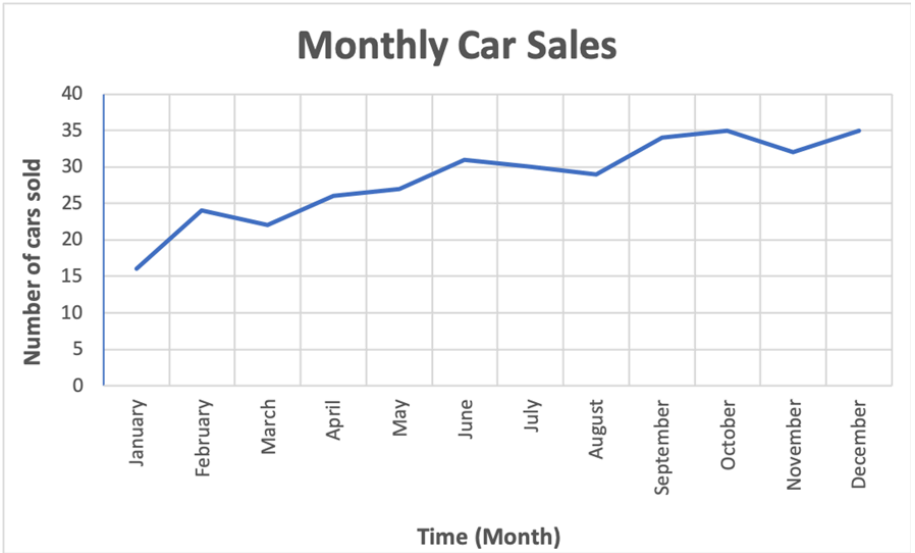
As data is collected over time, we plot points and join them together to show the changing patterns over time.



Example:

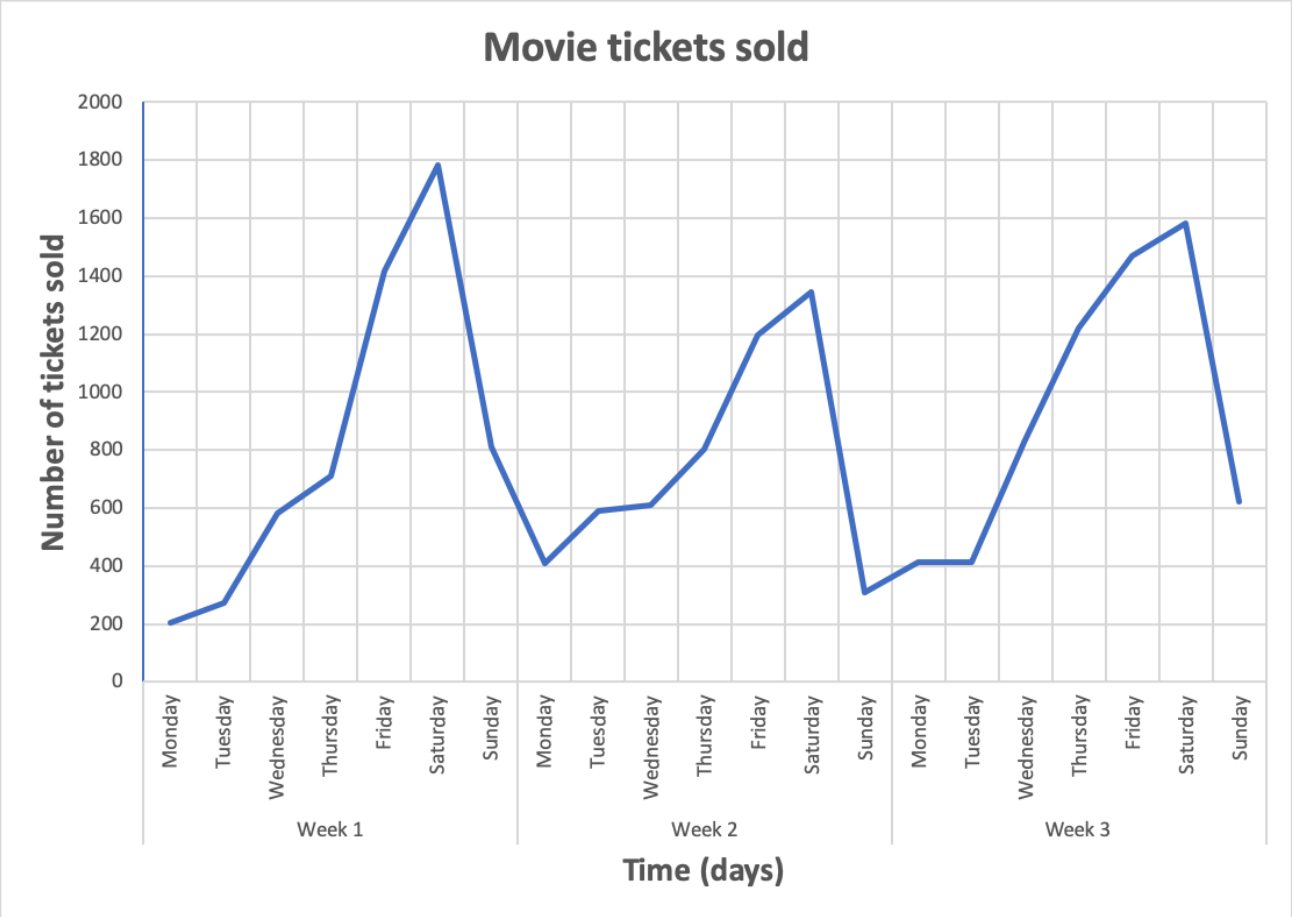
Here are two simple time series graphs.





Exercise 1:

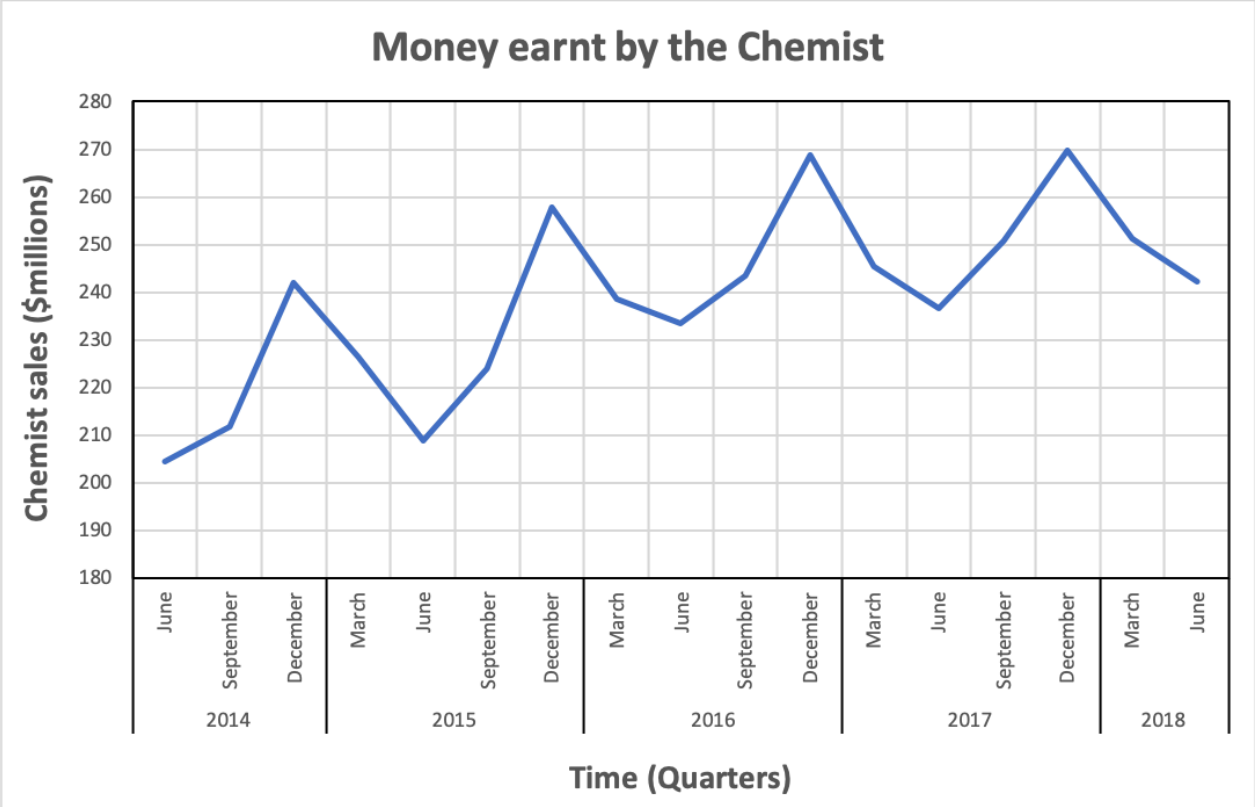
1) The graph below shows the total ticket sales from the cinema complex Movietime.



a) How many movie tickets were sold on Friday of Week 1?

b) Will the cinema **always** sell less tickets on **Monday** in the future? Explain why/why not.

2) The dataset below shows the total chemist sales (in millions of dollars) from June 2014 to June 2018.



a) How much money was spent in chemists from January 2015 to March 2015?

b) Over what months are chemist sales higher?

c) Why would there be more sales in December? Explain.

3) (a) If I worked at a factory which was open 24 hours a day, and collected data every 4 hours starting at midnight, how many times per day would I collect data?

(b) The first time period would be from midnight to 4am. List the rest of the time periods below:

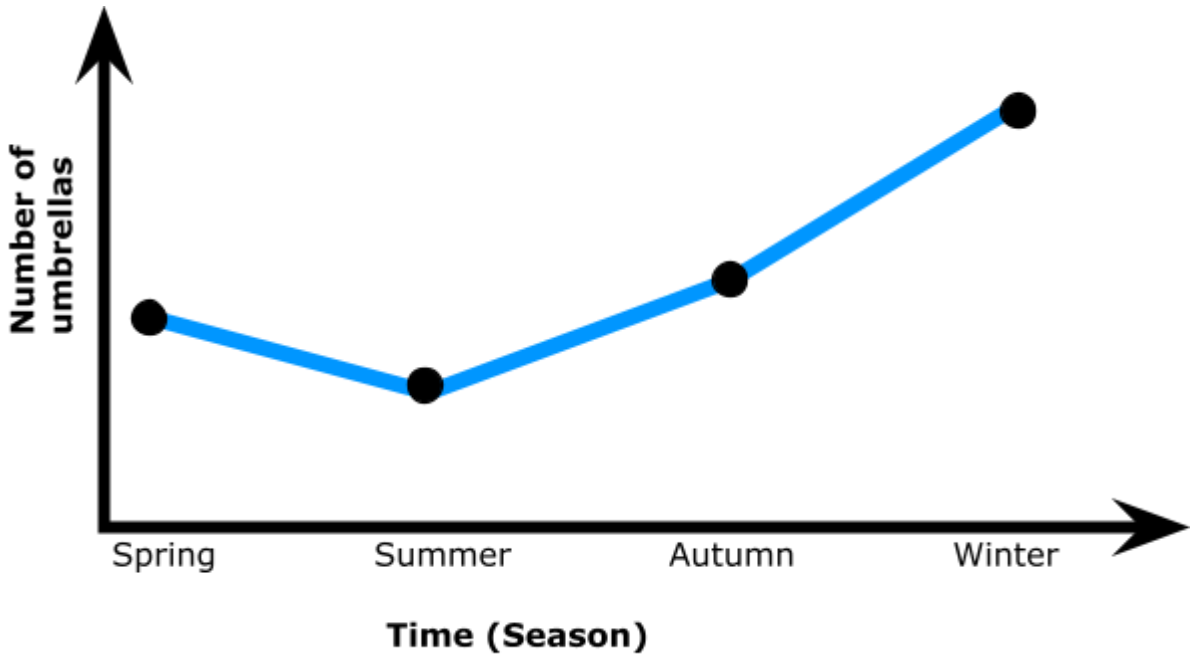
Period	Time
1	12 midnight - 4am
2	
3	
4	
5	
6	

4) (a) Most businesses have to report to their shareholders every 3 months, which we call quarterly data. How many times per year would I collect data?

(b) The first quarter would be from January to March. List the rest of the time periods below:

Quarter	Months
1	January, February, March
2	
3	
4	

5) Here is my hypothesis of the **pattern** for the number of umbrellas I expect would be sold during the year.



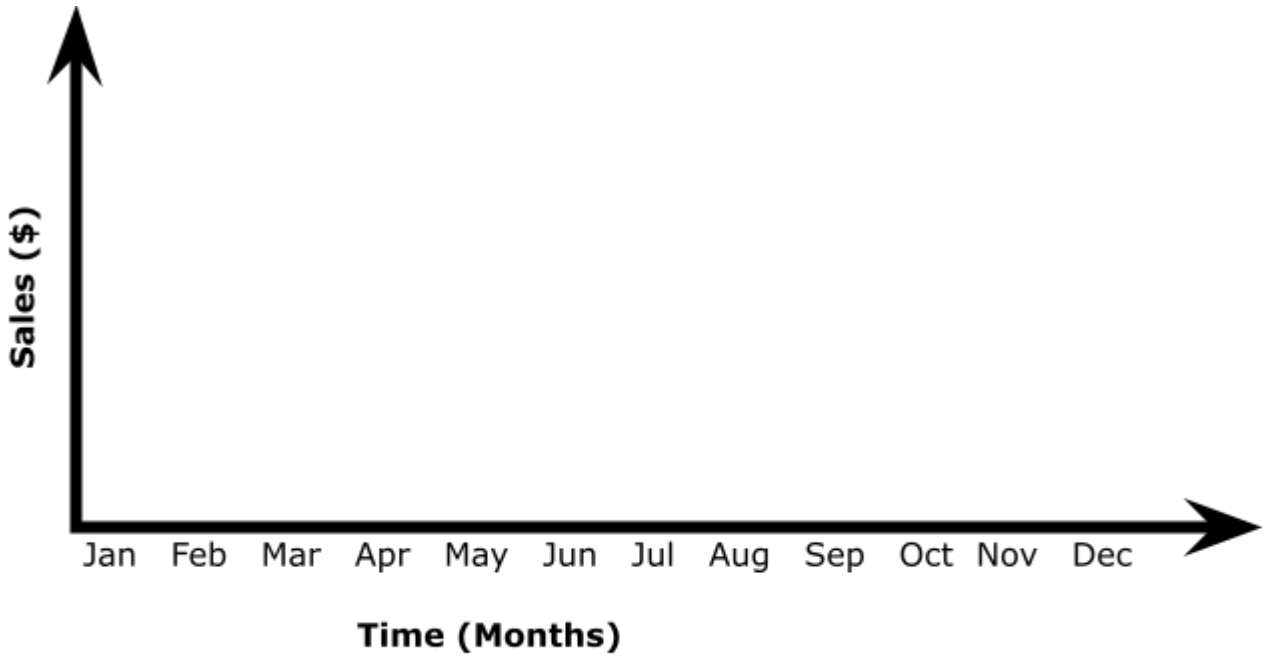
a) Explain why more umbrellas is likely to be sold in **Winter**.

b) Explain why more umbrellas sold in Summer is **not zero**.

c) Do you think that this pattern (of more sales in winter and less sales in summer) will **repeat itself every year**? Explain why/why not.

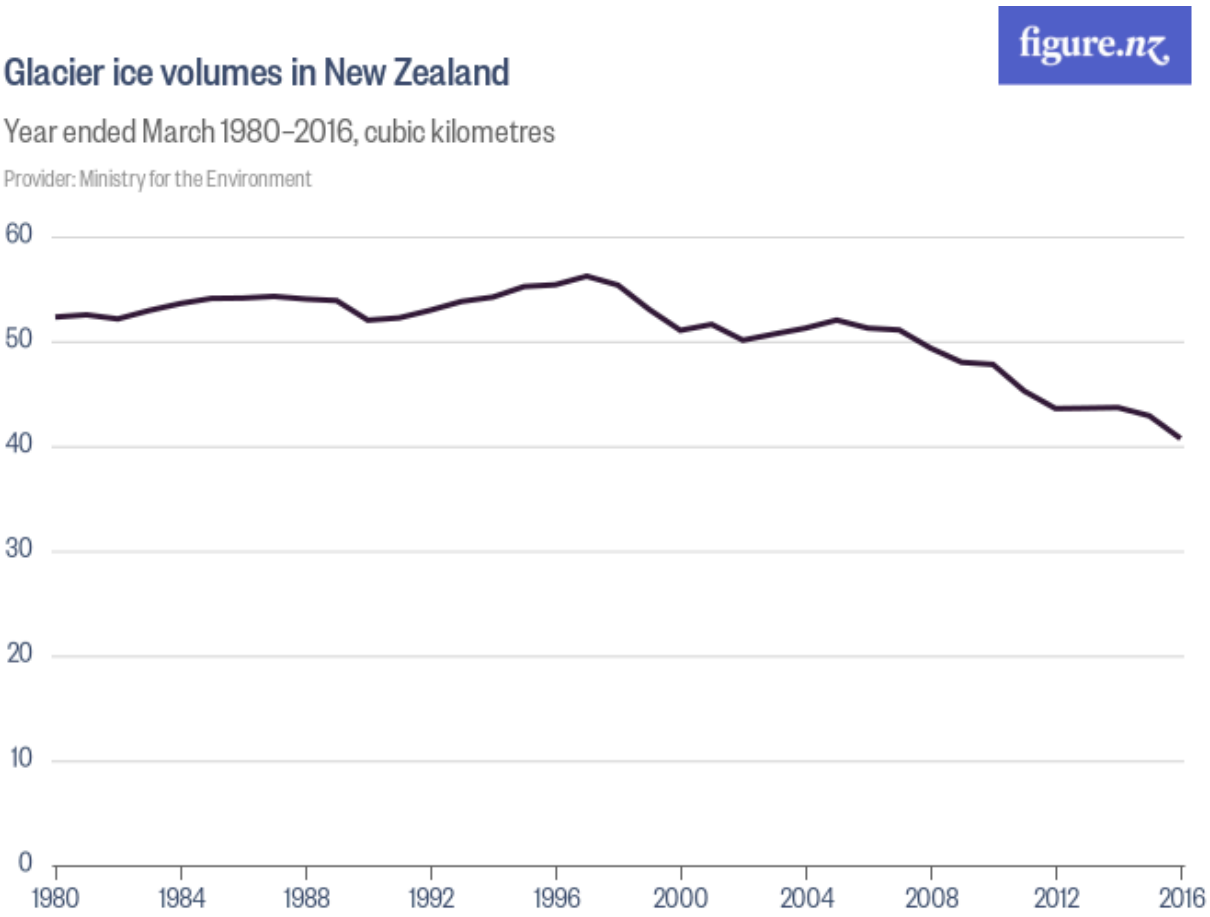
d) Why do we want several years of data?

6) a) Hypothesise what you think the graph of toy sales might look like on the axis below.



b) Explain why you have drawn this pattern.

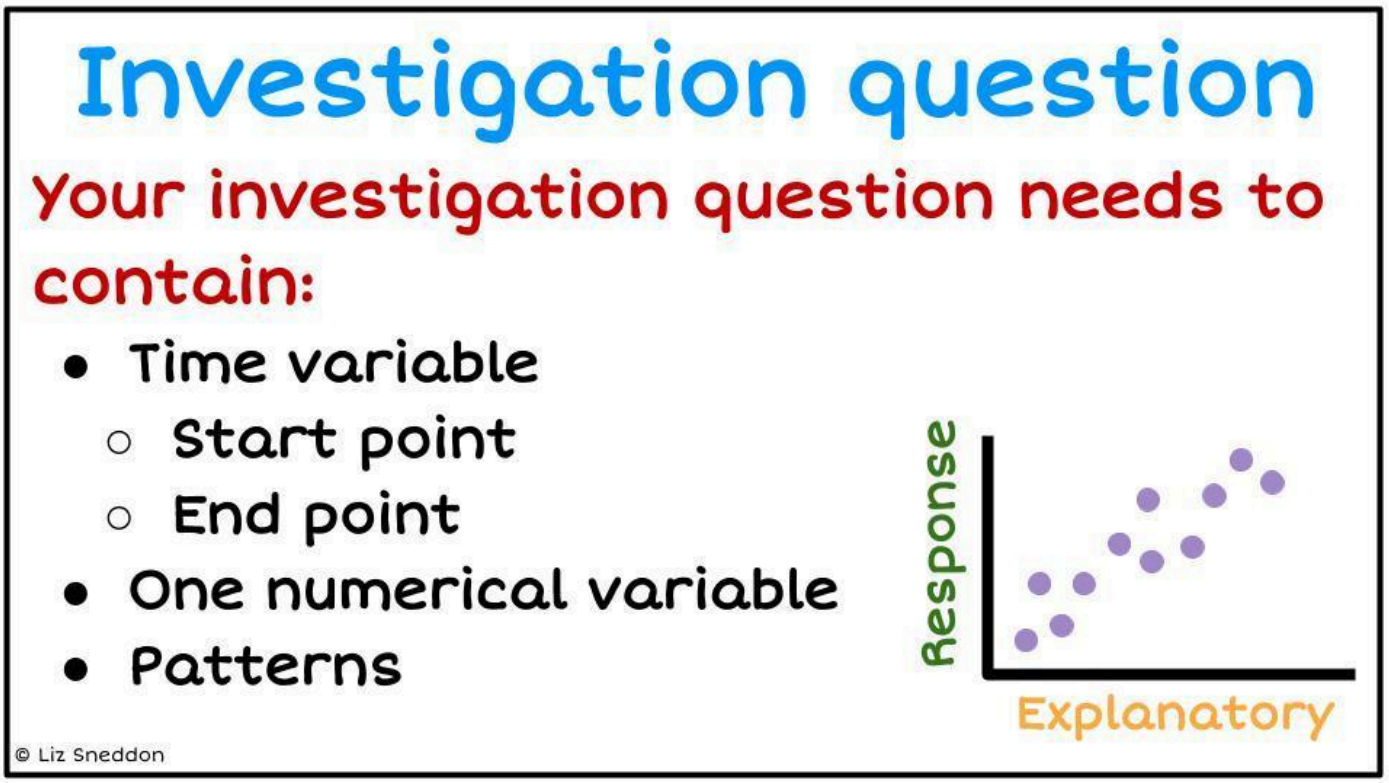
7)



Can you explain why the glacier ice volumes in NZ may be changing between 1980 and 2016?

Problem / Kaupapa

The investigation question to pose is **if there are any patterns in the time period** for the numeric variable.



Example:

I wonder if there are any patterns in data on the weekly attendance of Year 11 ākonga at school in Term 1 between 1st February and 12th April 2024.

Exercise 2:

1) **TS - Forestry dataset:**

Data on the volume of wood removed from different types of forests in New Zealand (sourced from the Ministry for Primary Industries) was recorded between Quarter 1, 2000 and Quarter 3, 2013.

Variable	Description
Quarter	Time is quarterly (4 times per year)
Natural Forests	The volume of wood removed from Natural Forests in millions of cubic metres (millions m^3)
Plantation Forests	The volume of wood removed from Plantation Forests in millions of cubic metres (millions m^3)

There are two possible time series questions that you can write from the dataset above. Write these below.

Investigation 1:

Time Variable (and units)	
Numerical variable (and units)	
Investigation question:	

Investigation 2:

Time Variable (and units)	
Numerical variable (and units)	
Investigation question:	

2) **TS – Temperatures Auckland dataset:**

Data on the temperature from the weather station at Auckland Airport (sourced from NIWA) was recorded between June 1994 and January 2019.

Variable	Description
Month	The month of the data
Tmax	Average Maximum Temperature for the Month
Tmin	Average Minimum Temperature for the Month

There are two possible time series questions that you can write from the dataset above. Write these below.

Investigation 1:

Time Variable (and units)	
Numerical variable (and units)	
Investigation question:	

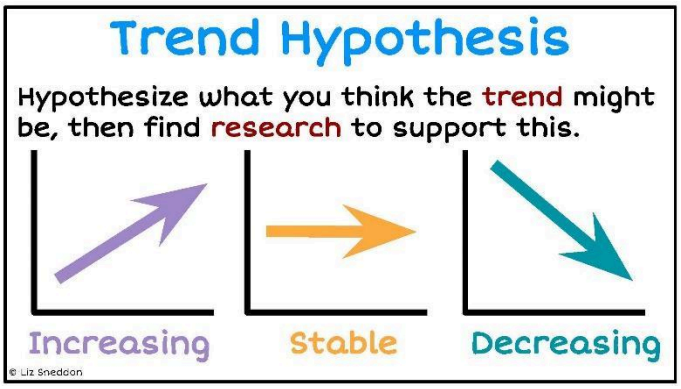
Investigation 2:

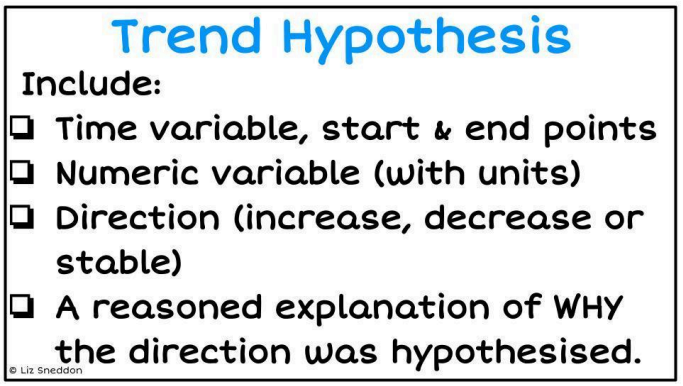
Time Variable (and units)	

Numerical variable (and units)	
Investigation question:	

Hypothesis

Your hypothesis is what **patterns you expect to see** in the data, made **BEFORE** you look at the data. You need a trend hypothesis with research that explains the direction of your hypothesis.





Example:

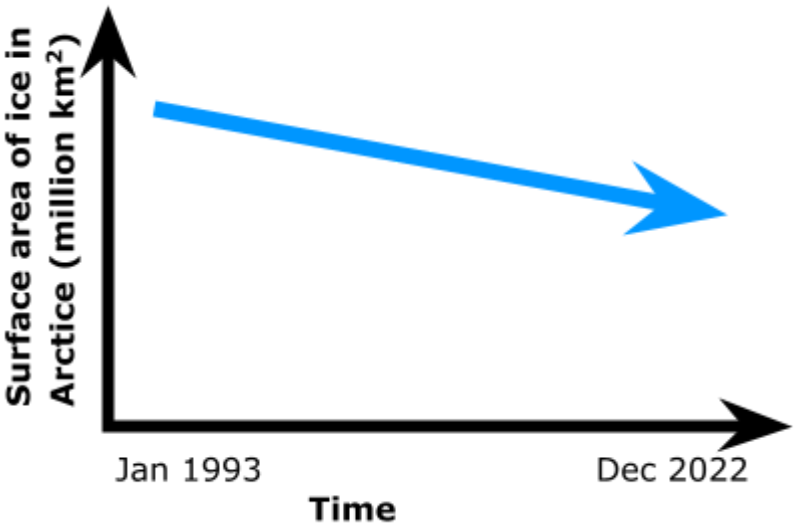
Dataset: TS – Sea Ice – Updated 2023[1]

The data is the surface area of sea ice in millions of square kilometres and covers the time period from January 1993 until December 2022.

Variable	Description
Time	Monthly
Arctic	Million Square Kilometres of Ice in Arctic

Hypothesis:
Make both a trend hypothesis, and then support this with research.

[1] sourced from the National Snow and Ice Data Centre



I hypothesise that the amount of sea ice in Arctic between January 1993 and December 2022 would be **slowly decreasing, because** there has been a lot of research into global warming, which means our oceans are warming, which in turn melts the sea ice, leading to the amount of sea ice decreasing over this time period.

Exercise 3:

Make a trend hypothesis for the datasets below. Support both hypothesis with contextual explanation and research as appropriate.

1) **Forestry dataset**

Data on the volume of wood removed from Plantation forests (e.g. forests that are planted to turn into wood products) in New Zealand. The data is sourced from the Ministry for Primary Industries.

The data covers the time period from Quarter 1, 2000 until Quarter 3, 2013.

Variable	Description
Quarter	Quarterly
Plantation Forests	The volume of wood removed from Plantation Forests in millions of m^3

Support the trend hypothesis with contextual explanation and research as appropriate.

2) **TS – Temperatures Auckland dataset:**

Data on the temperature from the weather station at Auckland Airport (sourced from NIWA) was recorded between June 1994 and January 2019.

Variable	Description
Month	The month of the data
Tmax	Average Maximum Temperature for the Month

Support the trend hypothesis with contextual explanation and research as appropriate.

3) **Daily Attendance dataset**

Data on the number of ākonga who attended school for Term 1 for a school in Auckland was recorded.

The data covers the time period from Week 1, Day 1 (Monday) to Week 10, Day 5 (Friday).

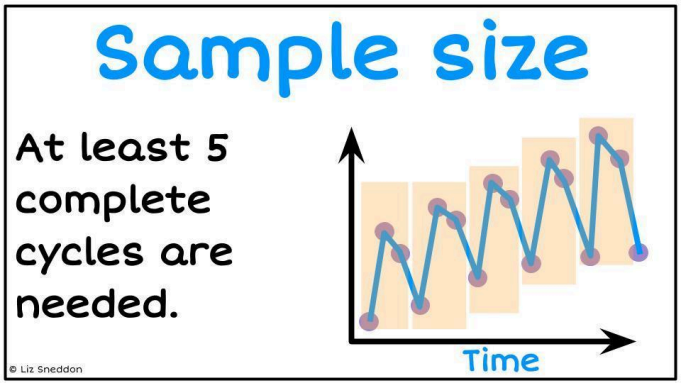
Variable	Description
Time (daily)	The week and which day of the school week (1D1 = Week 1, Day 1)
Number of ākonga	The number of ākonga attending school each day.

Support the trend hypothesis with contextual explanation and research as appropriate.

Plan / Whakamahere

In the first workbook, Exploring data, we covered a lot of information about the different data collection methods, including primary and secondary data, sources of variation and types of studies.

For this assessment, the requirement is to have at least 5 complete cycles.



Data / Raraunga

Often the data needs to be formatted and organised to be able to enter into NZGrapher. Then a time series graph can be drawn

Example: Annually (yearly)

Time (year)	Numeric variable
2000	
2001	
2002	
2003	
...	

Other time periods

The general formatting requirements is to have a number, then a letter, then a number.

E.g. 2000D1

Example: Quarterly (every 3 months)

Use the letter "Q"

Time (year)	Numeric variable
2000Q1	
2000Q2	
2000Q3	
2000Q4	
2001Q1	
...	

Example: Monthly

Use the letter "M" and use 2-digit numbers for months

Time (year)	Numeric variable
2000M01	
2000M02	
2000M03	
...	
2000M12	
...	

Example: Weekly

Use the letter "W" and use 2-digit numbers for weeks

Time (year)	Numeric variable
2000W01	
2000W02	
2000W03	
2000W04	
...	

Example: Daily

Use the letter "D" and go up to Day 7 then restart at Day 1

Time (year)	Numeric variable
1D1	
1D2	
1D3	
...	
1D7	
2D1	
...	

Example: Hourly

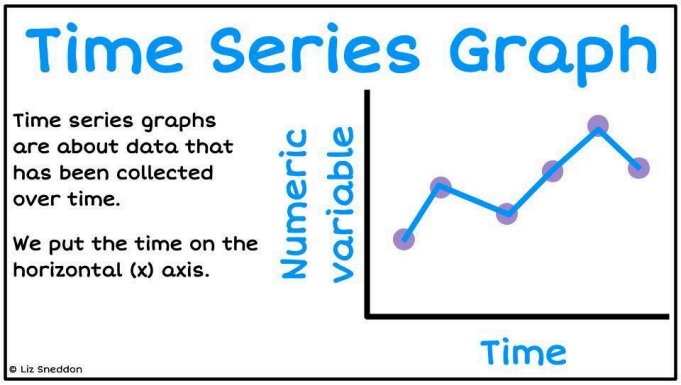
Use the letter "H" and use 2-digit numbers for hours

Time (year)	Numeric variable
1H01	
1H02	
1H03	
...	
1H24	
2H01	
...	

Example: Custom

Use the letter "C"

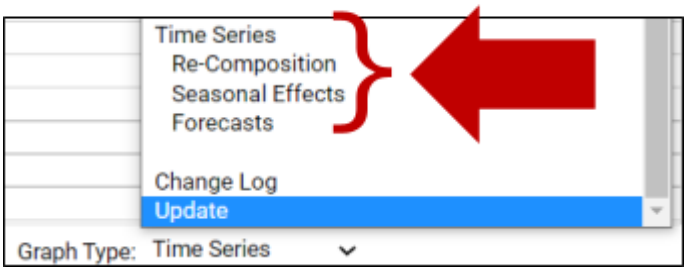
Time (year)	Numeric variable
1C1	
1C2	
1C3	
...	



Steps for using NZGrapher

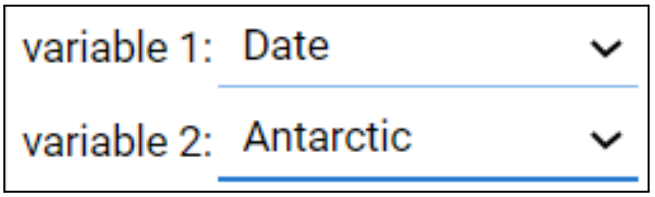
Step 1:

Click on **Graph Type** and scroll down to find the options for Time Series.



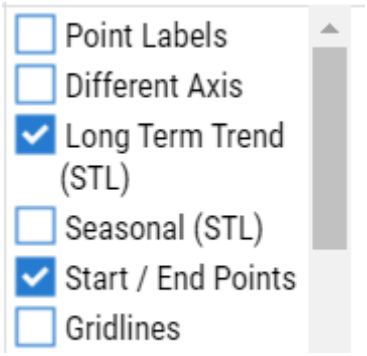
Step 2:

Select your variables. **Variable 1 is always the time variable**, and Variable 2 is the data you are measuring/counting.



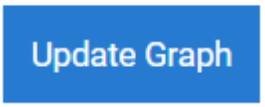
Step 3:

Select the **Long-Term Trend (STL)** and the **Start / End Points**



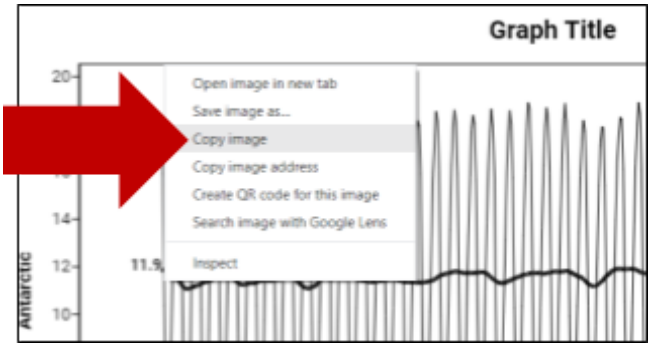
Step 4:

Add title, axis labels and units, then press the **Update Graph** button on the bottom right of the screen.



Step 5:

Right click over the graph, select "**Copy Image**", and then go to your document and **Paste** it in. This will copy your graph.



Step 6:

Select the **Show Dots** and **Seasonal** then copy and paste this graph into your document.

Exercise 4:

1) Open NZGrapher and select the dataset **TS – Forestry.csv**. Choose the Plantation Forest variable.

   Then create a Time Series graph with the trend and a Time Series graph with the Seasonal Dots. Make sure you add a title to the graph, add unit labels, and add any trend lines, start/end points etc. Save the graph in a document.

2) Create the same graphs for the dataset **TS – Temperatures Auckland.csv**.

3) Create the same graphs for the dataset **TS - Sunglasses.csv**.

Analysis

There are several features we want to explore when analysing the graphs of our data. We need to look visually at the data and explore these features, and then get evidence to support this.

The features we want to explore include:

- Trend,
- Seasonality,
- Variation,
- Outliers.

Let's look at each of these features separately.

Trend

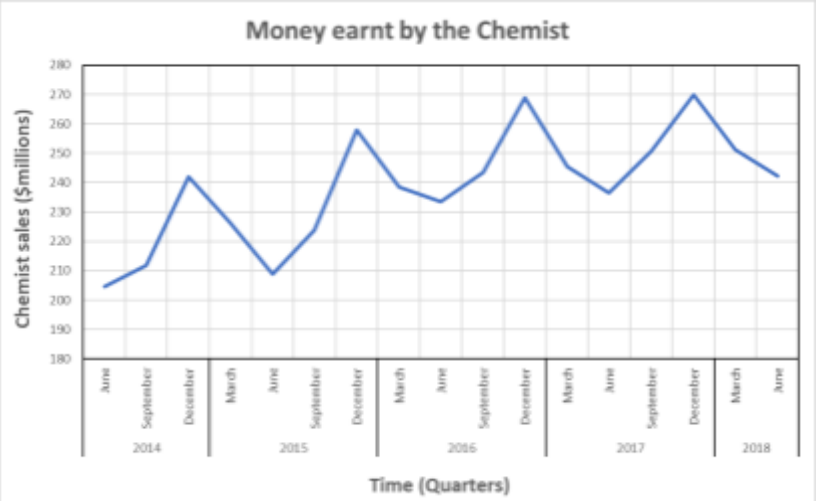
The trend pattern is finding the pattern through the middle (or average) of the data.

Drawing the Trend

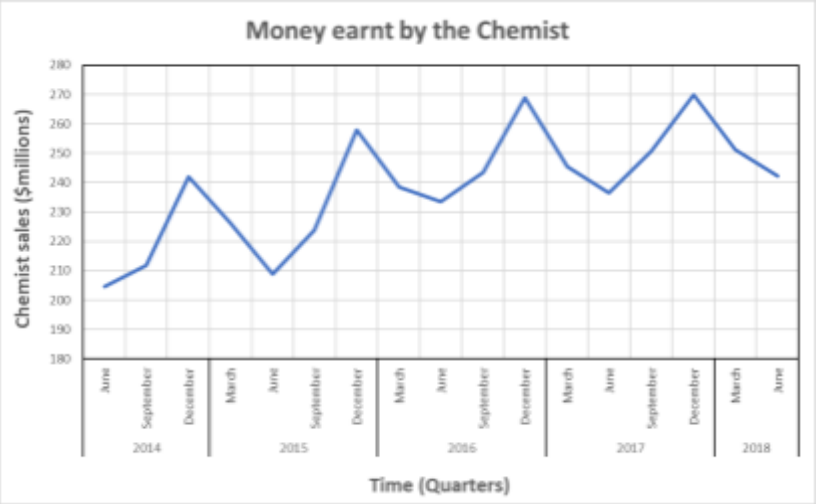
When we add a trend line to a time series graph, you want to draw it through the middle, so half the data is above, and half the data is below.

Example:

Step 1:
Draw a line connecting the peaks (highest points) together.



Step 2:
Draw a line connecting the troughs (lowest points) together.

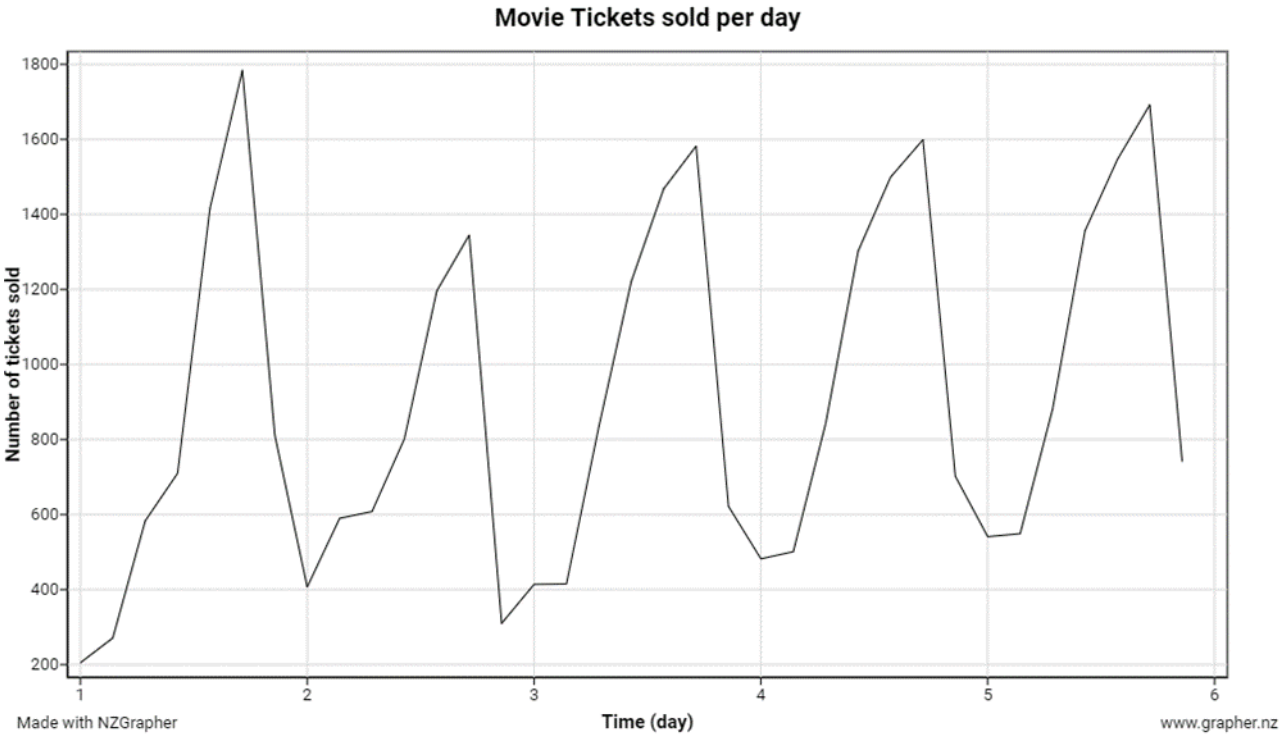


Step 3:
Draw a line halfway between these two lines. That is your trend line.

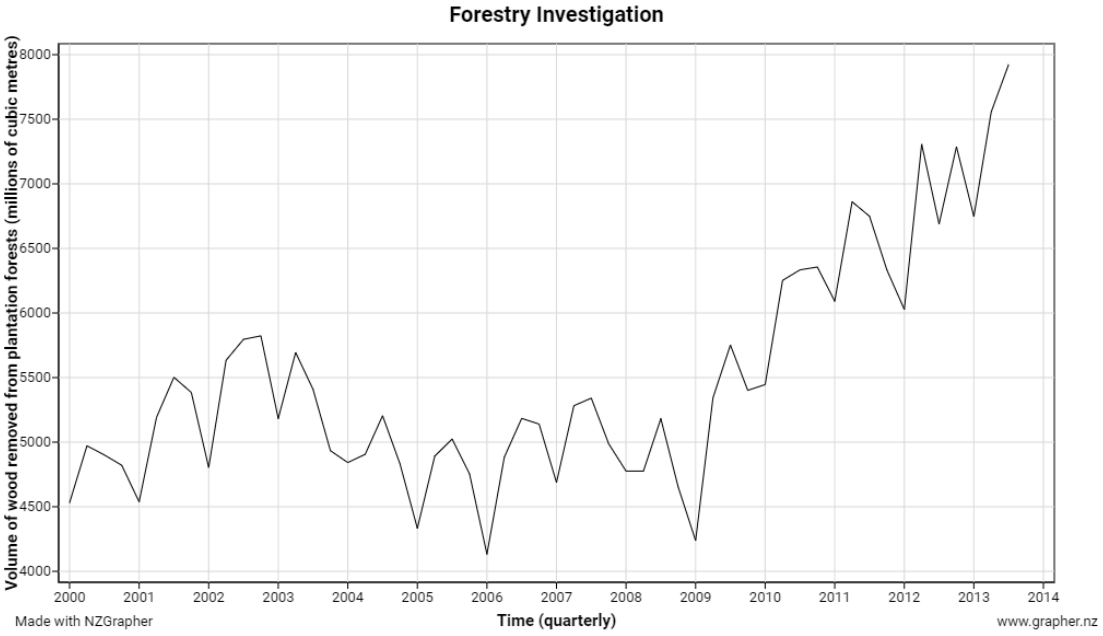
Exercise 5:

For each graph below, add a trendline to the graph.

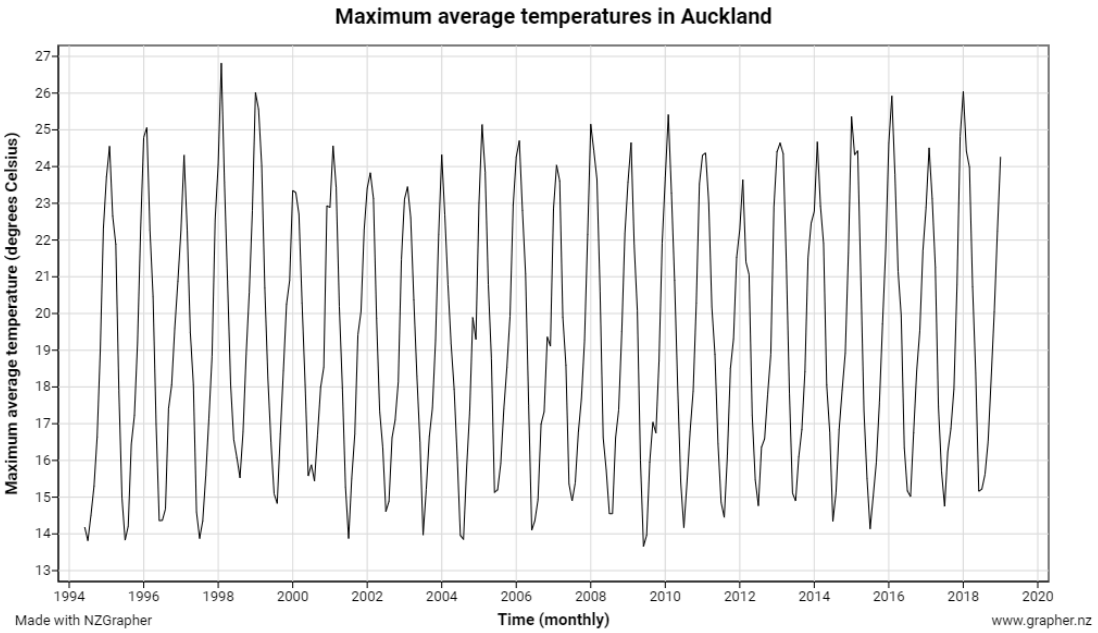
1)


Movie Tickets sold per day
Number of tickets sold
1800
1600
1400
1200
1000
800
600
400
200
1
2
3
4
5
6
Time (day)
Made with NZGrapher
www.grapher.nz

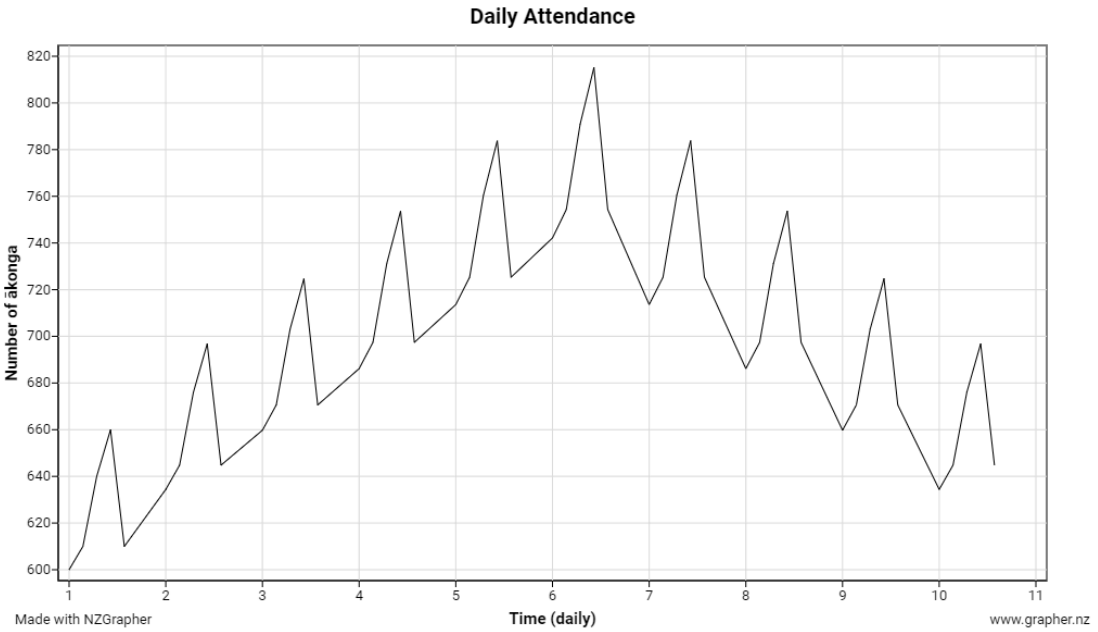
2)


Forestry Investigation
Volume of wood removed from plantation forests (millions of cubic metres)
8000
7500
7000
6500
6000
5500
5000
4500
4000
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Time (quarterly)
Made with NZGrapher
www.grapher.nz

3)



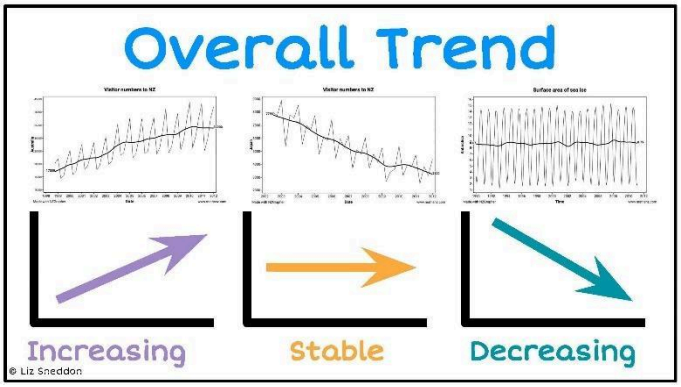
4)

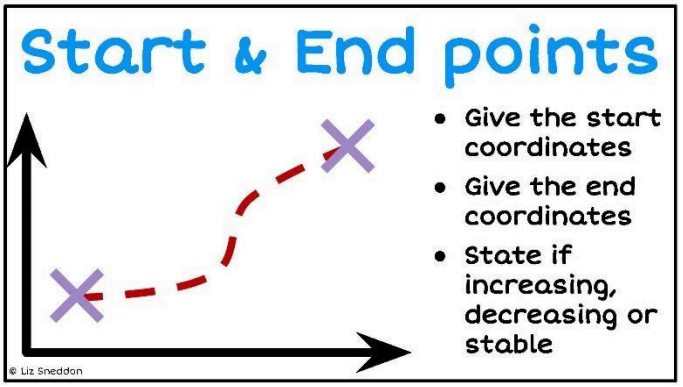


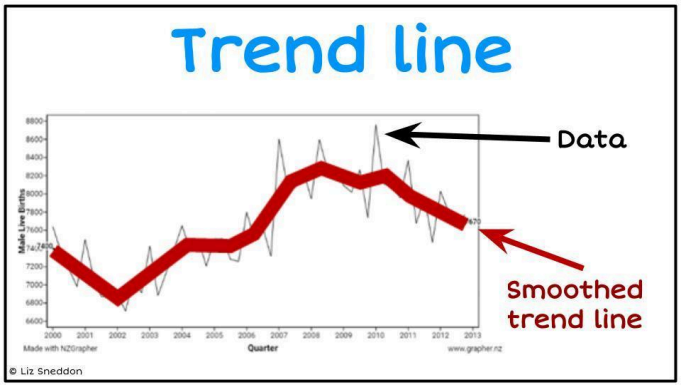
Describing the Trend

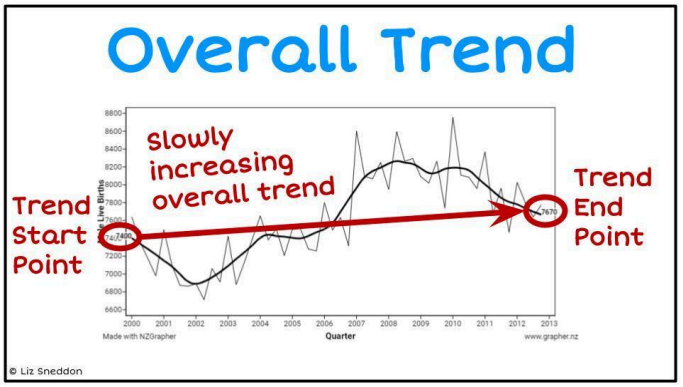
We first look at the data overall, and decide if the **overall trend** is increasing, stable or decreasing. We then need to support this by giving the start and end coordinate points which back up this trend. These coordinate points need to include the start and end dates of the data (go back to the table of data to check, or hover with your mouse over these points).

The most important part (and the most common mistake ākonga make) is to use the data values of the **smoothed trend line**, **NOT the actual data values**.







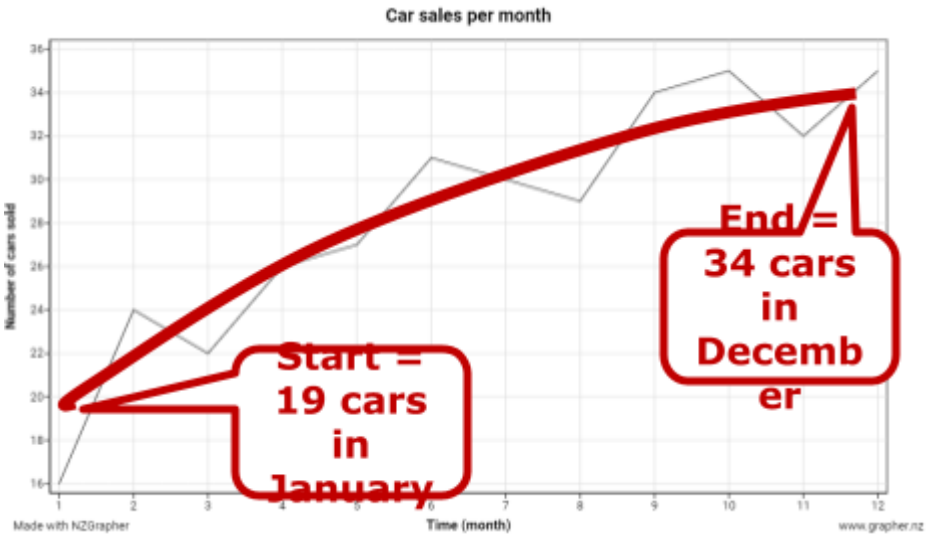


There are two methods to draw the trend line. The first method is drawing it by hand (which is what I want ākonga to do initially to build an understanding of what the trend line is), and the second method is drawing the trend line using NZGrapher.

Once you have identified the trend pattern, connect this to the context and tell the story, connecting it to research where possible.

Trend line drawing by hand

Example:

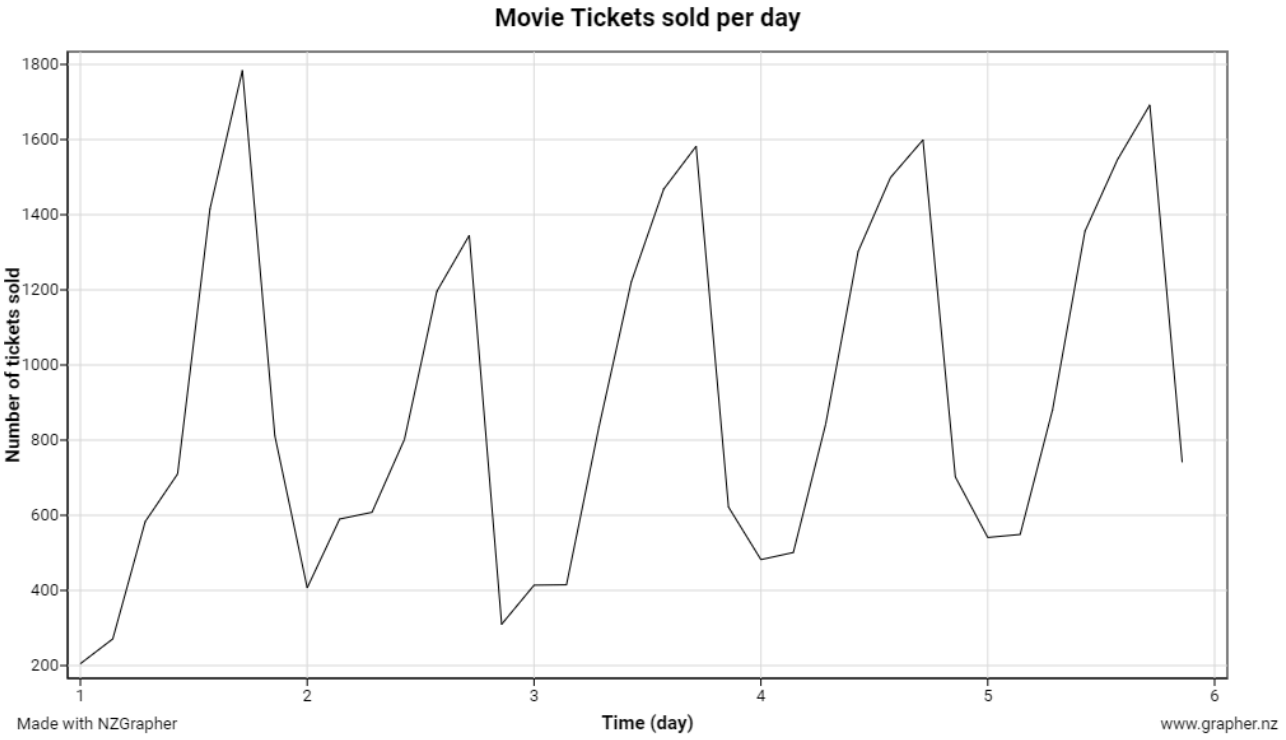
Step 1: Draw the trendline and work out the start and end points. (Notice that these are the trend line points, **NOT** the raw data values)	
Step 2: Interpret the overall trend in context, including referring to the trend values as the "average" value.	The **average** number of cars sold **each month** at the Car Yard is **increasing**, from an **average** of **19** cars sold per month in **January**, to an **average** of **34** cars sold per month in **December**.

Exercise 6:

For each graph below, add a trendline to the graph, work out the start and end points, and write a sentence describing this trend.

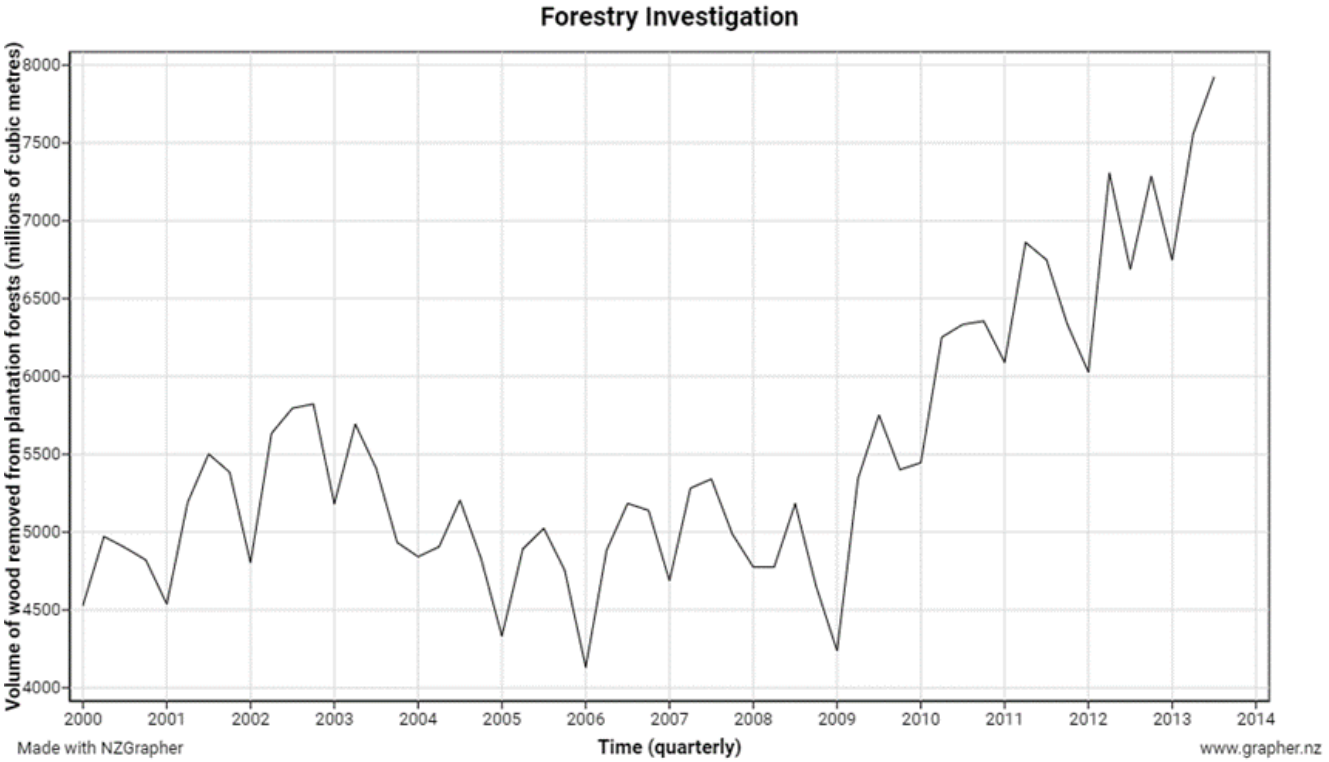
1) **Movie ticket dataset**

The data covers 5 weeks of data, collecting data each day, starting on Monday of Week 1, and finishing Sunday Week 5.



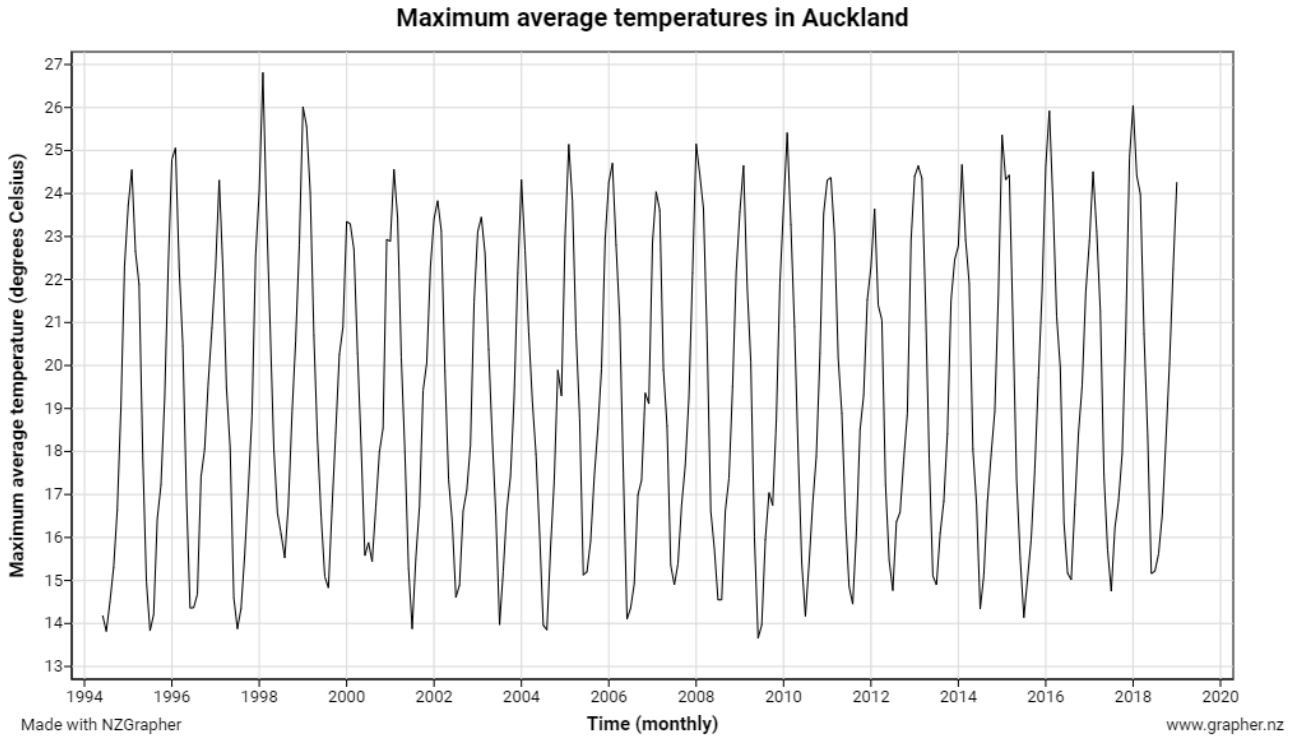
2) **Forestry dataset**

The data collected data each quarter (3-month period), starting on quarter 1 of 2000 and finishing in quarter 3 of 2013.



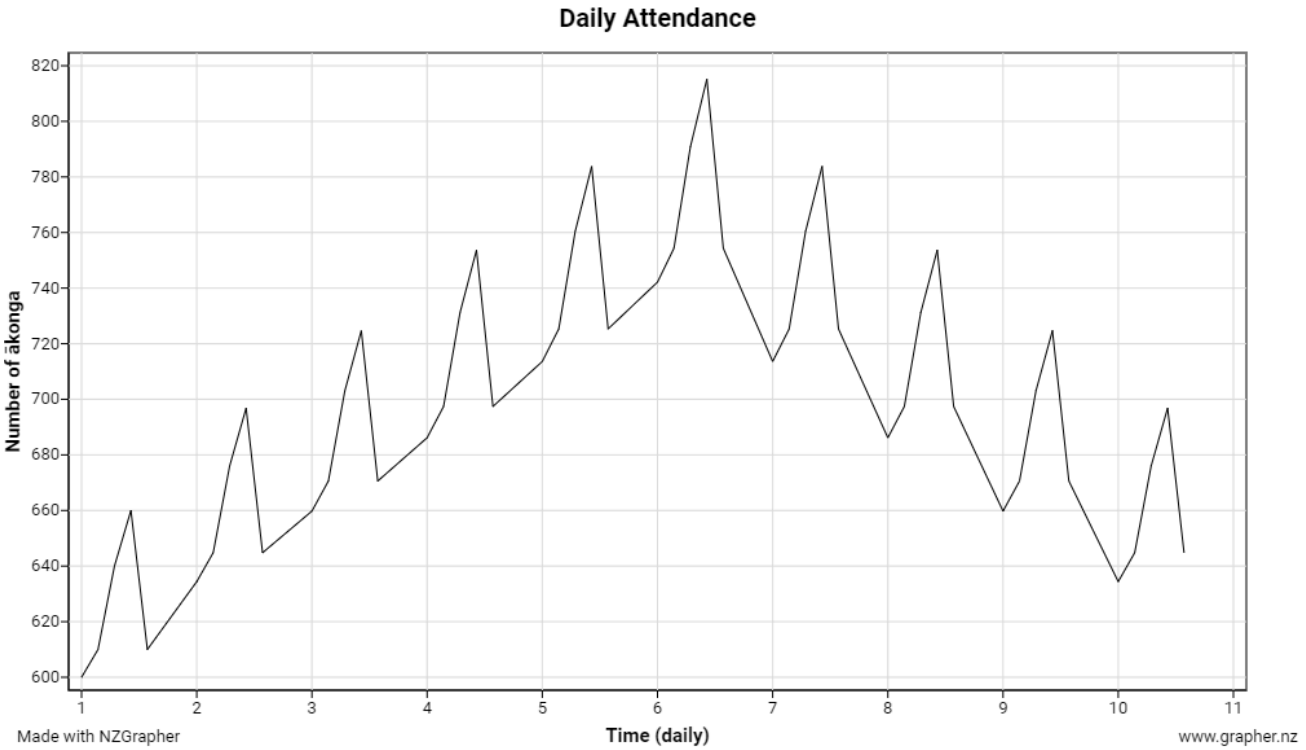
3) **Temperature dataset**

The data was collected monthly, starting on January of 1994, and finishing in January 2019.



4) **Attendance dataset**

The data was collected each school day in Term 1, starting on Monday of Week 1 and finishing Friday of Week 10.

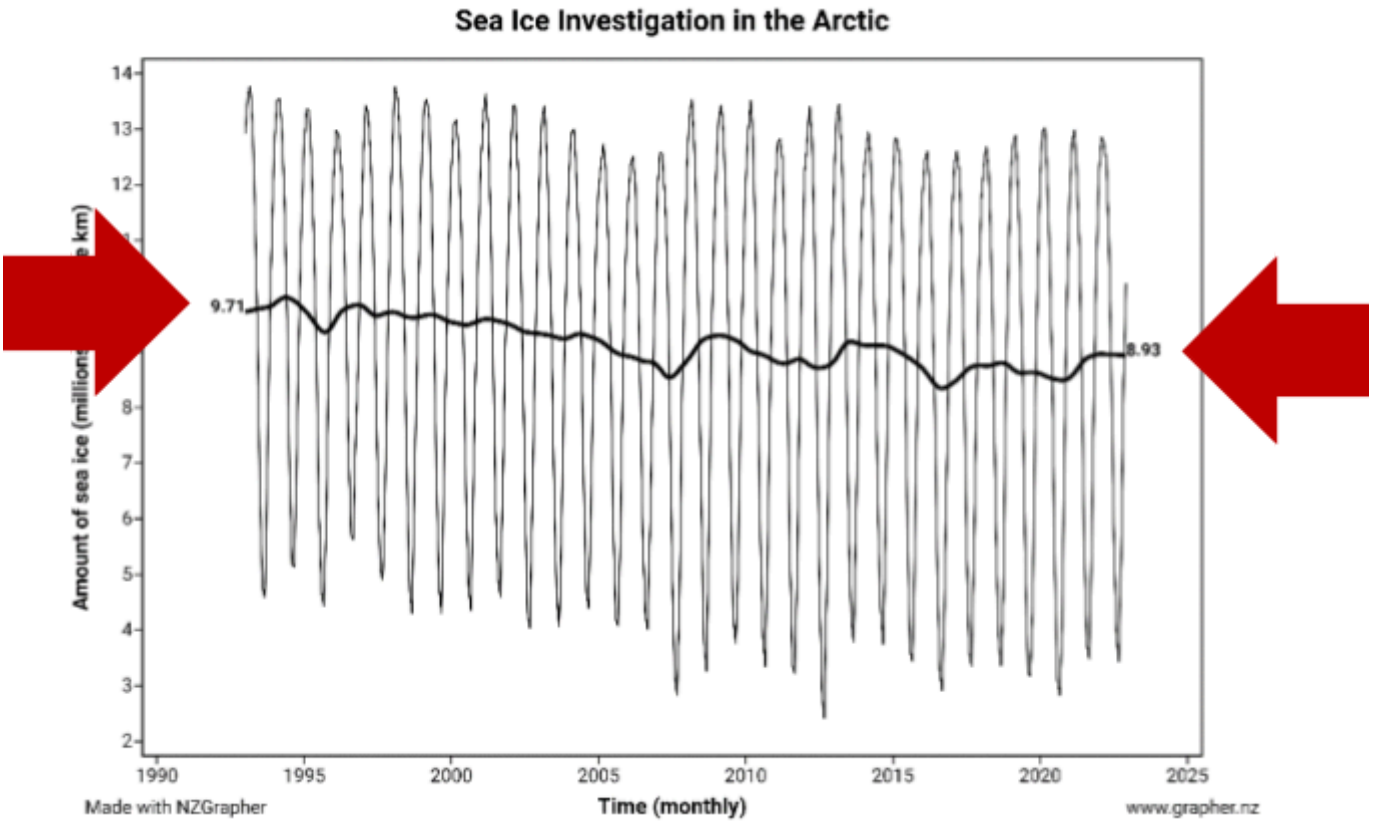


Trend line using NZGrapher

NZGrapher can add both the trend line and the start and end trend values.

Example:

The data covers the time period from January 1993 until December 2022.



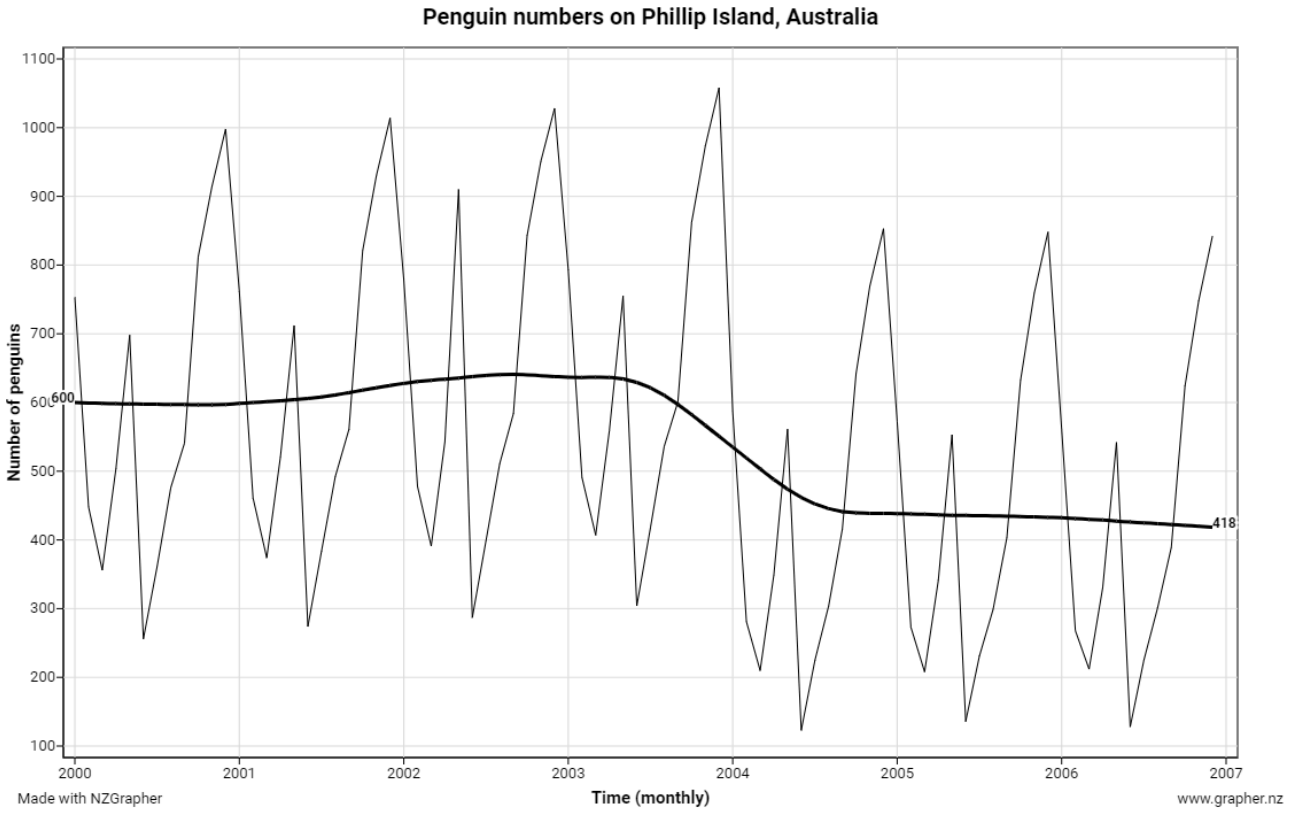
Looking at the overall trend line, we can see that the average amount of sea ice in the Arctic (North pole), has **decreased** from an **average** of **9.71 million square kilometres of sea ice** in **January 1993** to around **8.93 million square kilometres of sea ice** by **December 2022**.

Exercise 7:

Discuss the overall trend for each of the graphs below.

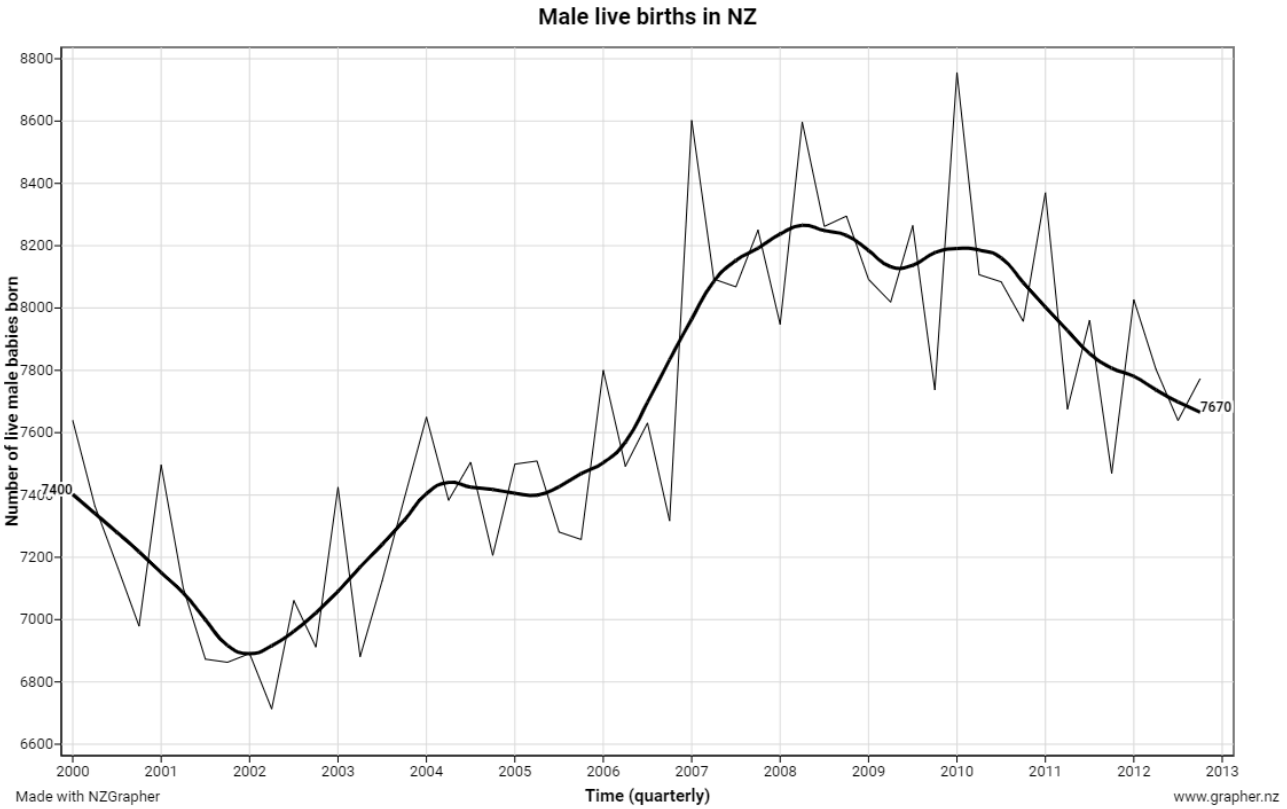
1) **Penguin dataset.**

The data covers the time period from January 2000 until December 2006.



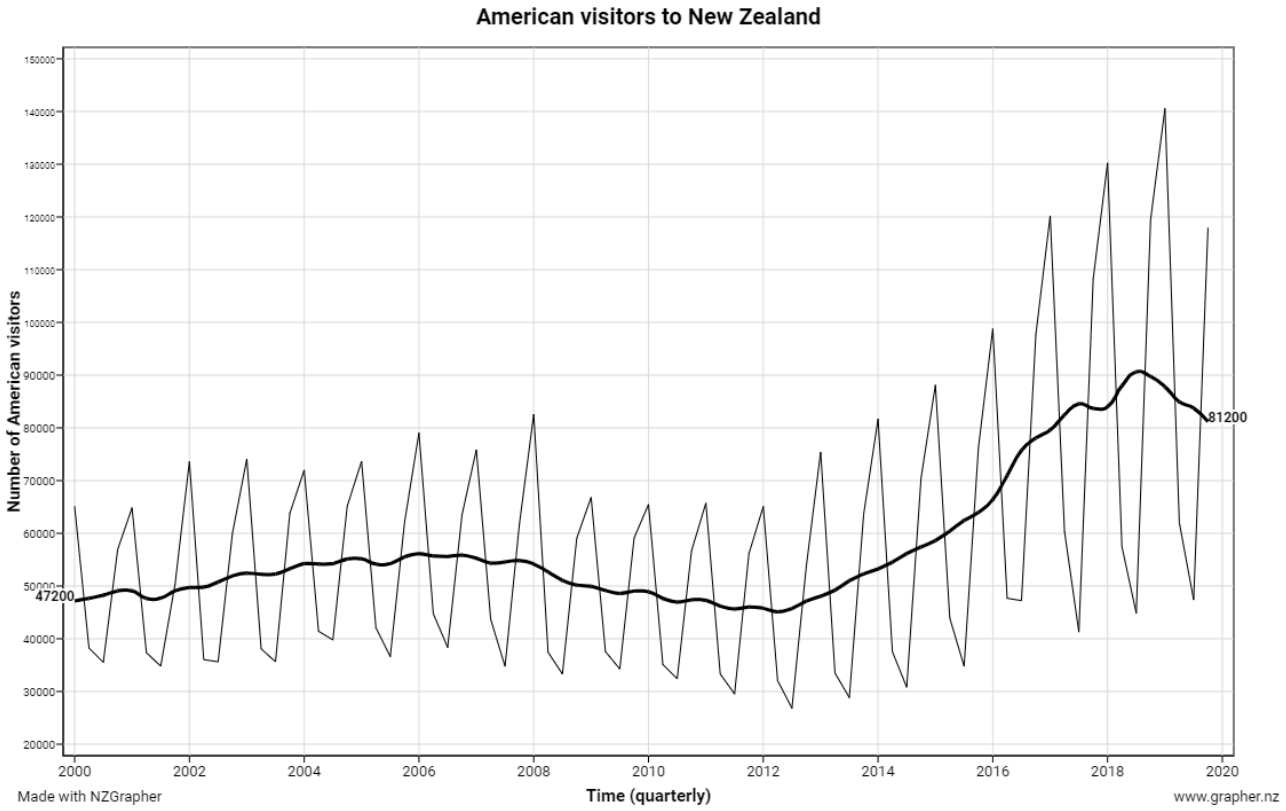
2) **Births and deaths dataset**

The data covers the time period from Quarter 1, 2000 until Quarter 4, 2012.



3) **Visitors' dataset**

The data covers the time period from Quarter 1, 2000 until Quarter 4, 2019.



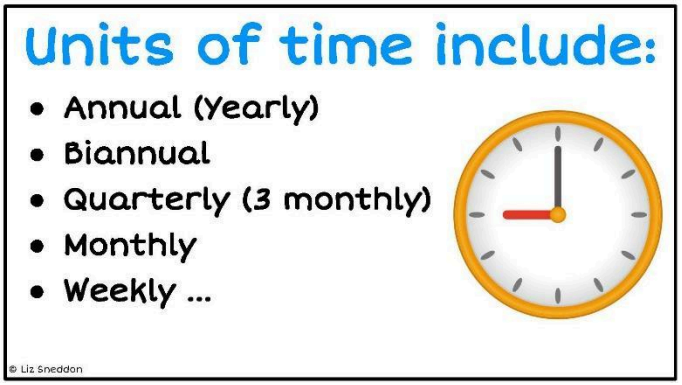
Seasonality

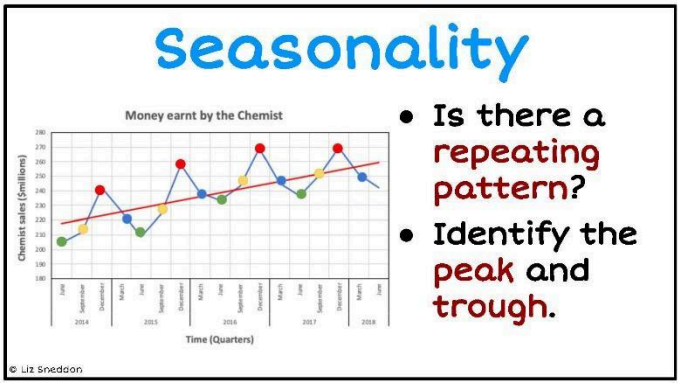
Seasons could be hours, days, weeks, months, quarters, etc.

There may be a repeating pattern within the data, which repeats in regular intervals.

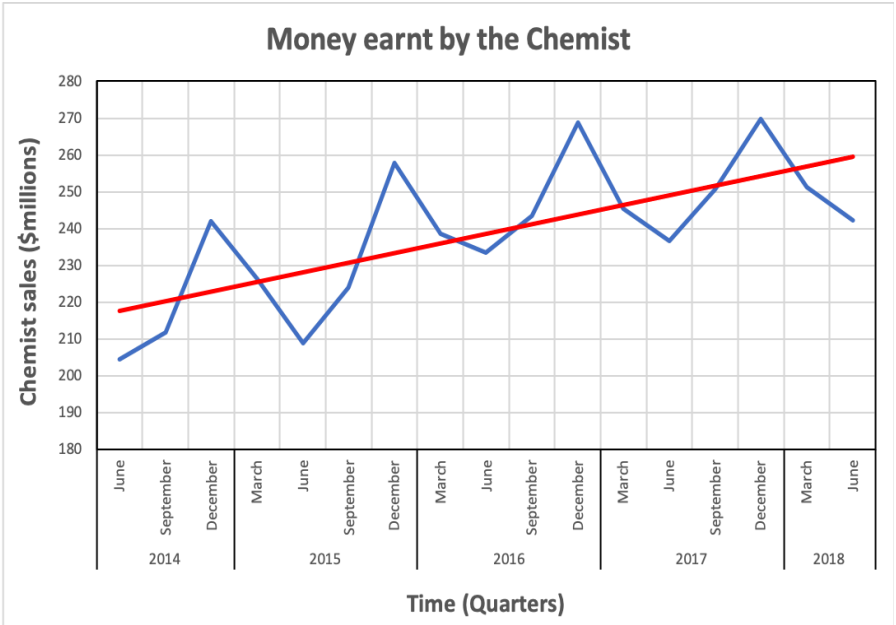
For example, if you have data collected every day, then you may find a pattern that repeats every week.

First identify if there is a repeating pattern, and if there is, then the next step is to describe the repeating pattern, including when the peak and trough occurs.





Example:

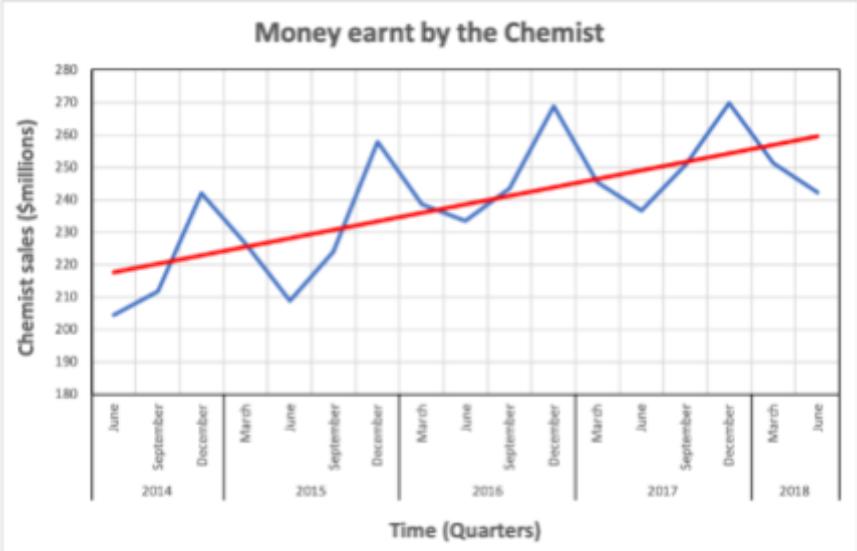


The data has been collected **quarterly**, which means every 3 months. Therefore, each data point represents the total amount of money earnt in the chemist for the three-month periods shown below.

Quarter	Months
1	January, February, March
2	April, May, June
3	July, August, September

4	October, November, December

Is there a repeating pattern (seasonality)?

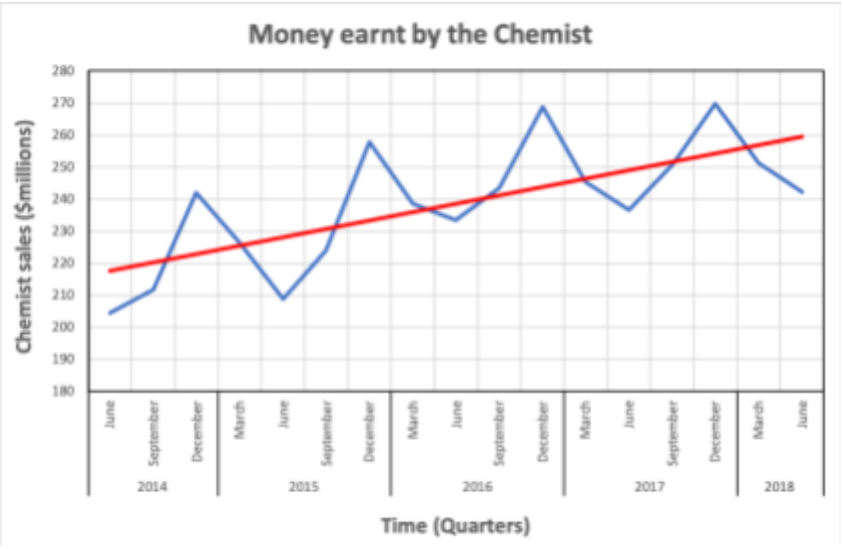


First, I want to identify if there is a repeating pattern. In this case, I am looking to see if the pattern repeats each year.

I traced each year in a different colour highlighter, and I notice that each year has the same pattern of starting higher, dropping in the middle of the year, and rising at the end of the year.

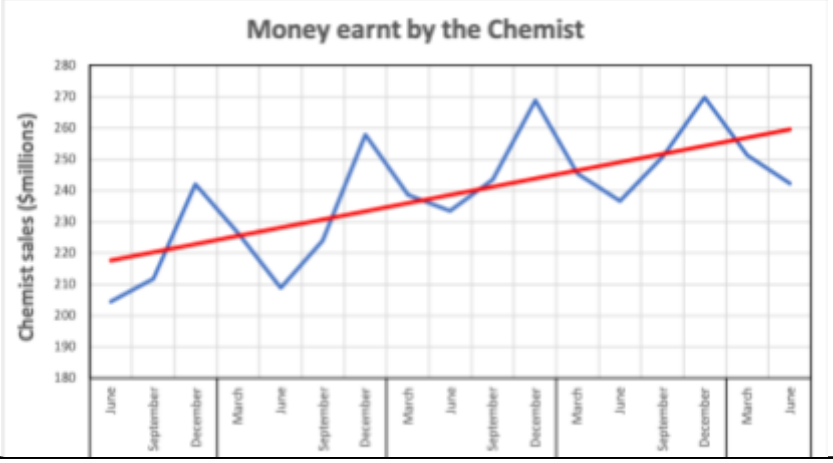
There is a constant repeating pattern (seasonality) present in the data.

When are the highest points (peaks) each year?



The peaks each year occur in the last quarter, which is the months of October, November, and December. This tells us that the amount of money that chemists earn each year tend to be highest in Quarter 4.

When are the lowest points (trough) each year?

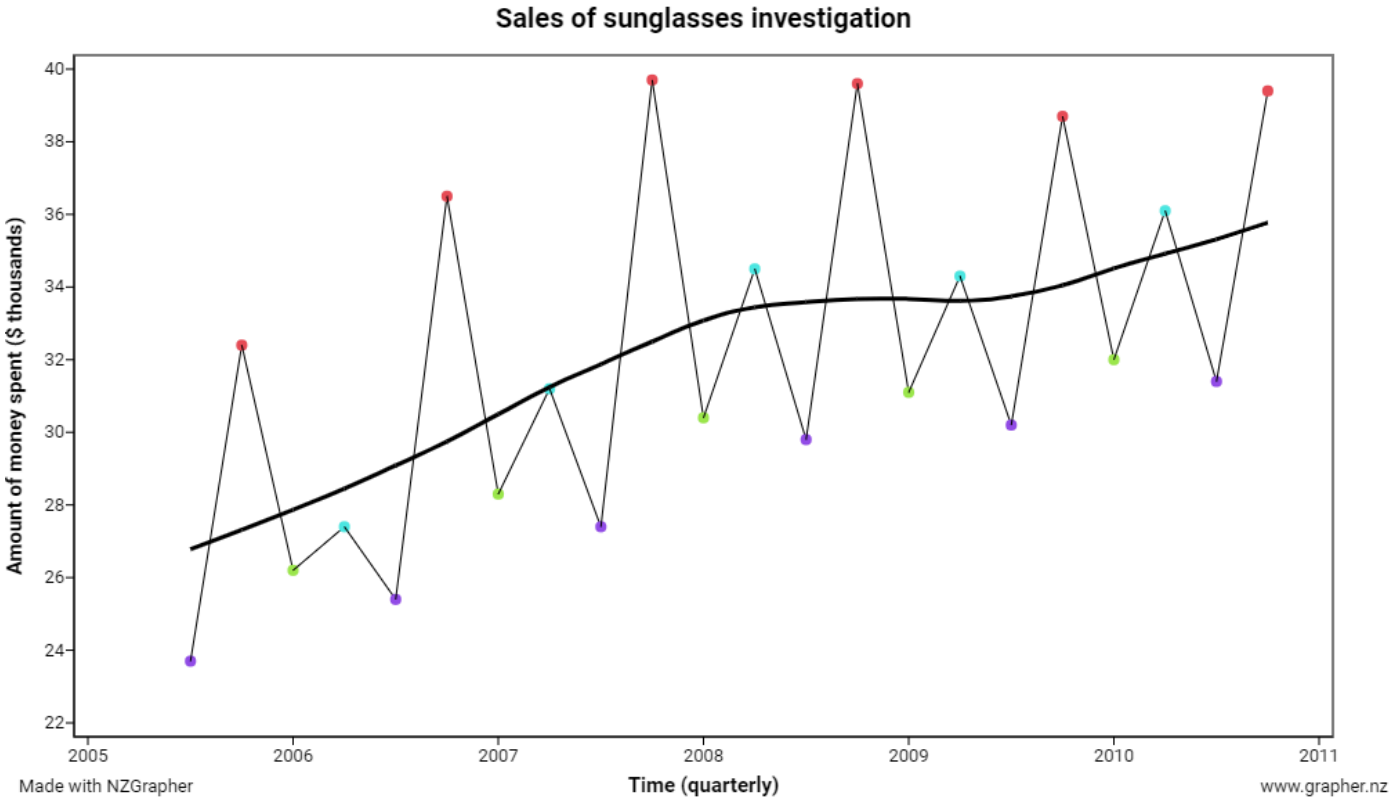


The troughs each year occur in the 2nd quarter, which is the months of April, May, and June. This tells us that the amount of money that chemists earn each year tend to be lowest in Quarter 2.

Seasonal patterns in NZGrapher

NZGrapher allows us to colour code each season (e.g. day of the week, hour of the day, month of the year etc.)

Example:



I notice that there seems to be a **consistent repeating seasonal** pattern.

I notice that the **red dots, quarter 4,** seems to be the **highest** each year, so the sales of sunglasses tend to be highest in Quarter 4.

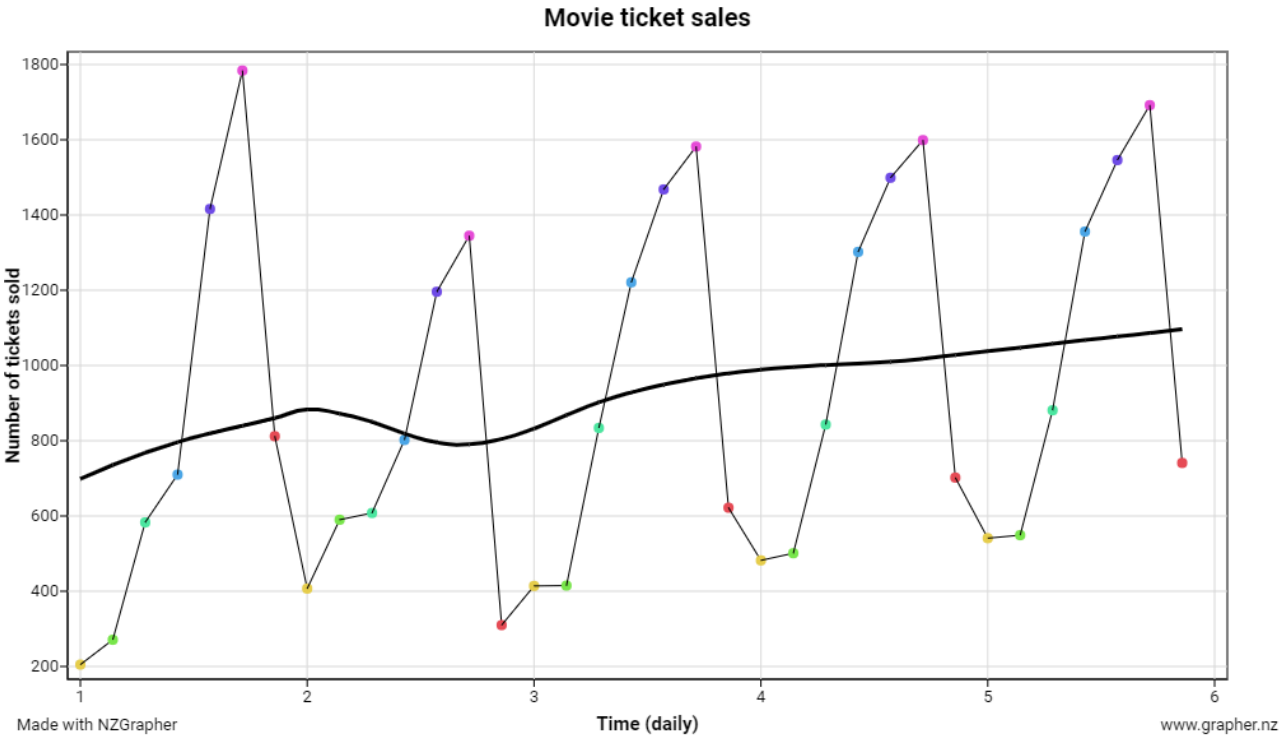
I notice that the **purple dots, quarter 3**, seem to be the **lowest** each year, so the sales of sunglasses tend to be lowest in Quarter 3.

Exercise 8:

For each graph below, identify if there is a repeating pattern or not (the coloured dots match to the "season"). If there is a repeating pattern (seasonality), then identify when the peak and trough.

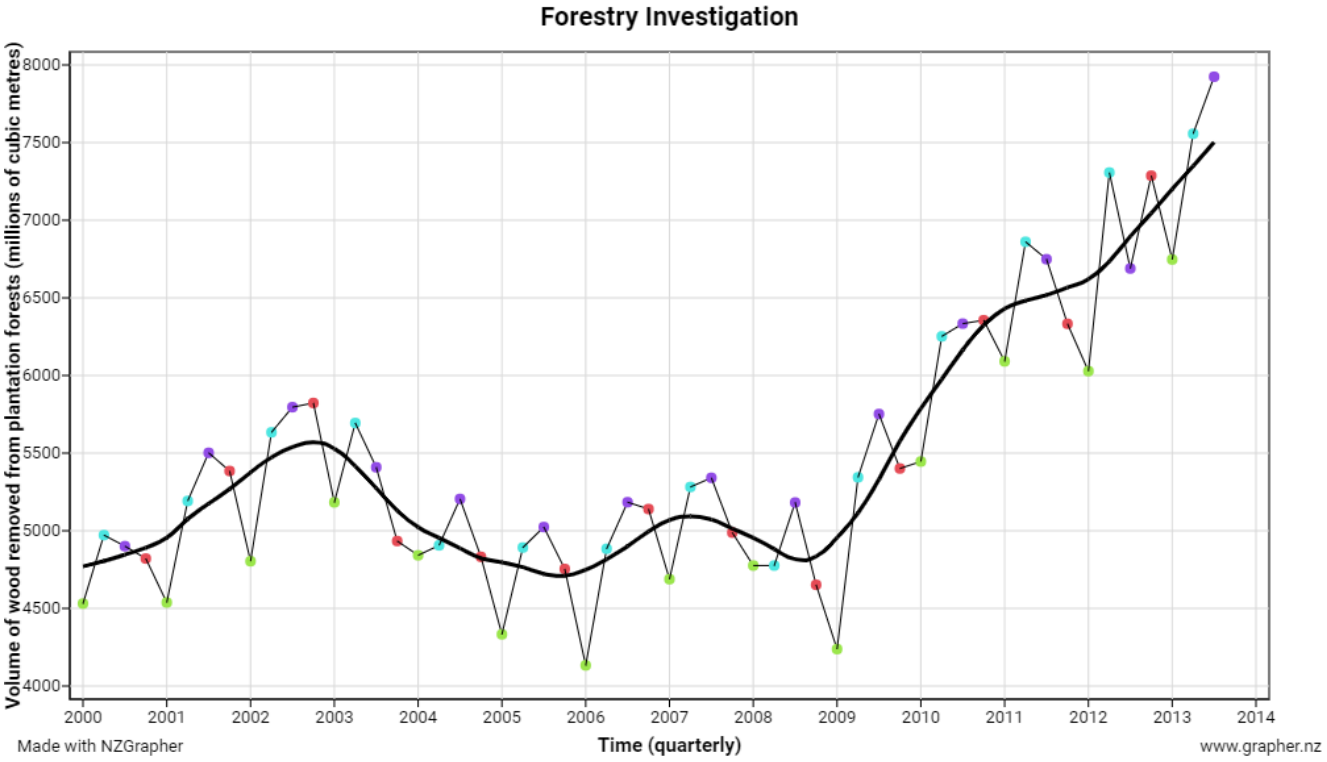
1) **Movie ticket dataset**

The data covers 5 weeks of data, collecting data each day, starting on Monday of Week 1, and finishing Sunday Week 5.



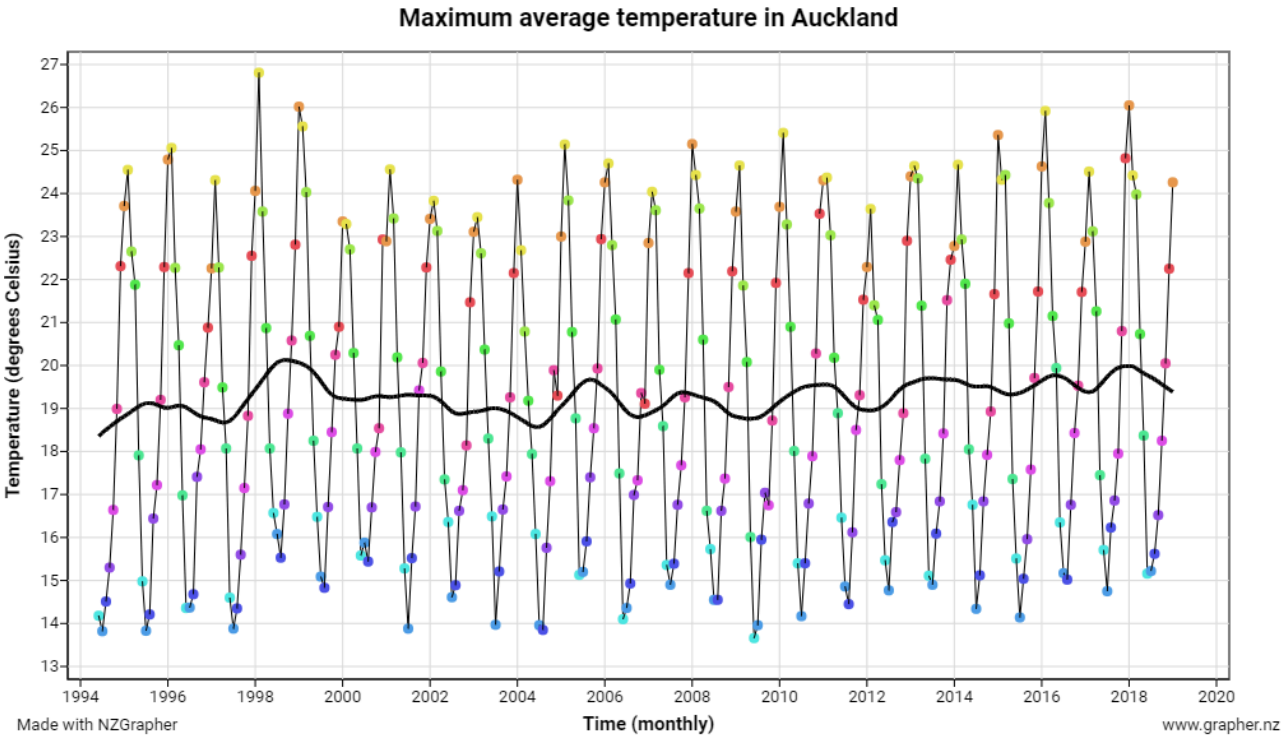
2) **Forestry dataset**

The data collected data each quarter (3-month period), starting on quarter 1 of 2000 and finishing in quarter 3 of 2013.



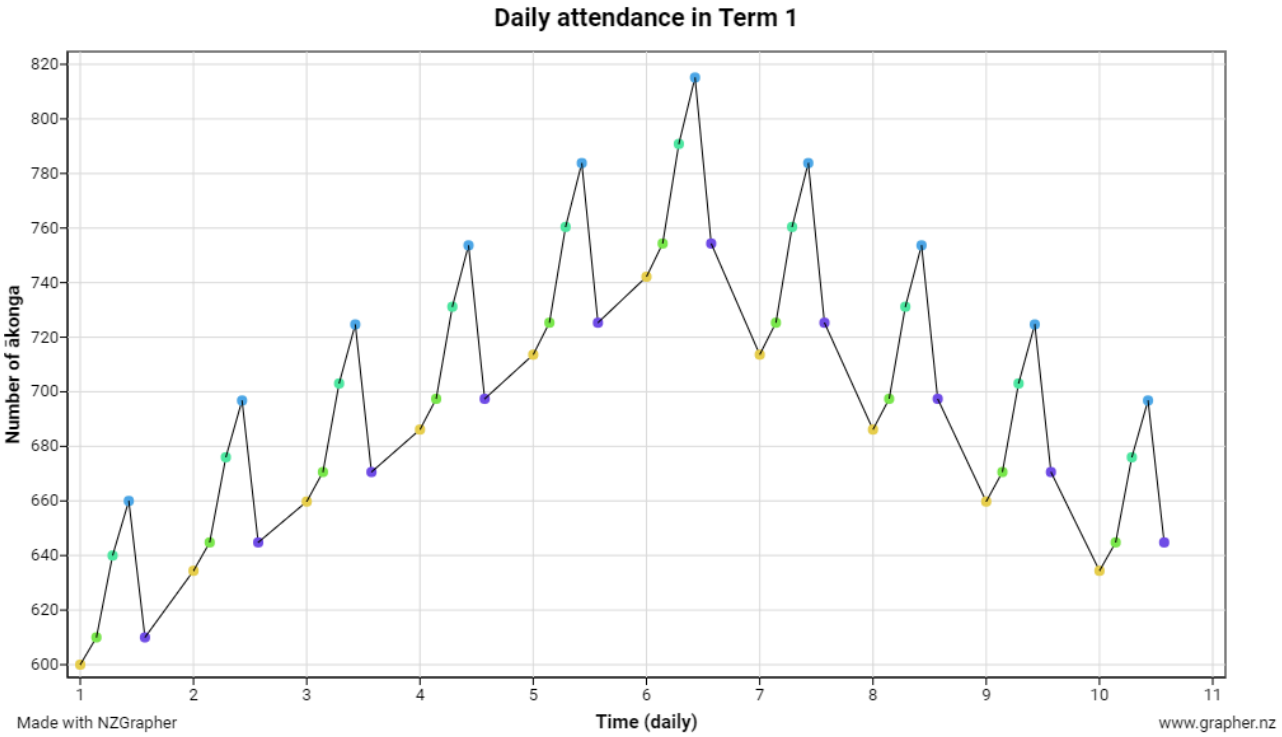
3) **Temperature dataset**

The data was collected monthly, starting on January of 1994, and finishing in January 2019.



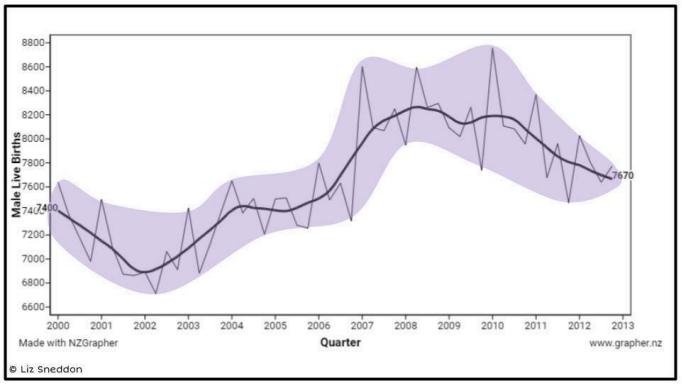
4) **Attendance dataset**

The data was collected each school day in Term 1, starting on Monday of Week 1 and finishing Friday of Week 10.

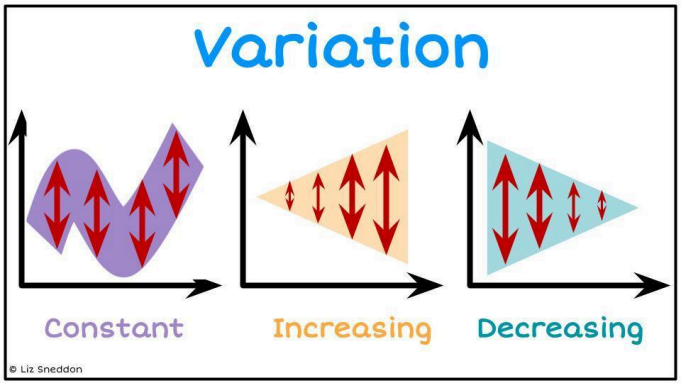


Variation

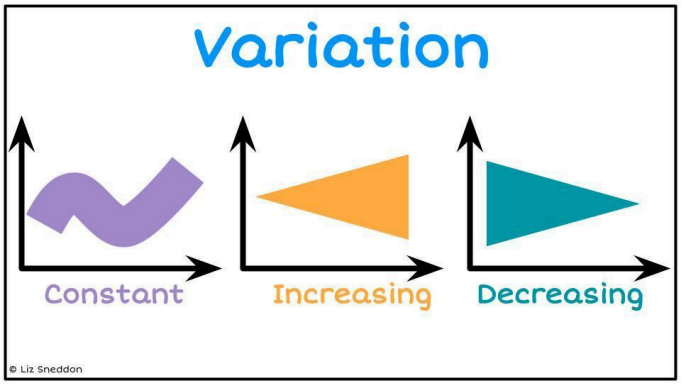
To see the variation, draw a line on the top that hits the top peaks, and another one on the bottom that hits the troughs. Then imagine that you have coloured the area in between these lines.



When thinking about variation, think about what is happening **as the time increases**. Does the **vertical variation** (variable on the y axis) change a lot, or is it pretty consistent? Small changes in variation are normal, as that is just **random variation**.

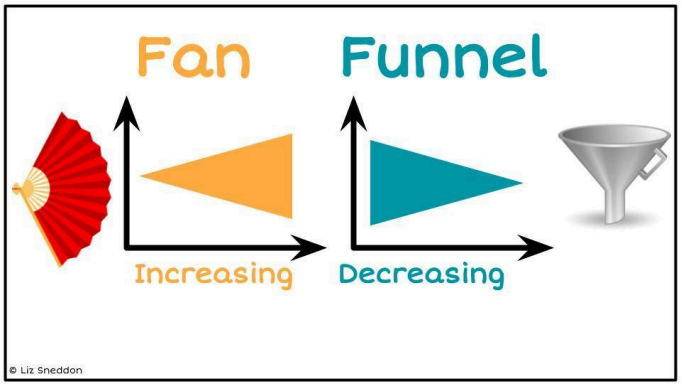


We want to look over the data and see whether the amount of variation over time is reasonably constant, or whether the variation changes significantly, as this in turn affects whether the model fitted is appropriate or not (we will discuss the model in the conclusion section).



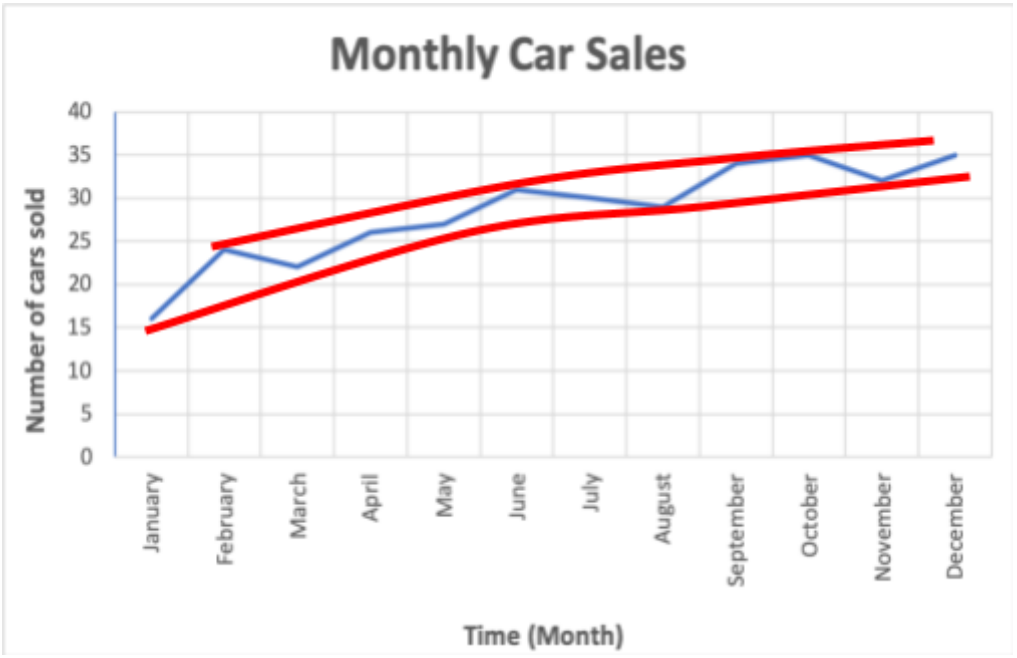
Increasing variation is sometimes called a **fan effect**, as the variation starts small and increases like a fan opening.

Decreasing variation is sometimes called a **funnel effect,** as the variation starts wide like the top of a funnel and gets smaller over time.



Example:

Here is our graph of car sales.

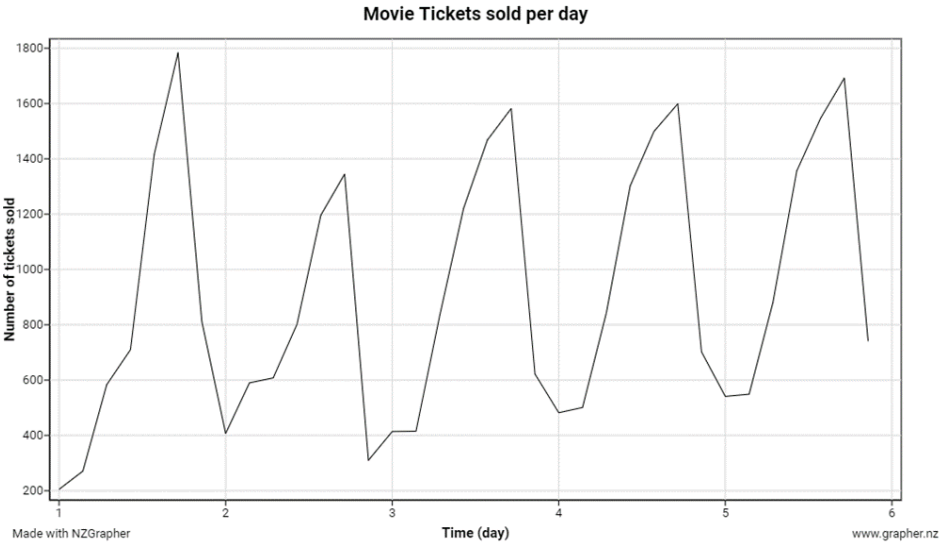


Looking at the lines that we have drawn above and below, they appear nearly parallel. This shows us that the variation in the number of cars sold over the year is reasonably constant.

Exercise 9:

For each of the graphs below, draw a line above and below to identify whether the variation is constant, increasing or decreasing.

1)



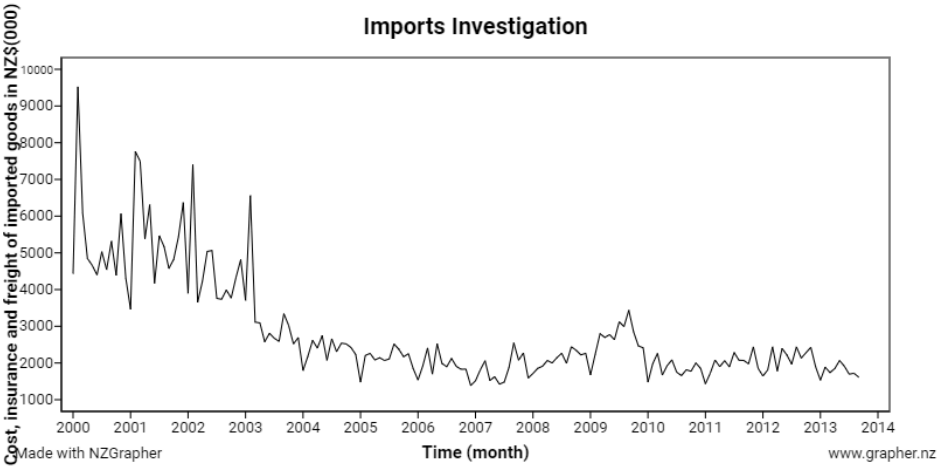
The variation is:

Constant,

Increasing (fan)

Decreasing (funnel)

2)



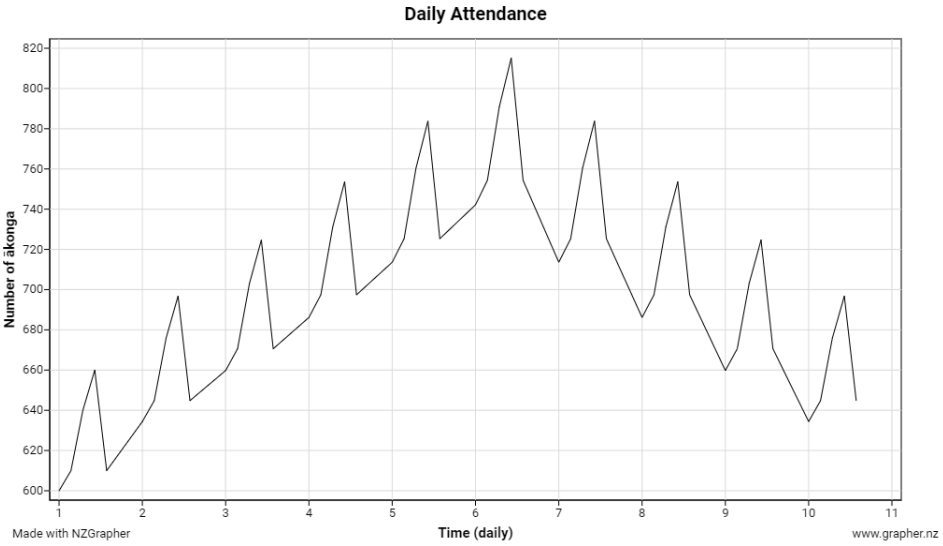
The variation is:

Constant,

Increasing (fan)

Decreasing (funnel)

3)



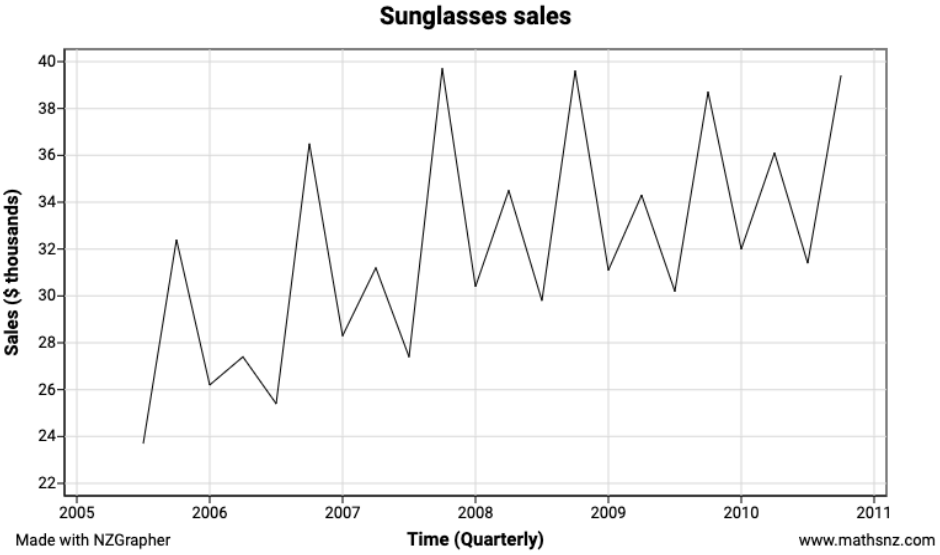
The variation is:

Constant,

Increasing (fan)

Decreasing (funnel)

4)



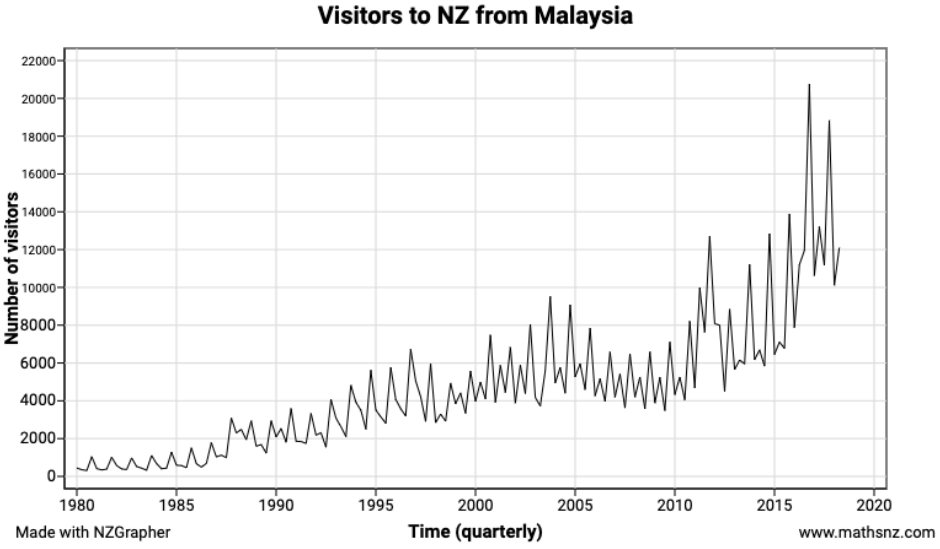
The variation is:

Constant,

Increasing (fan)

Decreasing (funnel)

5)



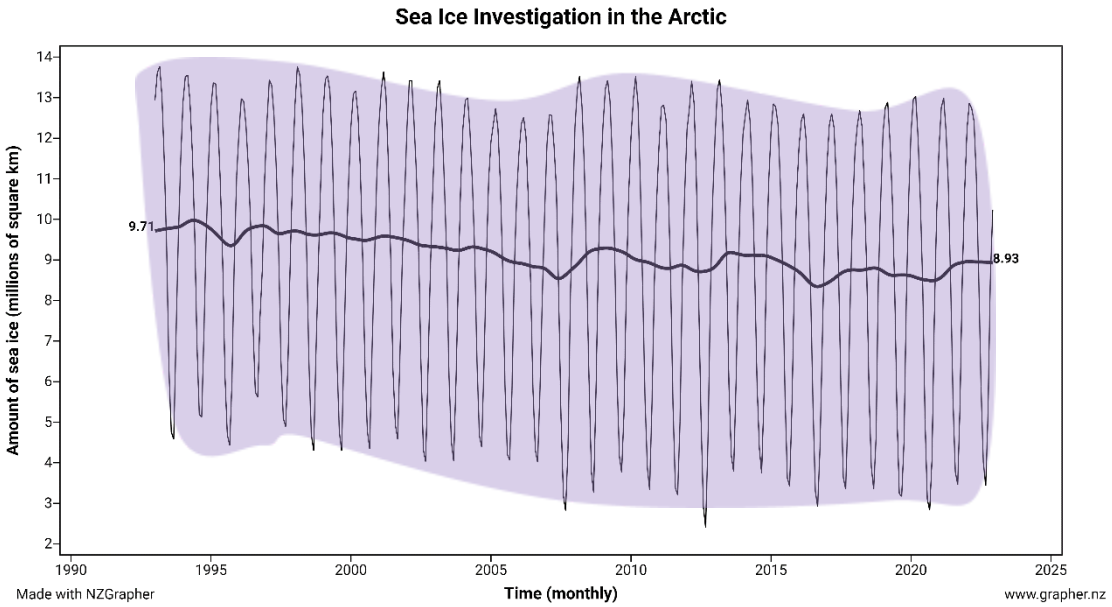
The variation is:

Constant,

Increasing (fan)

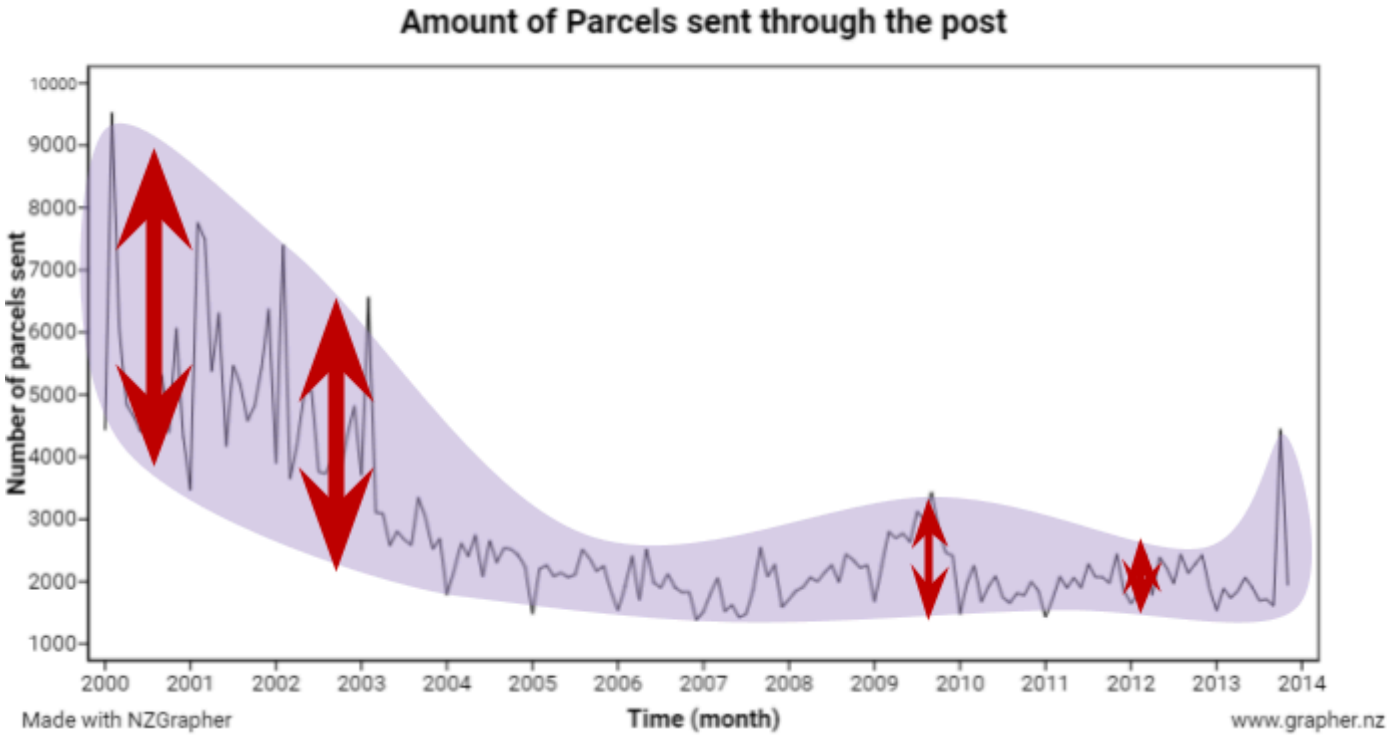
Decreasing (funnel)

Example 1:



The variation in the amount of sea ice in the Arctic is roughly constant between 1993 and 2022.

Example 2:

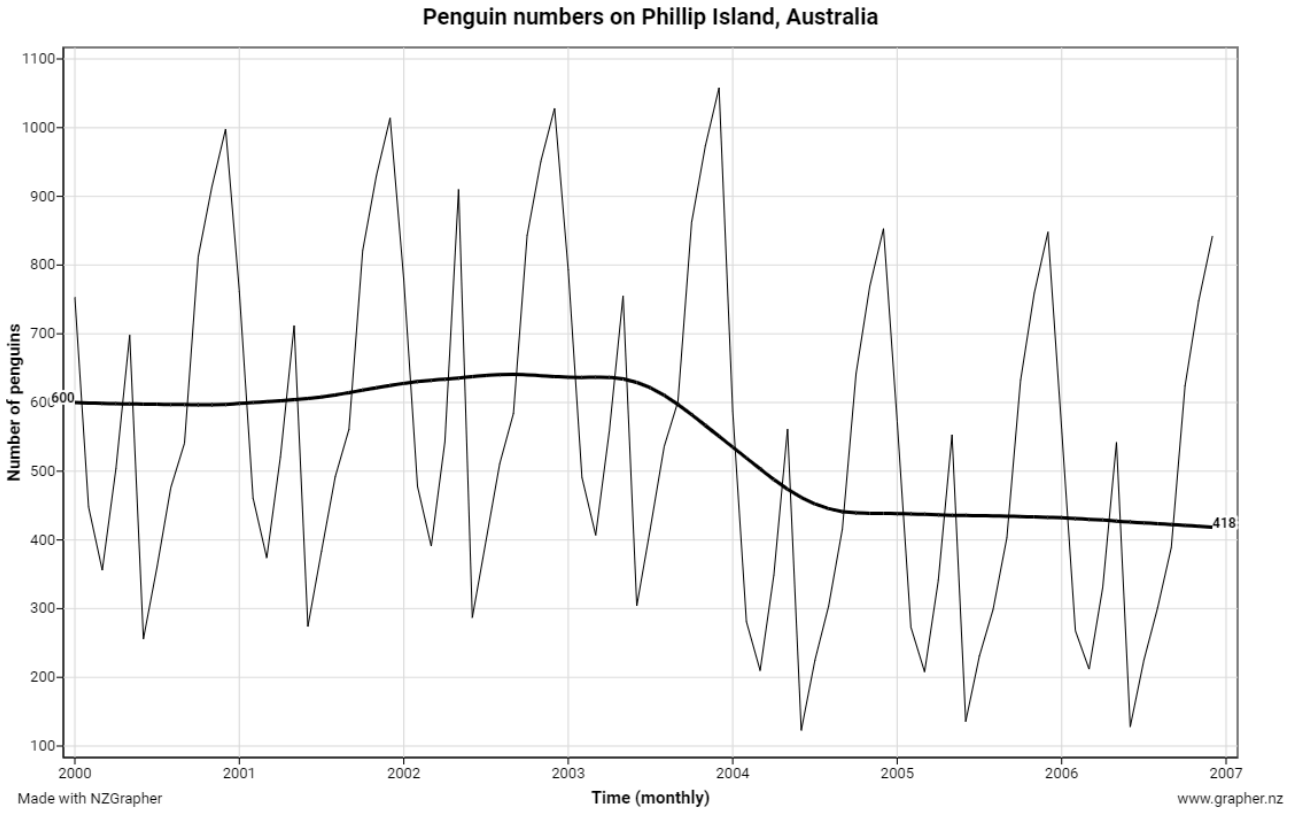


The variation in the number of parcels sent through the post has decreased between 2000 and 2014, as we can see that there is a lot of variation around 2000, while the variation is a low lower by 2012.

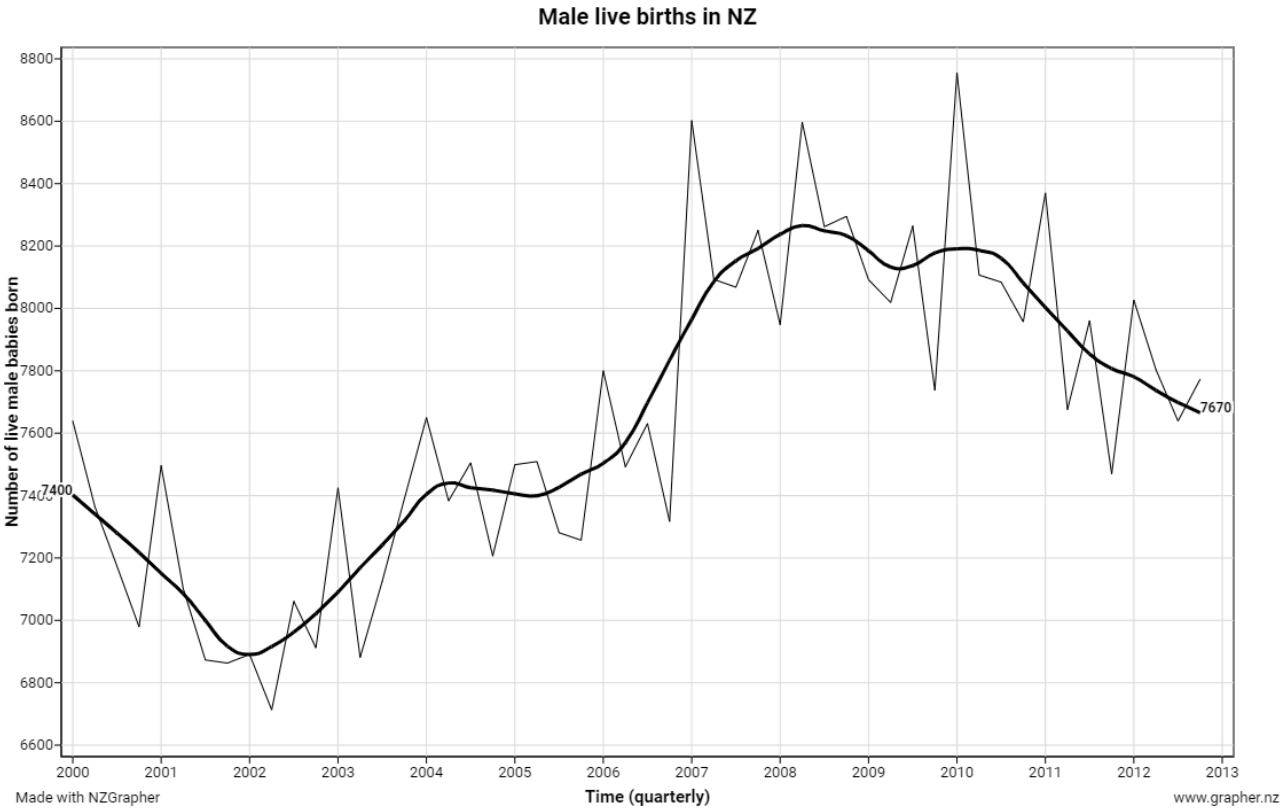
Exercise 10:

Discuss the variation for each of the graphs below.

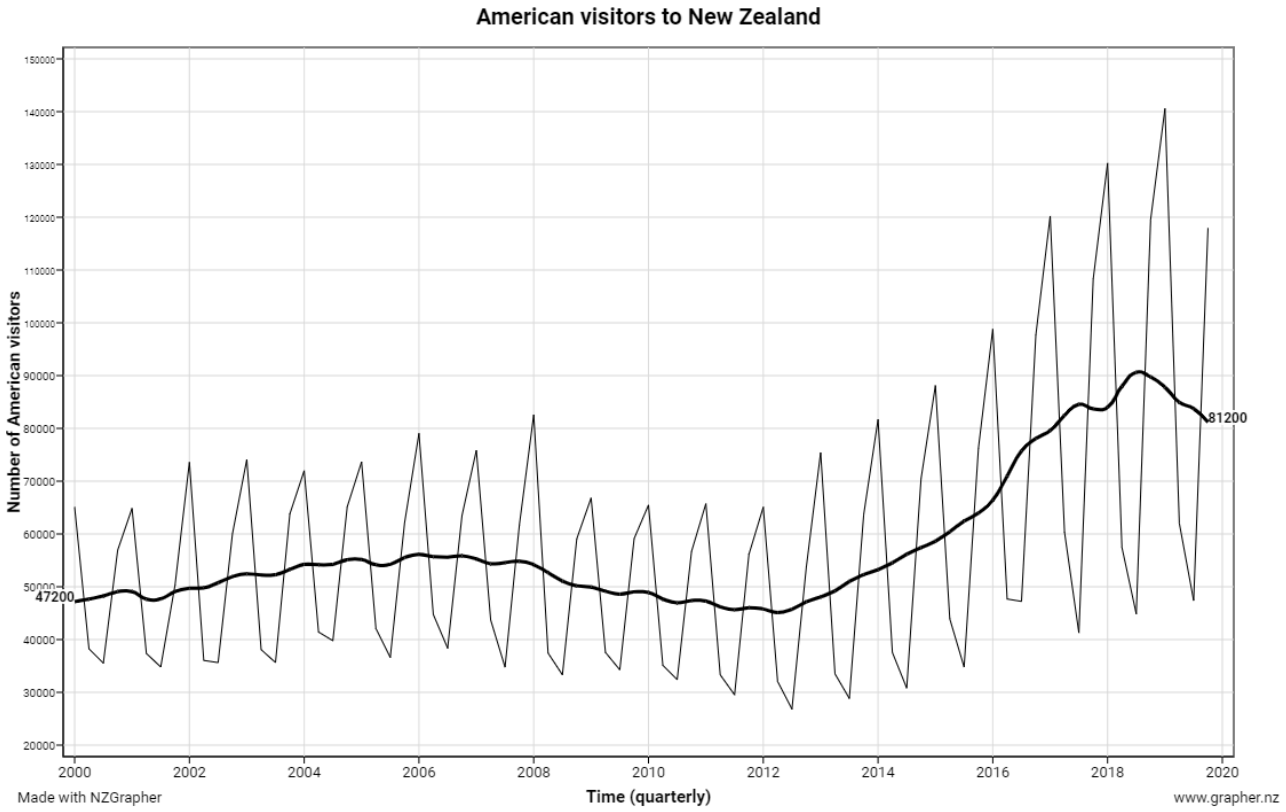
1) **Penguin dataset**



2) **Births and deaths dataset**

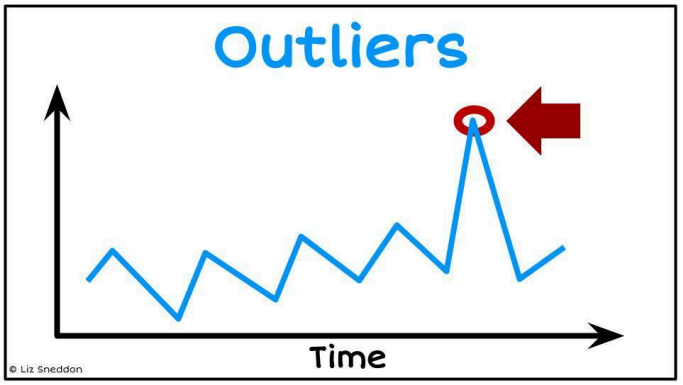


3) **Visitors dataset**



Outliers

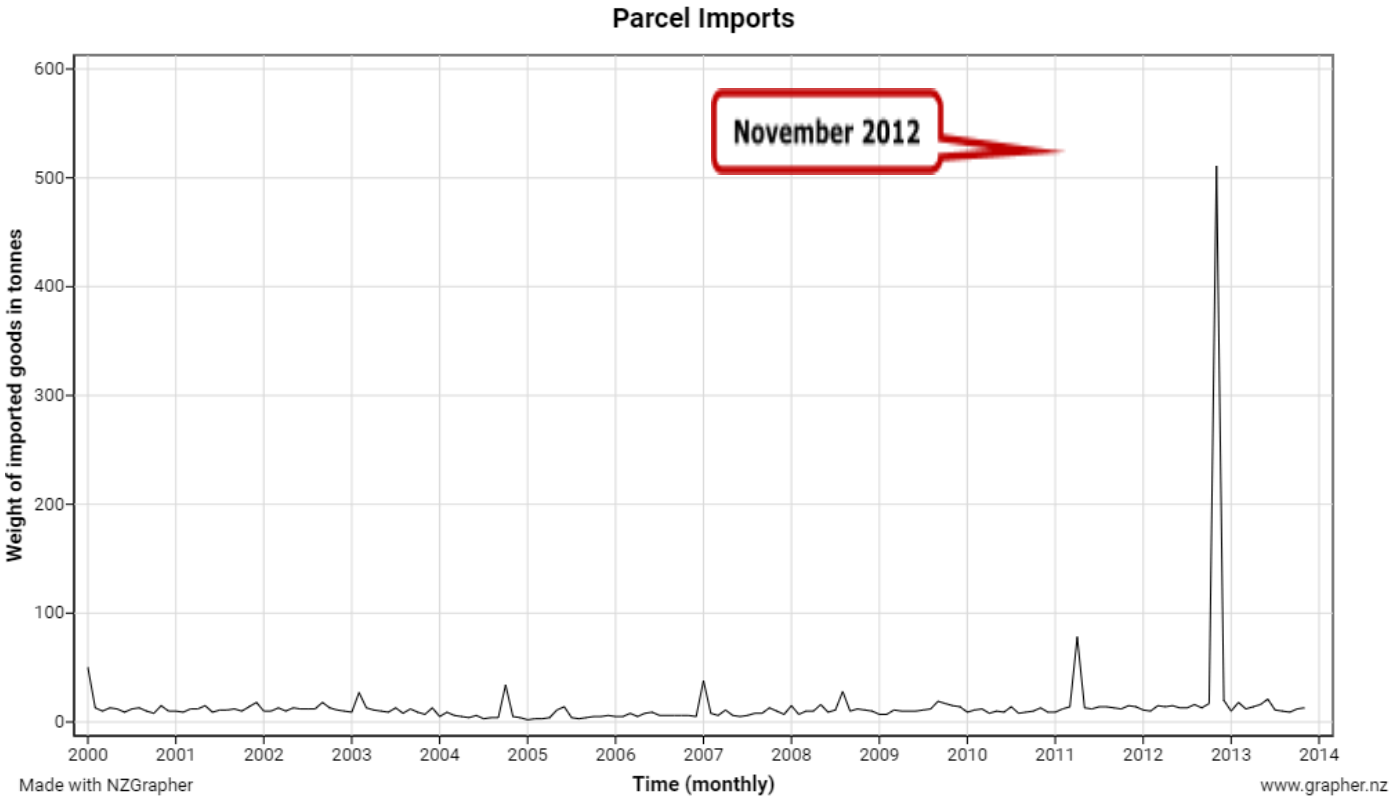
An outlier is an unusual point, something that is very unexpected, and **a long way** away from the normal pattern. There will have been something unusual happen that contributed significantly. Each outlier will have different reasonings.



To identify an outlier, we need to understand that some variation is normal, so we need to identify points that differ from the normal patterns.

Example:

Identify any outliers.

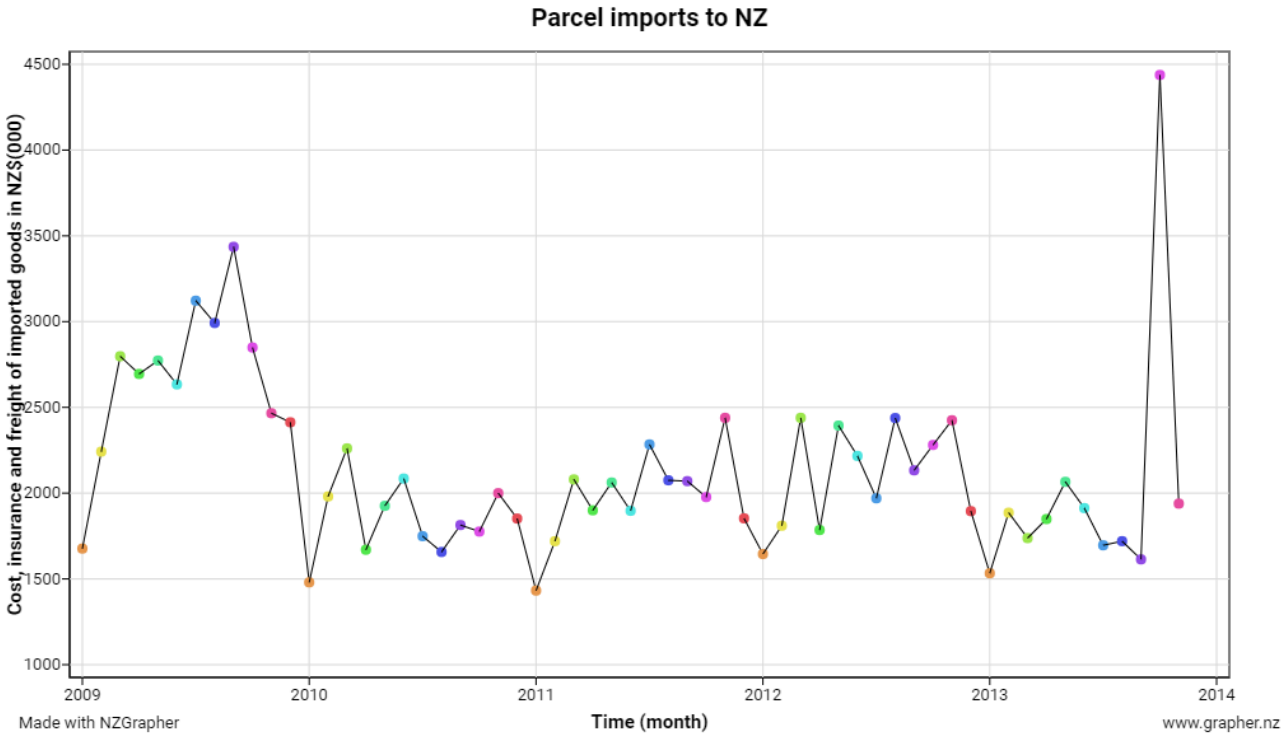


There is an outlier in November 2012. The weight of imported goods was unusually high at this time, far more than expected.

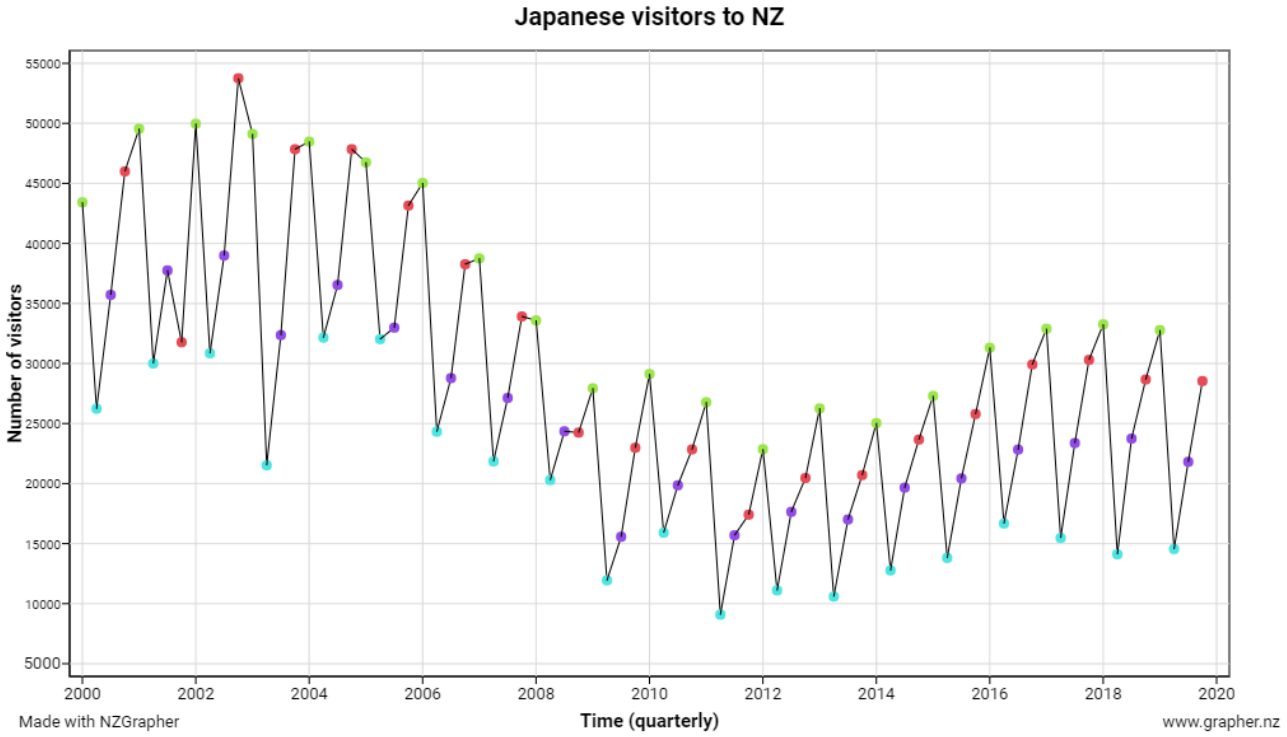
Exercise 11:

Identify any outliers in the following graphs.

1) **Imports dataset**



2) **Visitors dataset**



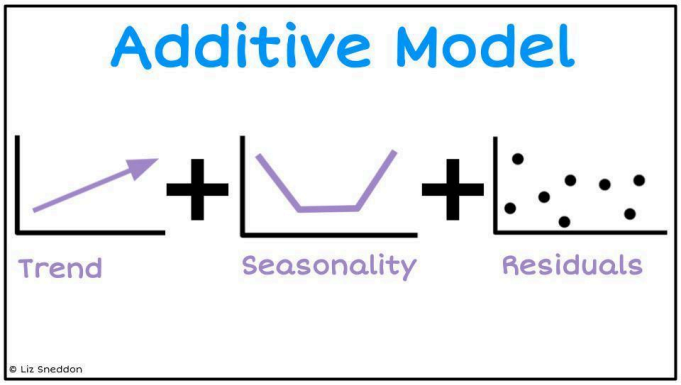
Conclusion

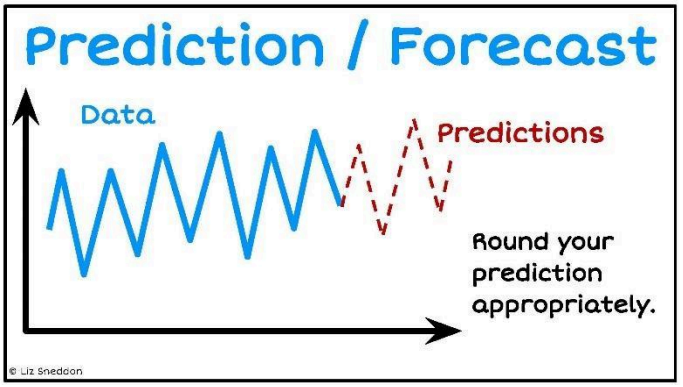
Once we have identified the patterns in the data, then we want to fit a model to the data so that we can make predictions.

Building a model

For NCEA Level 1 we want to build an appropriate model to fit the data. We will do this visually by hand.

We need to think about the different features in the data and combine these together to make predictions. We need to combine both the trend and seasonality together.

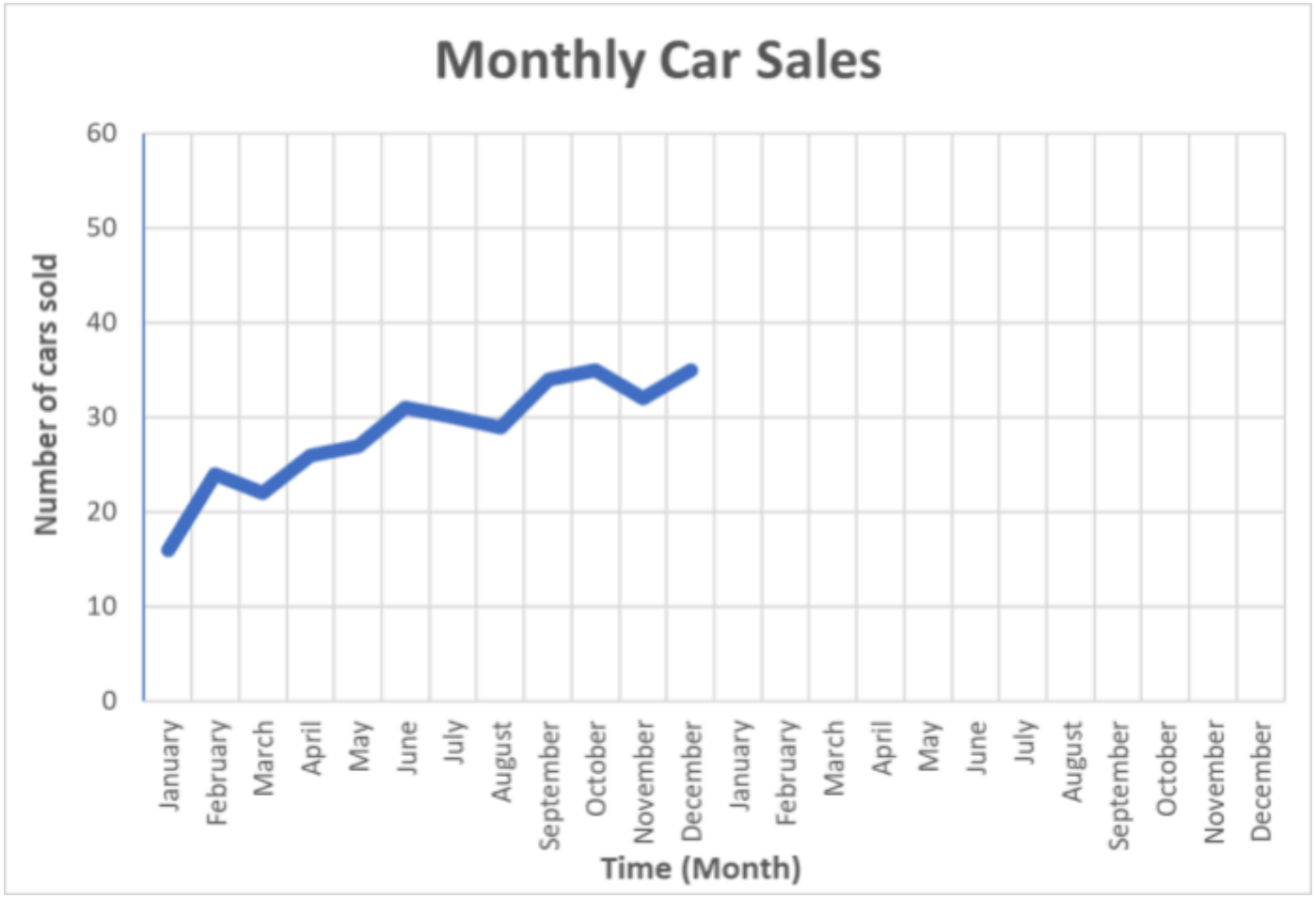




I want to trace the data in the graph below with a felt pen or highlighter, following the pattern. I will then extend this beyond the data to estimate and draw a prediction model. The model needs to take both the trend and seasonality into account.

Example:

Using a highlighter, trace over the data, then continue the pattern on. Lastly use your model to make a prediction, writing a sentence in context.



We can choose any month to write a prediction for.

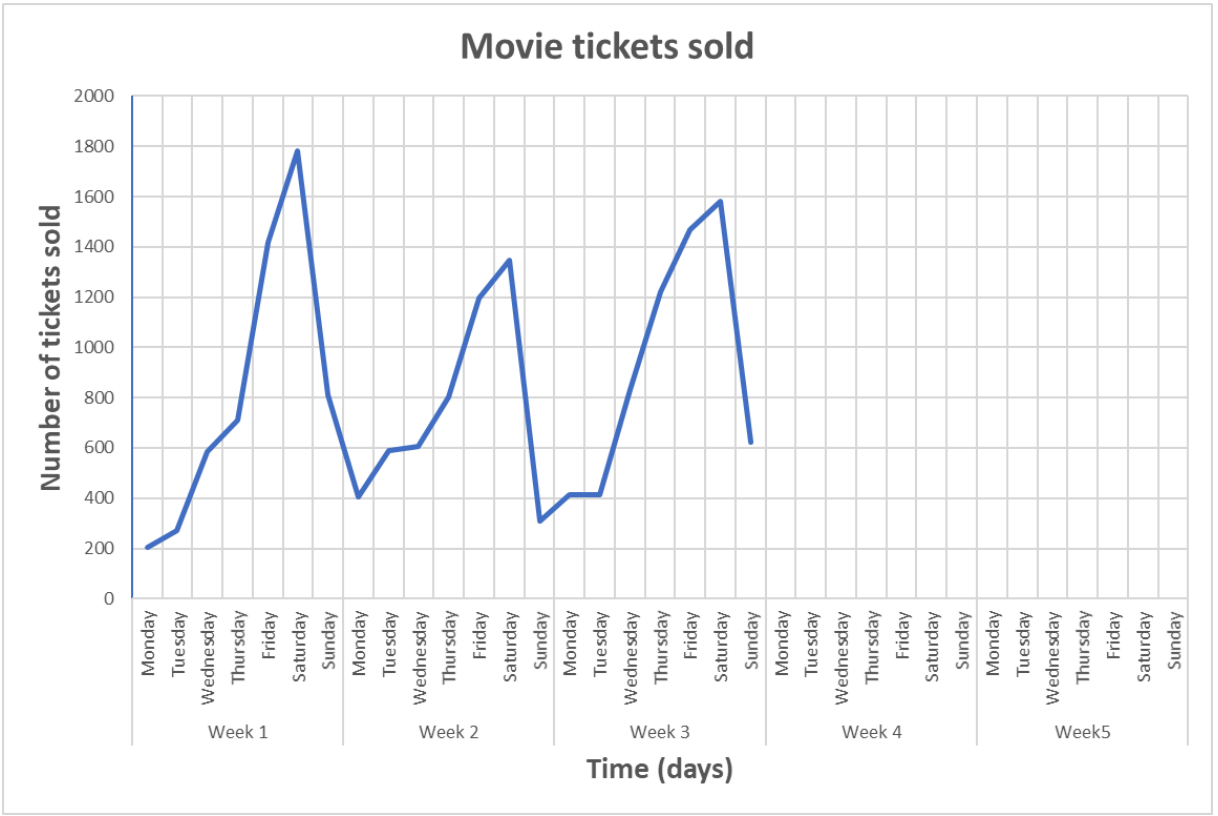
E.g. I predict that for January in the second year the number of cars sold is likely to be around 40.

Exercise 12:

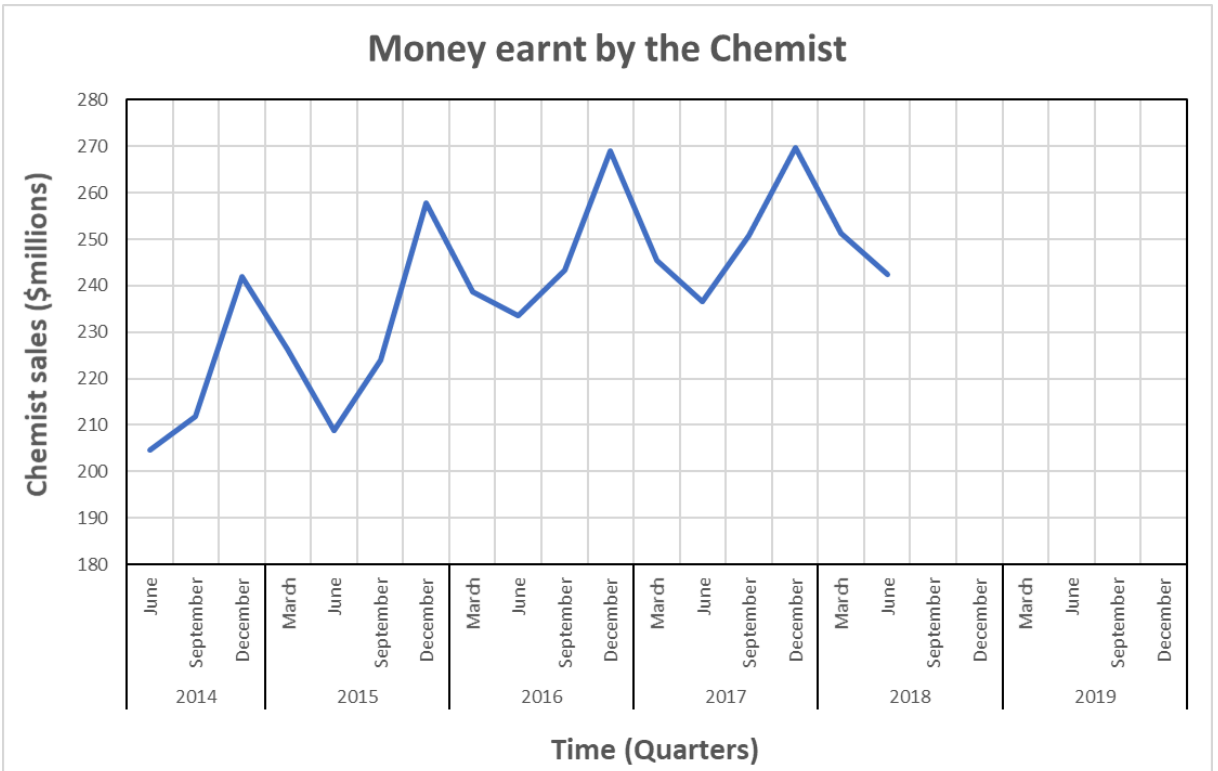
1) Go to the website **https://bit.ly/TimeSeriesPredictions** and complete the same type of activity. Once you have traced the pattern, click on the **Show missing data** button to see how good your prediction model was.

2) Get a highlighter, trace over the data, and then continue the pattern to form a prediction model. Make a prediction from your model and write this in a sentence in context.

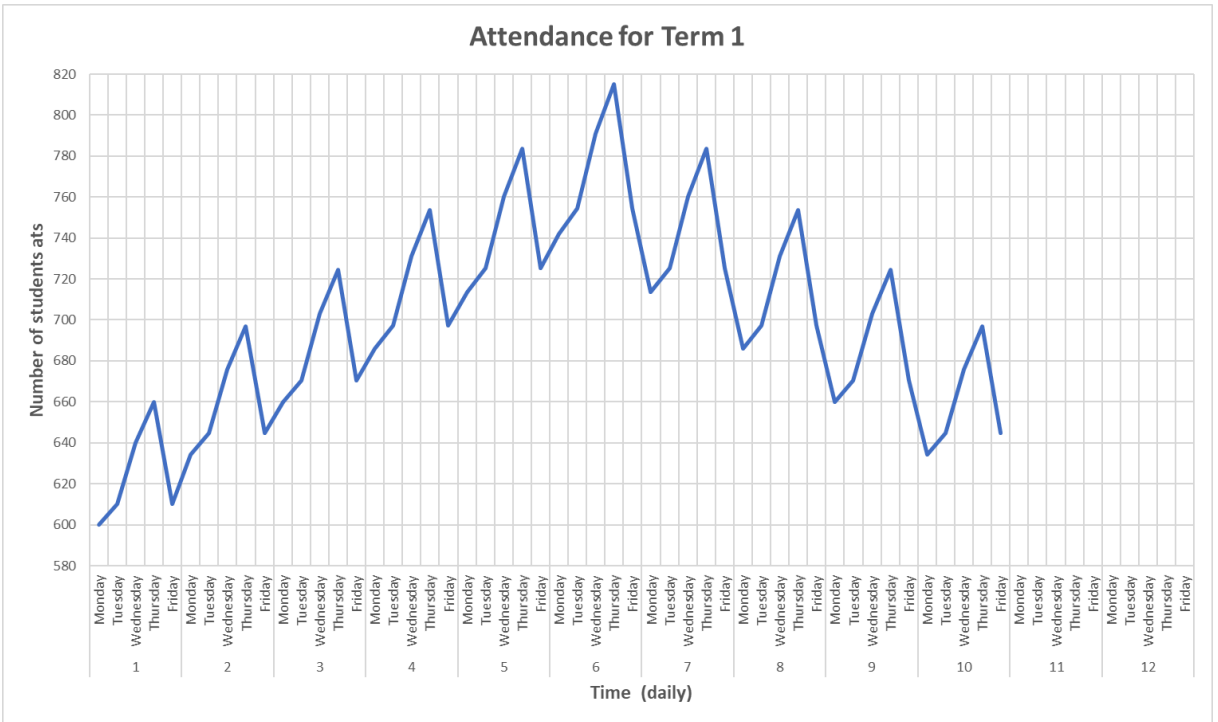
a)



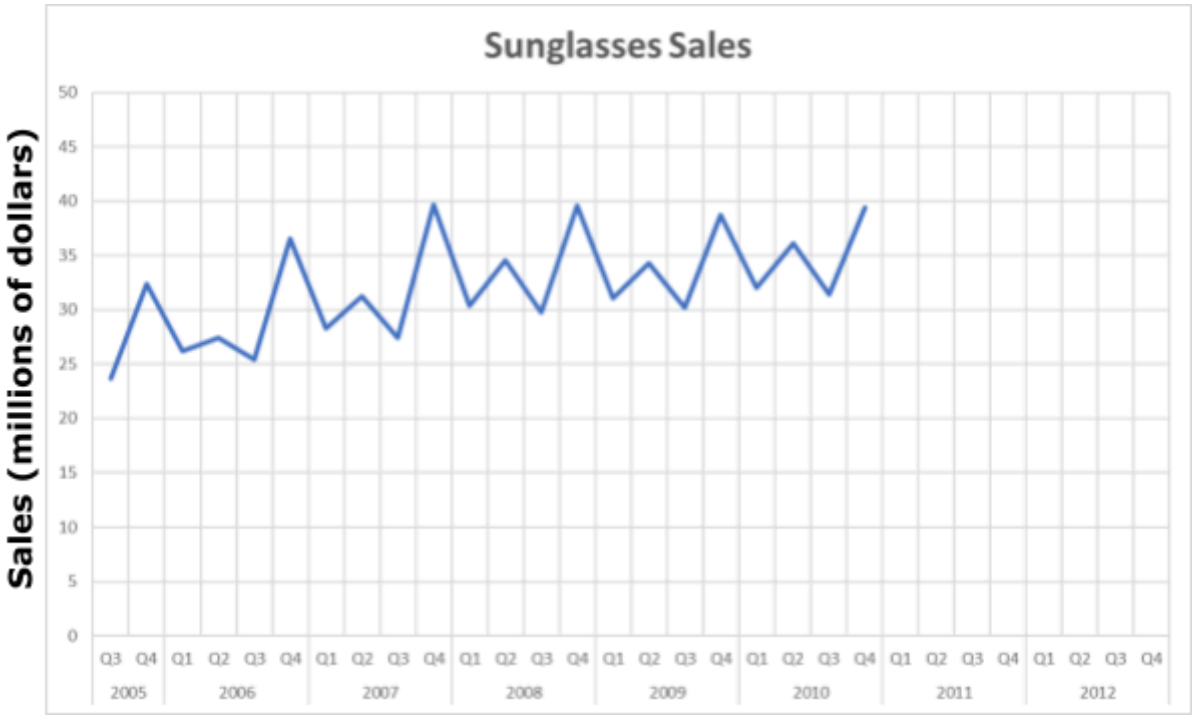
b)


Money earnt by the Chemist
Chemist sales ($millions)
280
270
260
250
240
230
220
210
200
190
180
June
September
December
March
June
September
December
2014
2015
2016
2017
2018
2019
Time (Quarters)

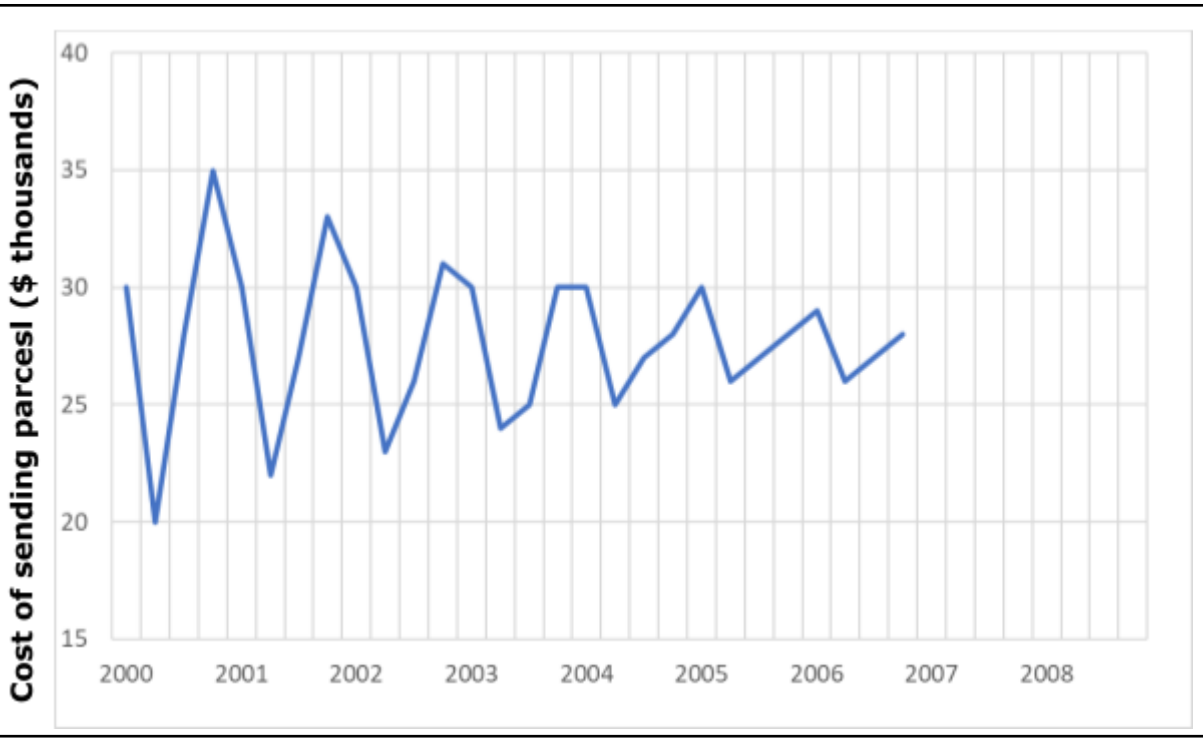
c)


Attendance for Term 1
Number of students ats
820
800
780
760
740
720
700
680
660
640
620
600
580
Monday
Tuesday
Wednesday
Thursday
Friday
1
2
3
4
5
6
7
8
9
10
11
12
Time (daily)

d)


Sunglasses Sales
Sales (millions of dollars)
50
45
40
35
30
25
20
15
10
5
0
Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4
2005 2006 2007 2008 2009 2010 2011 2012

e)


Cost of sending parcesl ($ thousands)
40
35
30
25
20
15
2000 2001 2002 2003 2004 2005 2006 2007 2008

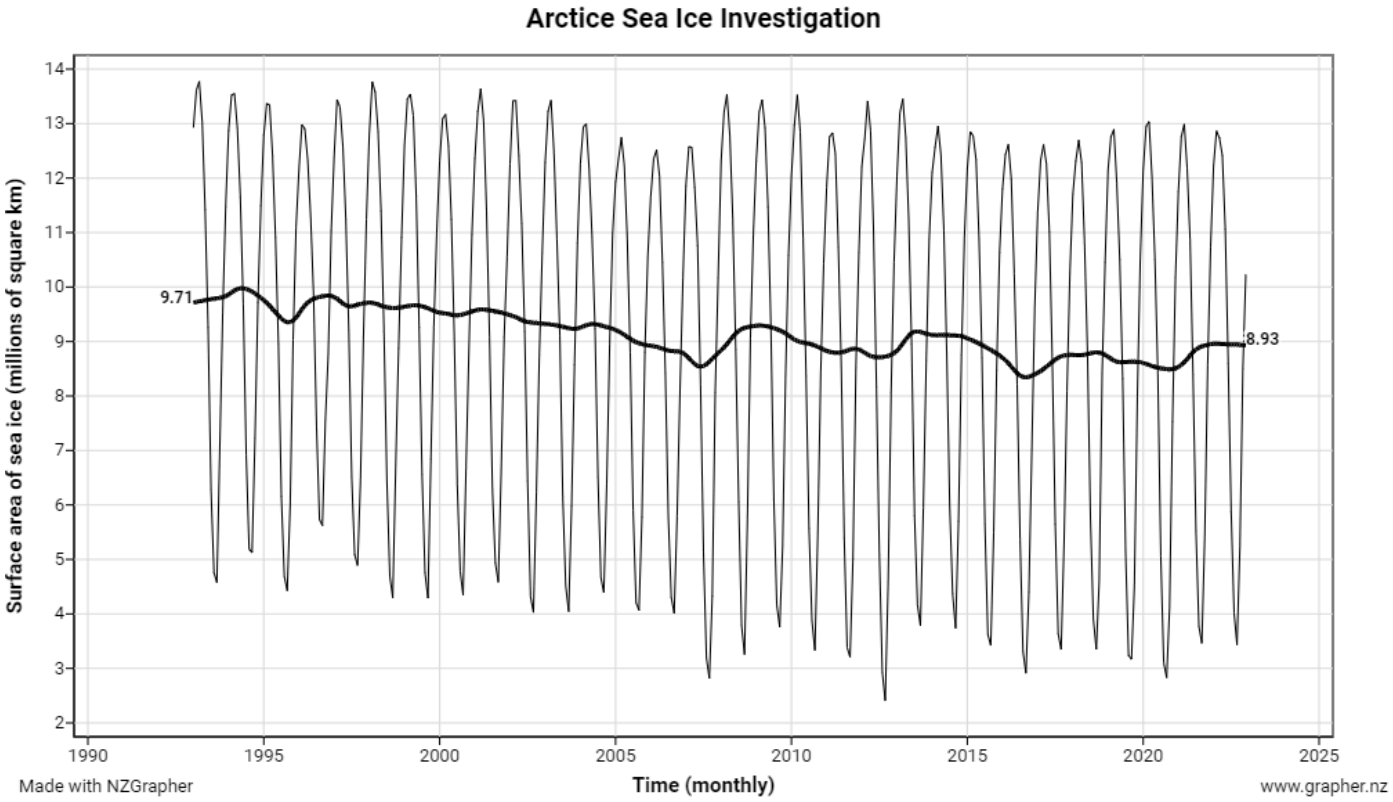
Linking findings to Purpose

Example:

Purpose:

I was interested in exploring data on the surface area of sea ice in the Arctic as I am concerned about the effect of climate change on the temperature of the oceans and whether we can see effects of a change in the amount of sea ice over time.

Findings:



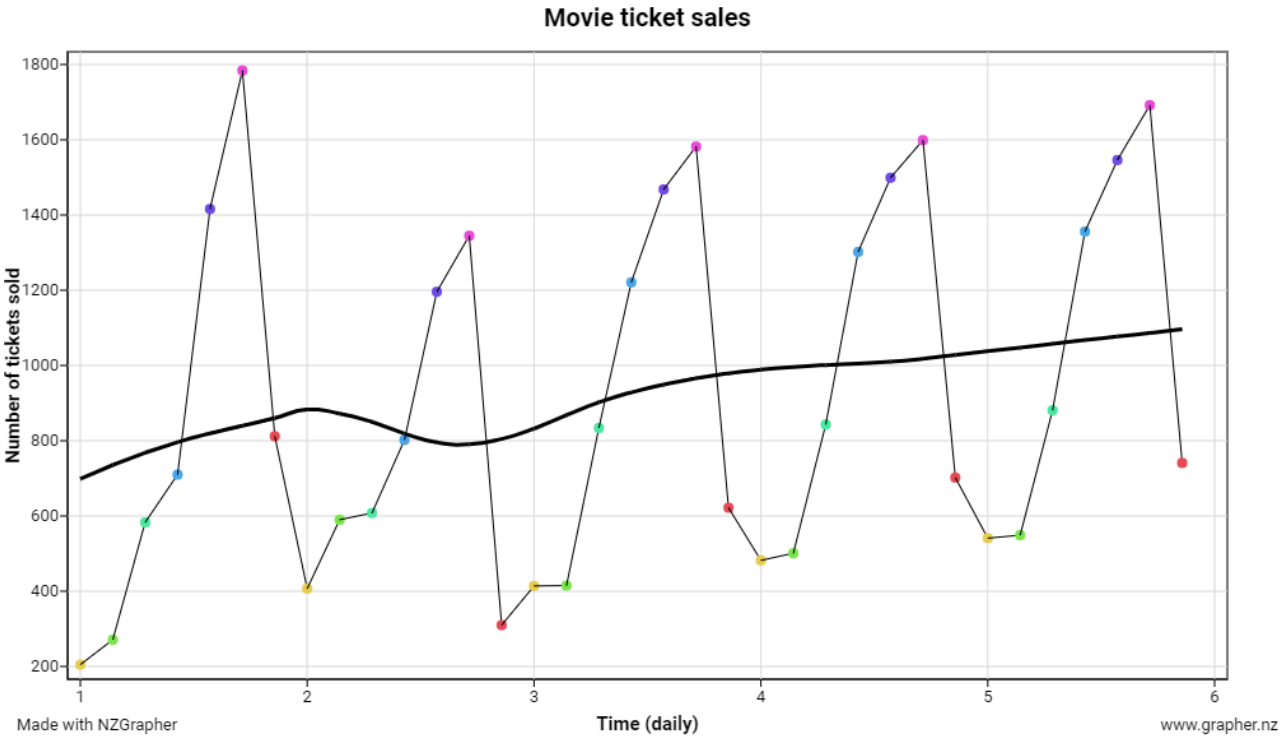
Conclusion:

My investigation into the surface area of sea ice in the Arctic found that there is a slow decreasing trend, with a consistent seasonal pattern. This is useful information for anyone interested in the effect of climate change in our oceans, as we expect that if the surface area is decreasing, this will likely to be having an effect on the size and number of icebergs, the environment that sea animals live in, and the whole ecosystem.

Exercise 13:

For each of the questions below, connect the results to the given purpose.

1) **Movie ticket dataset**

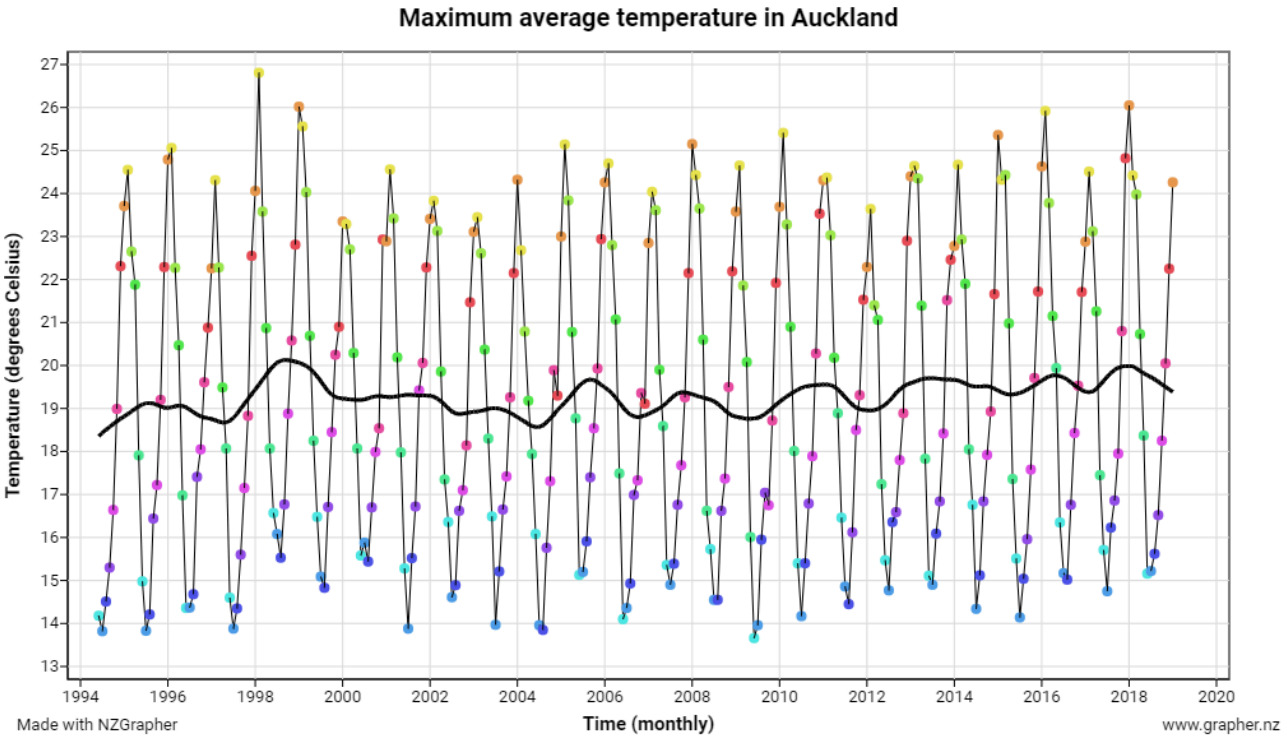


Purpose:

The owners and managers of the Movietime cinema are interested in investigating the patterns in the number of movie tickets sold daily because this affects their business, profit and gives feedback on how well they are doing.

Conclusion:

2) **Temperature dataset**

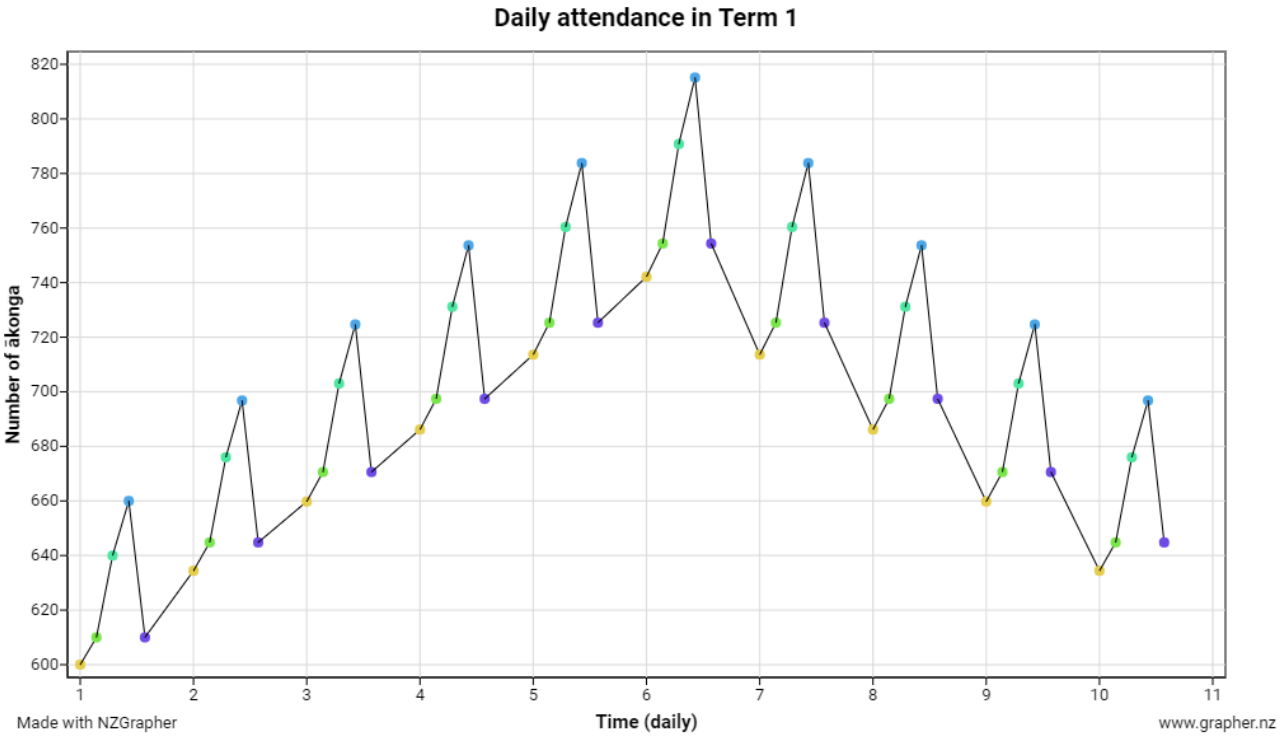


Purpose:

Meteorologists and people involved in climate change will be interested in tracking the average maximum monthly temperature in Auckland over time, because they are interested in seeing if there have been any significant changes over time, as this may show the effect of any changes in weather patterns or climate change.

Conclusion:

4) **Attendance dataset**



Purpose:

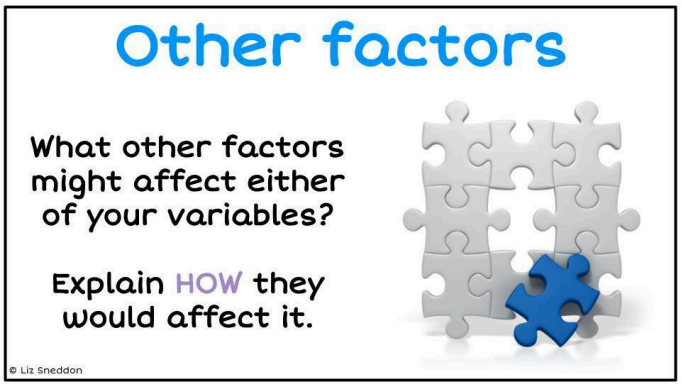
The principal and board of trustees are interested in tracking the attendance of ākonga over the term as they are aware of the effects of attendance on students being successful in NCEA and want to make sure that their support systems are working well and effectively.

Conclusion:

Other factors

For Excellence, the last thing you need to do is to reflect back on your investigation and show statistical and contextual insight. There are a number of ways that you can do this, for example, considering other variables / factors, reflecting on the process, carrying out more in-depth analysis, etc.

One way is to discuss in depth other factors or variables that may affect the variable you have investigated. You need to explain **how** this other factor or variable would affect the patterns and features you have identified in depth.



Example:

Dataset: TS-Sea Ice – Updated 2023

The data is the surface area of sea ice in millions of square kilometres.

The data is sourced from the National Snow and Ice Data Centre.

Variable	Description
Time	Monthly
Arctic	Million Square Kilometres of Ice in Arctic

Other factors / variables:

The Arctic is a very complex ecosystem and region, and there are a multitude of factors that affect the area of sea ice. For example, the temperature of both the area and sea play a role. If there are significant warm weather systems that flow over Arctic, then this would reduce the area of sea ice, as warmer weather will cause the ice to melt. However, in order to have a regular effect, these warm weather systems would need to be occurring regularly over many years.

Another factor could be the atmosphere, in terms of the locations and sizes of any ozone holes. These ozone holes would be allowing more heat and UV rays through, which in turn is likely to increase the temperature of the sea ice.

A third factor could be whether the ocean has been very calm or very rough. If the ocean is very rough, then it is much harder for sea ice to form into sheets. Whereas if

the ocean is mostly calm, then sheets of sea ice are much easier to form, increasing the area of sea ice.

There are many other factors that I have not discussed that also are likely to play a role in the area of sea ice over time.

Exercise 14:

Identify other factors that may affect the datasets you have investigated and explain in depth how these factors would affect the variable we selected.

1) **Penguin Dataset**

Data on the number of penguins at the Phillip Island Penguin Parade in Australia has been collected.

The data covers the time period from January 2000 until December 2006.

Variable	Description
Month	Monthly
Penguins	The number of penguins in the colony.

2) **Births and deaths dataset**

Data on the number of births and deaths in New Zealand. The data is sourced from Statistics New Zealand.

The data covers the time period from Quarter 1, 2000 until Quarter 4, 2012

Variable	Description
Quarter	Quarterly
Male live births	Number of males born during the quarter.

3) **Forestry dataset**

Data on the volume of wood removed from Natural forests in New Zealand. The data is sourced from the Ministry for Primary Industries.

The data covers the time period from Quarter 1, 2000 until Quarter 3, 2013.

Variable	Description
Quarter	Quarterly
Plantation Forests	The volume of wood removed from Plantation Forests in millions of m^3