Year 10 Relationships & Timeseries Workbook

Answers

By Liz Sneddon

Exercise 1:

1)	a)	Time played (minutes), Points scored
	b)	10
	c)	20
	d)	Looking at the players who spend only a **short** time on the court, the points they score are **low.**
	e)	Looking at the players who spend only a **lot of** time on the court, the points they score are **high.**
2)	a)	Rainfall (mm), Umbrellas sold
	b)	30
	c)	116mm
	d)	Looking at days with a **small** amount of rainfall, the number of umbrellas sold are **low.**
	e)	Looking at days with a **high** amount of rainfall, the number of umbrellas sold are **high.**
3)	a)	Carat (grams), Price
	b)	3
	c)	6
	d)	Looking at diamonds that are **small (low carat)**, the prices are **low.**
	e)	Looking at diamonds that are **large (big carat)**, the prices are **high.**
4)	a)	Engine size (Litres), Miles per gallon
	b)	3
	c)	Smallest engine = around 1.2 Litres Largest engine = around 5.7 Litres
	d)	Looking at cars with **small** engine sizes, the fuel efficiency (miles per gallon) is **high.**
	e)	Looking at cars with **big** engines, the fuel efficiency (miles per gallon) is **low.**
5)	a)	Age (years), Price ($)
	b)	13
	c)	4
	d)	Looking at secondhand cars which are **relatively new (age is small)**, the price of cars is **high.**
	e)	Looking at secondhand cars which are **older**, the price of cars is **low.**

Exercise 2:

1)

Explanatory Variable	Amount of sunlight that a plant gets
Response Variable	Height of the plant
Explanation why.	We can control how much sunlight a plant gets, but not the height of the plant. The height of the plant is what we measure.

2)

Explanatory Variable	The age of a person
Response Variable	Shoe size
Explanation why.	We measure the size of peoples shoe, and we expect younger people to have smaller shoes and older people to have larger shoes.

3)

Explanatory Variable	The height of the roller-coaster
Response Variable	The speed of the roller-coaster
Explanation why.	The height of the roller-coaster explains the speed – we can control the height of the roller-coaster and then measure the speed.

4)

Explanatory Variable	The distance to a location
Response Variable	The time it takes to drive there.
Explanation why.	The time it takes to drive depends on the distance away a location is. The further the distance, the longer the time.

5)

Explanatory Variable	The weight of the object.
Response Variable	The speed an object falls at when it is dropped.
Explanation why.	We control the weight of the object and measure the speed the object falls at.

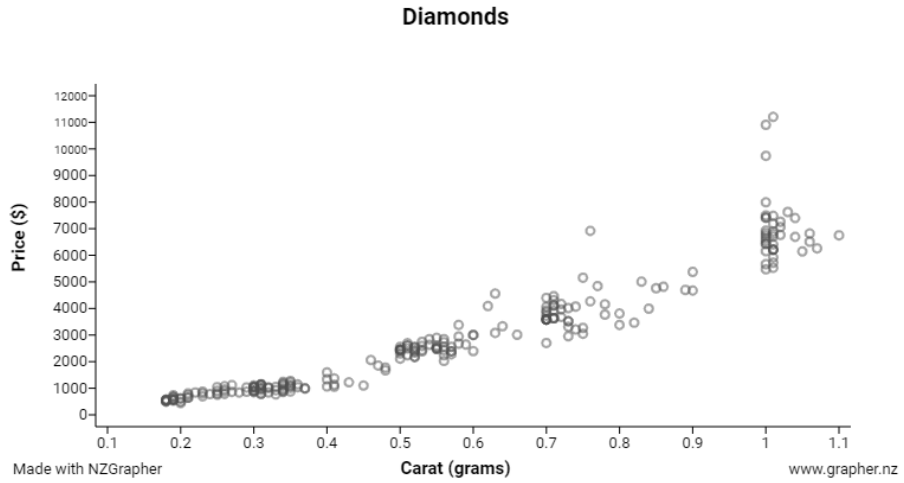
6)

Explanatory Variable	The daily temperature.
Response Variable	The number of ice-cream cones sold.
Explanation why.	As the temperature changes the number of ice-cream cones sold increases or decreases.

Exercise 3:

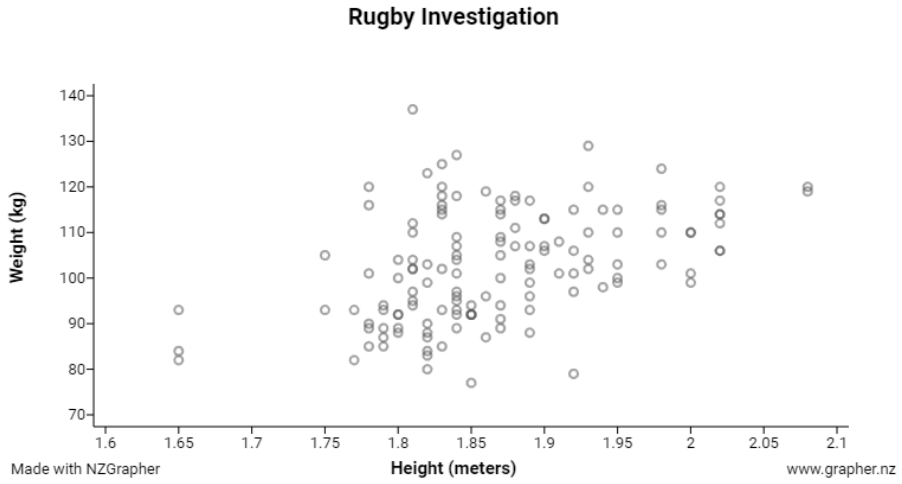
1)

Explanatory Variable	Carat
Response Variable	Price



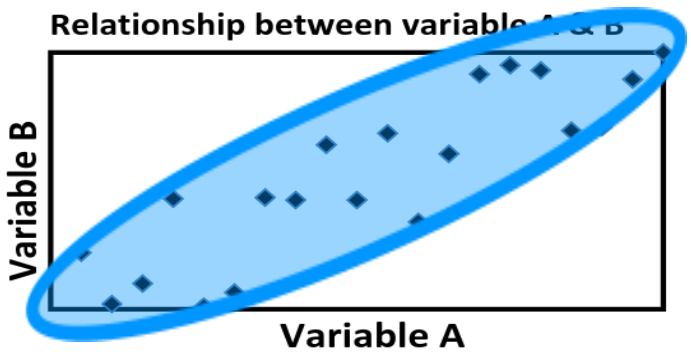
2)

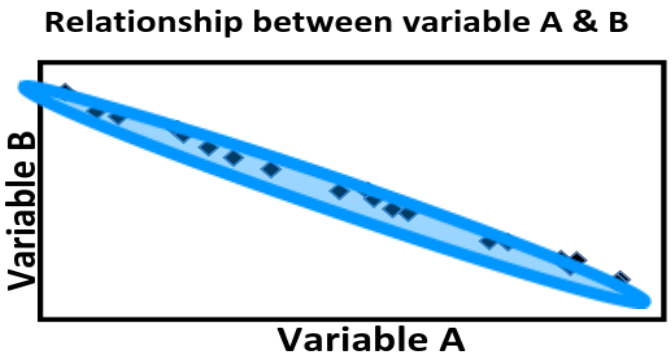
Explanatory Variable	Height
Response Variable	Weight



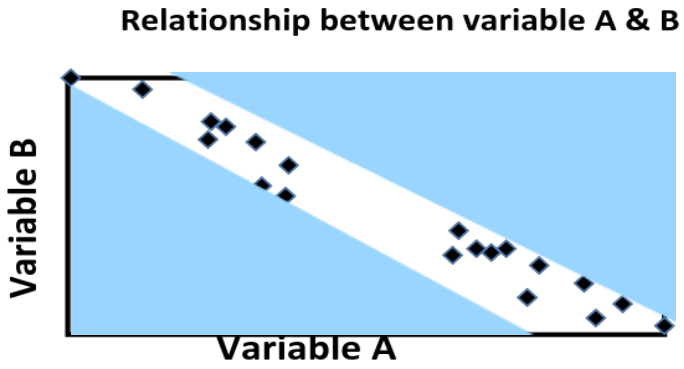
Exercise 4:

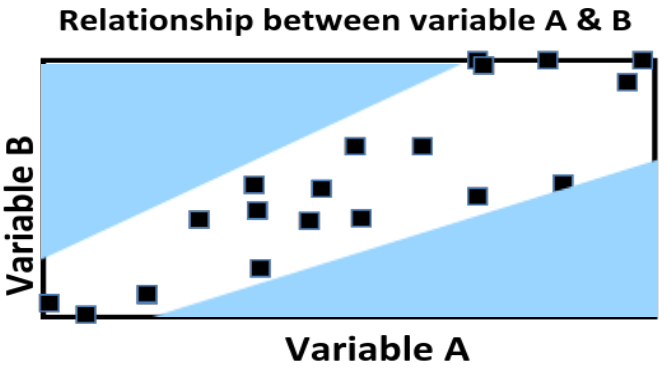
1)





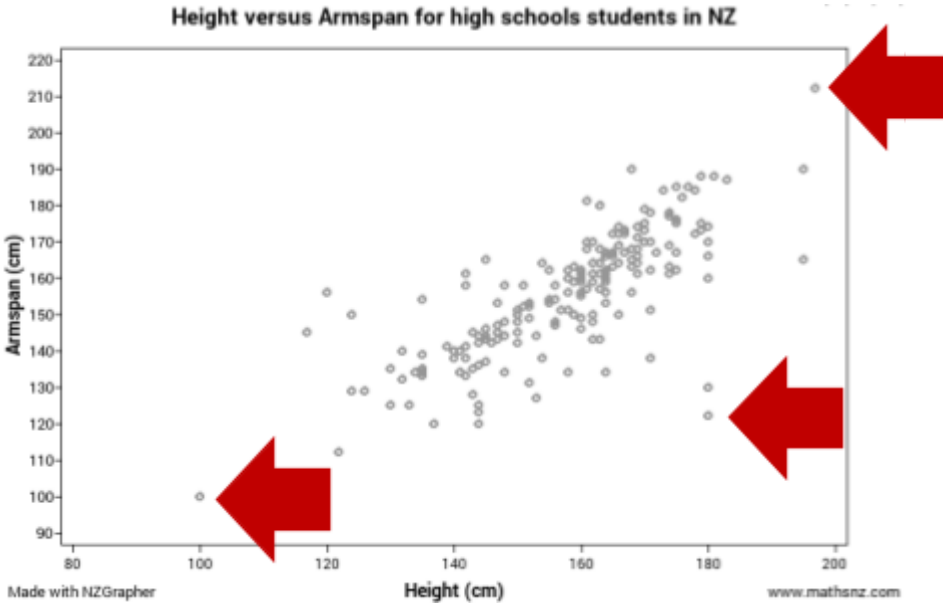
2) Shaded **OUT**





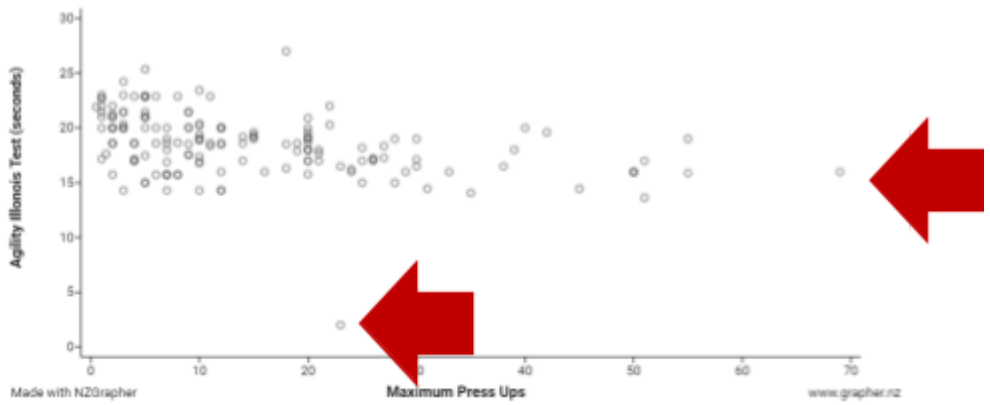
Exercise 5:

1)



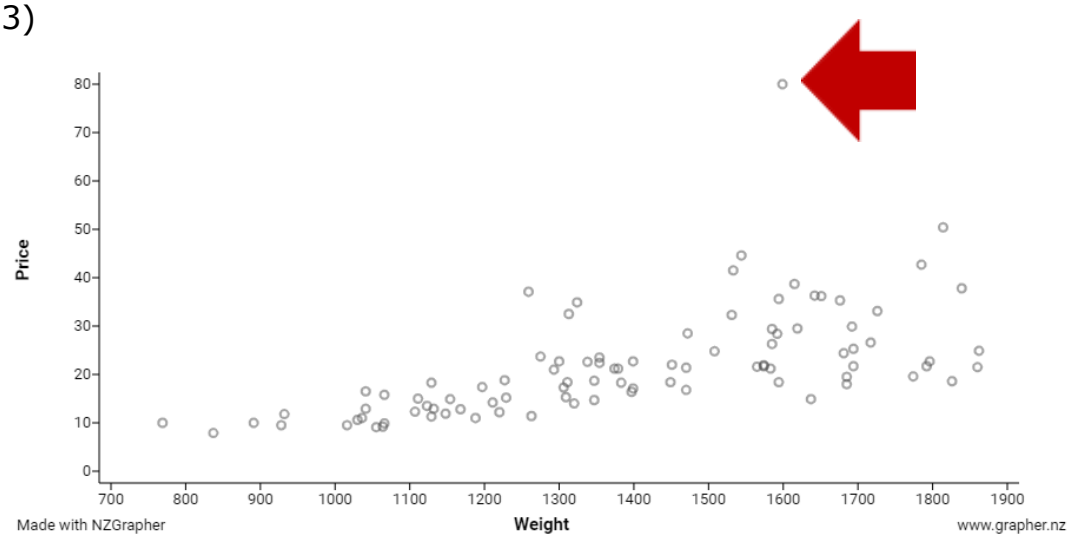
There are a few possible outliers, points that are a long way away from the trend. One is a person who has a height of 100cm and an armspan of 100cm. Another is a person who is very tall, around 180cm, but whose armspan is only around 120cm. A third point is a person who is extremely tall, around 200cm, with an armspan of 210cm.

2)



There are two possible outliers in this graph, a student who could do a maximum of around 23 press ups, with an agility illonois test result of only 2 seconds. The second outlier is a student who could do a maximum of around 70 press ups, and an agility illonois test time of around 16 seconds.

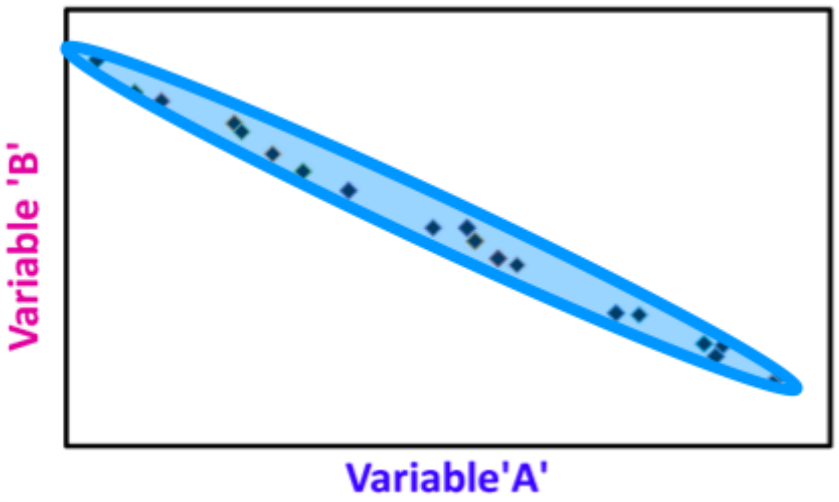
3)



There is one possible outlier, an object with a weight of 1600 units and a price of around 80 units.

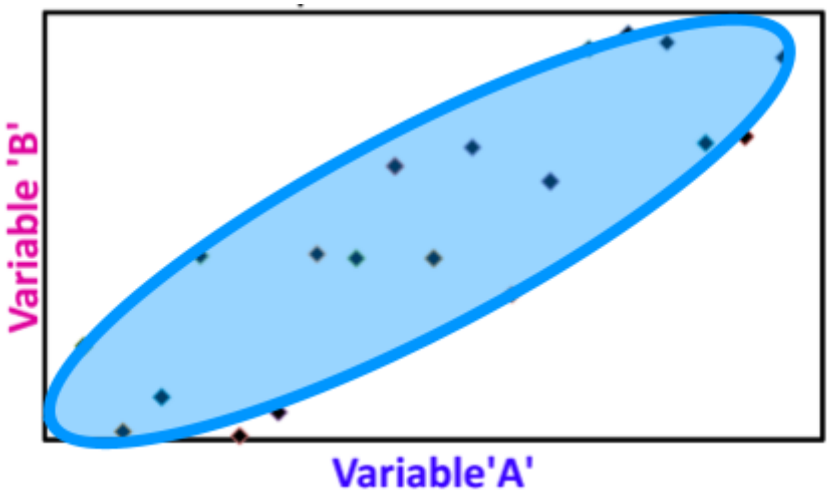
Exercise 6:

1)



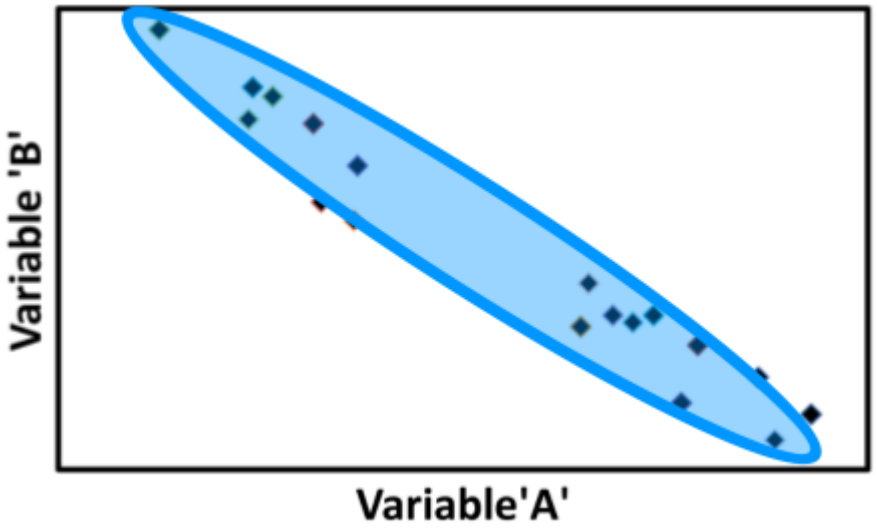
a)	Is there a relationship?	Yes
b)	Identify the trend	Linear
c)	Identify the direction	Negative
d)	Identify the strength	Strong
e)	Identify any outliers. Circle any outliers on the graph.	No

2)



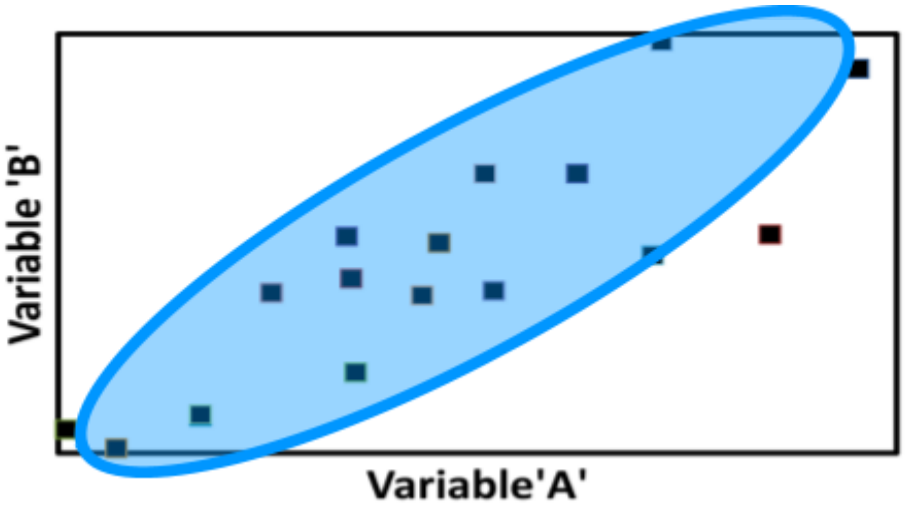
a)	Is there a relationship?	Yes
b)	Identify the trend	Linear
c)	Identify the direction	Positive
d)	Identify the strength	Moderate
e)	Identify any outliers. Circle any outliers on the graph.	No

3)



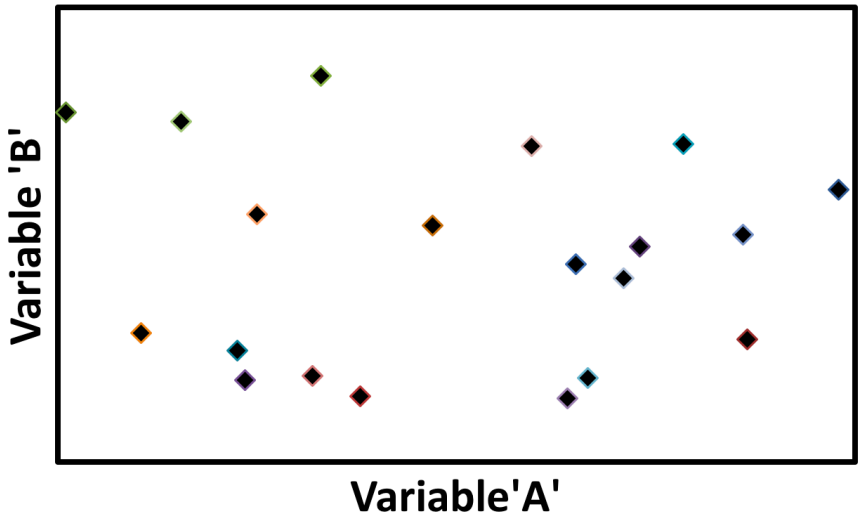
a)	Is there a relationship?	Yes
b)	Identify the trend	Linear
c)	Identify the direction	Negative
d)	Identify the strength	Strong
e)	Identify any outliers. Circle any outliers on the graph.	No

4)



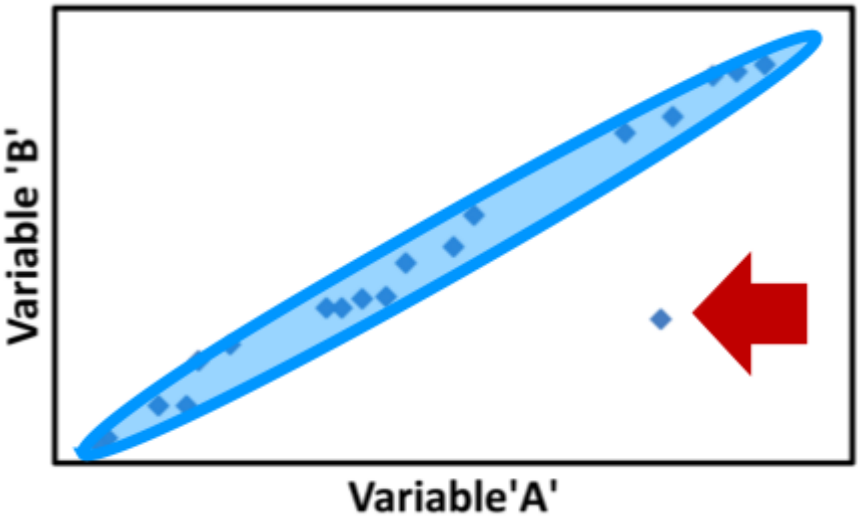
a)	Is there a relationship?	Yes
b)	Identify the trend	Linear
c)	Identify the direction	Positive
d)	Identify the strength	Moderate
e)	Identify any outliers. Circle any outliers on the graph.	No

5)



a)	Is there a relationship?	No
b)	Identify the trend	Linear / Non-linear
c)	Identify the direction	Positive / Negative
d)	Identify the strength	Strong / Moderate / Weak
e)	Identify any outliers. Circle any outliers on the graph.	Yes / No

6)

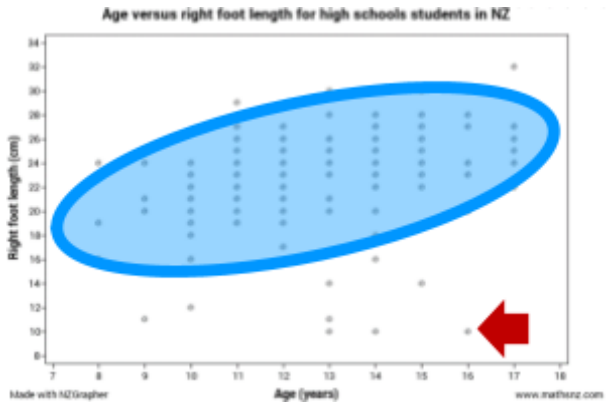


a)	Is there a relationship?	Yes
b)	Identify the trend	Linear
c)	Identify the direction	Positive

d)	Identify the strength	Strong
e)	Identify any outliers. Circle any outliers on the graph.	Yes

Exercise 7:

1)



There is a weak, linear, positive relationship between the age and right foot length of high school students in NZ.

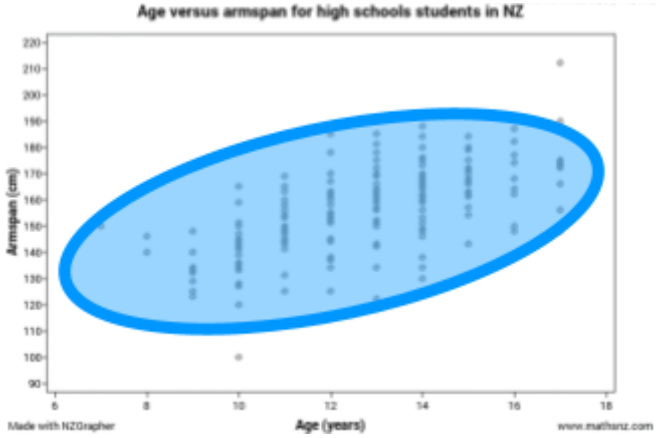
The relationship is weak because there is a lot of scatter between the data points.

The relationship is linear because there is a steady increase in the right foot length as the age increases.

The relationship is positive because as the age increases, the right foot length increases.

There is an outlier, a student who is 16 years old with a right foot length of around 10cm (which is very small for a student this age).

2)



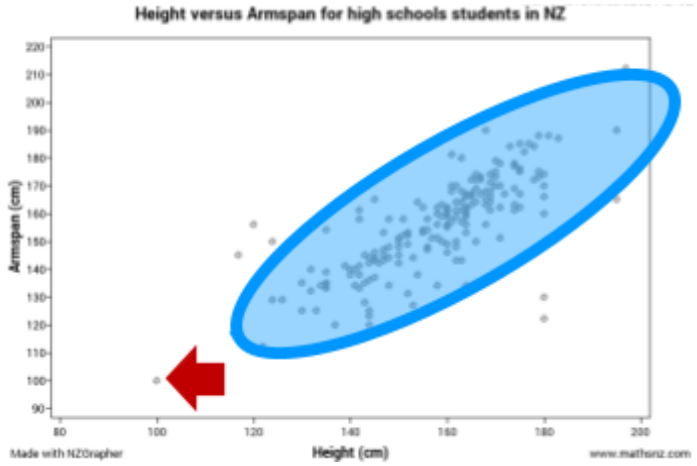
There is a moderate, linear, positive relationship between age and armspan of high school students in NZ.

The relationship is a moderate one and the trend is positive because the values are increasing, as age increases so does their arm span.

It is a linear relationship because the relationship increases steadily at a constant rate.

The strength is moderate-weak because the data points are very scattered.

3)



There is a moderate to strong, linear, positive relationship between height and armspan for high school students in NZ.

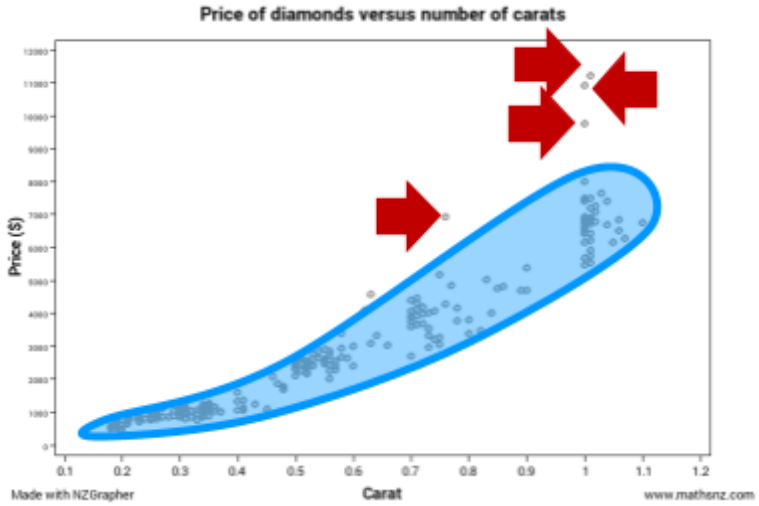
The relationship is moderate to strong because we can see the data points are moderately scattered.

It is linear because as the height increases the armspan increases as a steady rate.

The relationship is positive because as the height increases so does arm span.

There is an outlier, a student who is 100cm tall and with an armspan of around 100cm.

4)



There is a moderate, curved, positive relationship between the number of carats and the price for diamonds.

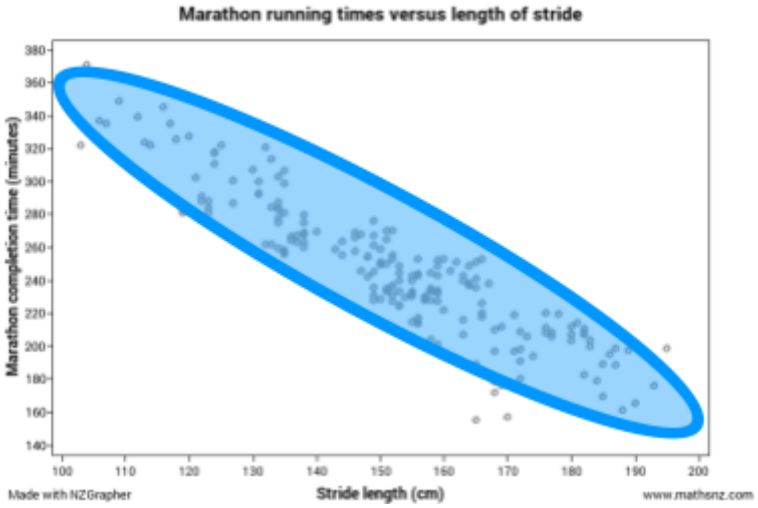
The relationship is a moderate one because the data points have a moderate amount of scatter. The relationship is strongest at the lower carats and fans out as carat increases.

The best model to fit is probably a curve which trends up as the number of carats increase. Because and curve would be the best model to fit it is a non-linear relationship.

It is a positive relationship because as the carat increases so does price.

There are 4 possible outliers. One is a diamond weighing around 0.76 grams and a high price of around $7000. The second is a diamond weighing around 1.05 grams with a price of around $$9500. The third is a diamond weighing around 1.05 grams with a price of around $10,500. The fourth is a diamond weighing around 1.06 grams with a high price of around $11,000.

5)



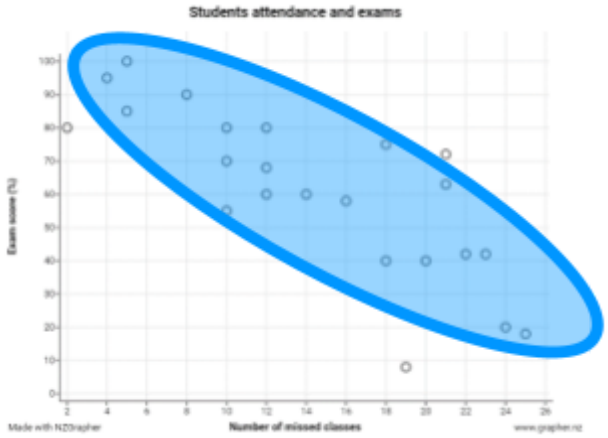
This is a moderate, negative linear relationship between the stride length and marathon completion time for marathon races in NZ.

It is linear because as the stride length increases, the time is going down at a constant rate.

It is negative because as Stride length increases the marathon completion time goes down.

It is a moderately strong relationship because the data points are quite close together.

6)



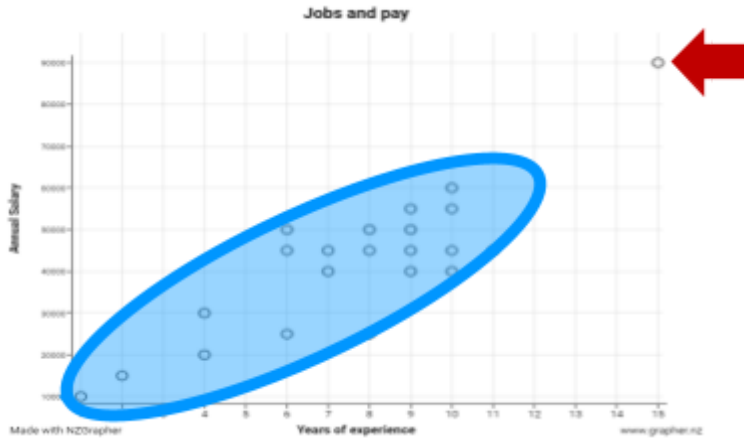
The relationship between the number of missed classes and the exam score is negative, linear and moderately strong.

The relationship is moderate because the data points are moderately scattered.

The relationship is linear because as the number of missed classes increases, the exam score drops at a steady rate.

The relationship is negative because as the number of missed classes increases, the exam score decreases.

7)



There is a linear, positive, and moderate relationship between the number of years of experience and the annual salary.

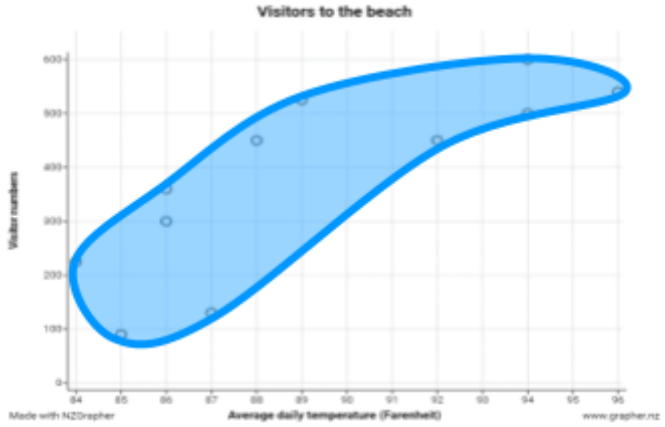
The relationship is moderate because the data points are moderately scattered.

The relationship is linear because as the number of years of experience increases, the annual salary increases as a steady rate.

The relationship is positive because as the number of years of experience increases, the annual salary increases.

There is an outlier, a person who has 15 years of experience, and an annual salary of $90,000.

8)



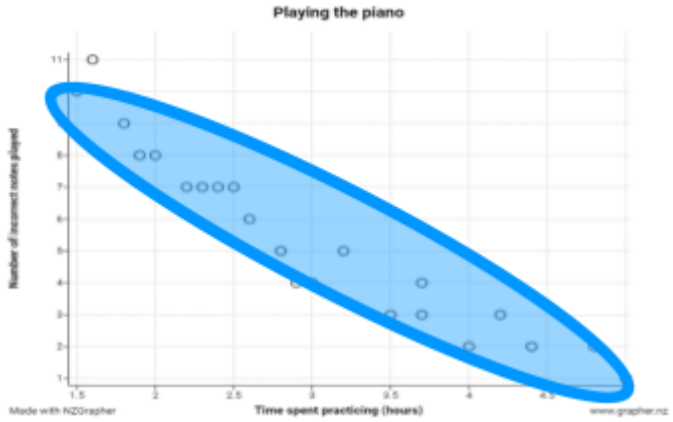
The relationship between the average daily temperature and the number of visitors is non-linear, positive and moderately strong.

The relationship is moderate because the data points are moderately scattered.

The relationship is non-linear because there is a curved relationship, as the average daily temperature increases, the visitor numbers change quickly with lower temperatures, and change more slowly with higher temperatures.

The relationship is positive because as the average daily temperature increases, the visitor numbers increases.

9)



The relationship between the time spent practicing and the number of incorrect notes played is a linear, negative and moderately strong.

The relationship is moderately strong because the data points are quite close together.

The relationship is linear because the slope is steady.

The relationship is negative because as the time spent practicing increases the number of incorrect notes played decreases.

Exercise 8:

1)	a)	
	b)	
	c)	
	d)	
	e)	
	f)	
2)	a)	
	b)	
	c)	
	d)	
	e)	
3)	a)	
	b)	
	c)	
	d)	
	e)	
	f)	

Exercise 9:

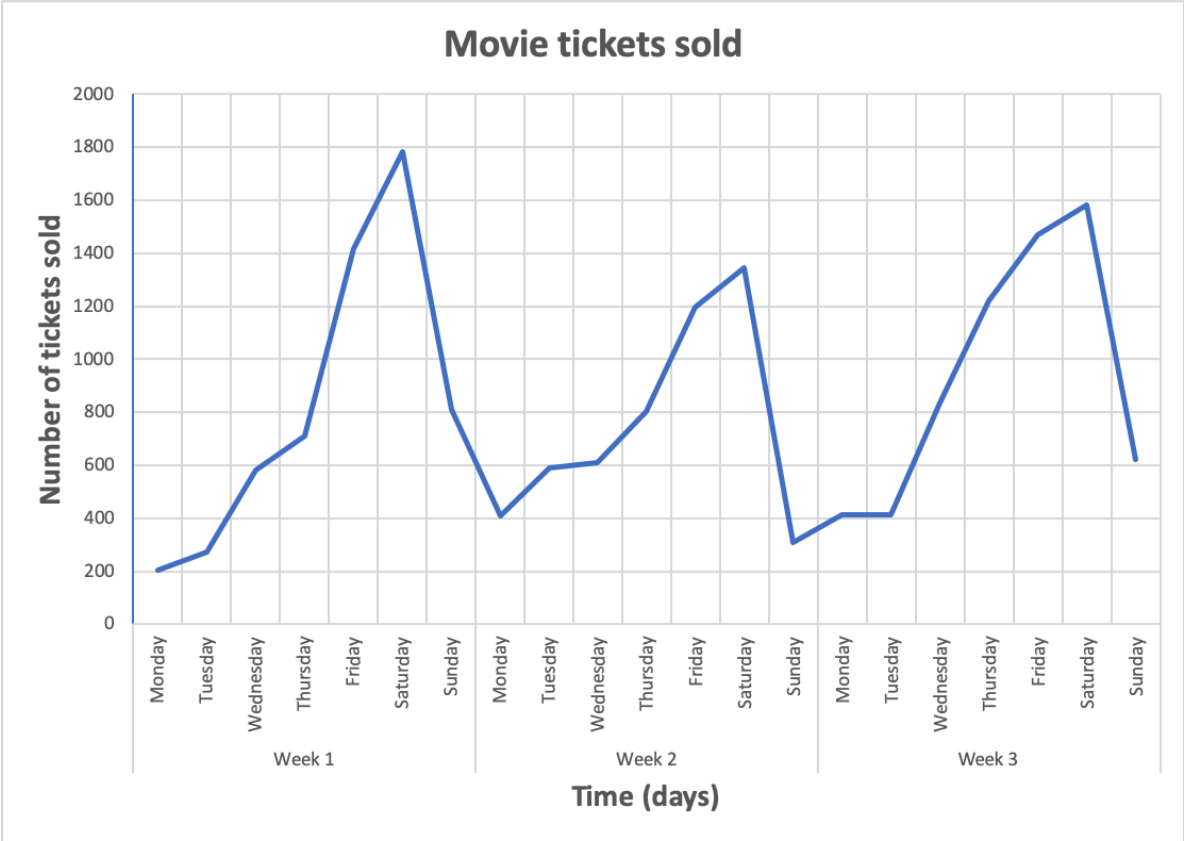
1)
2)
3)
4)
5)

Exercise 10:

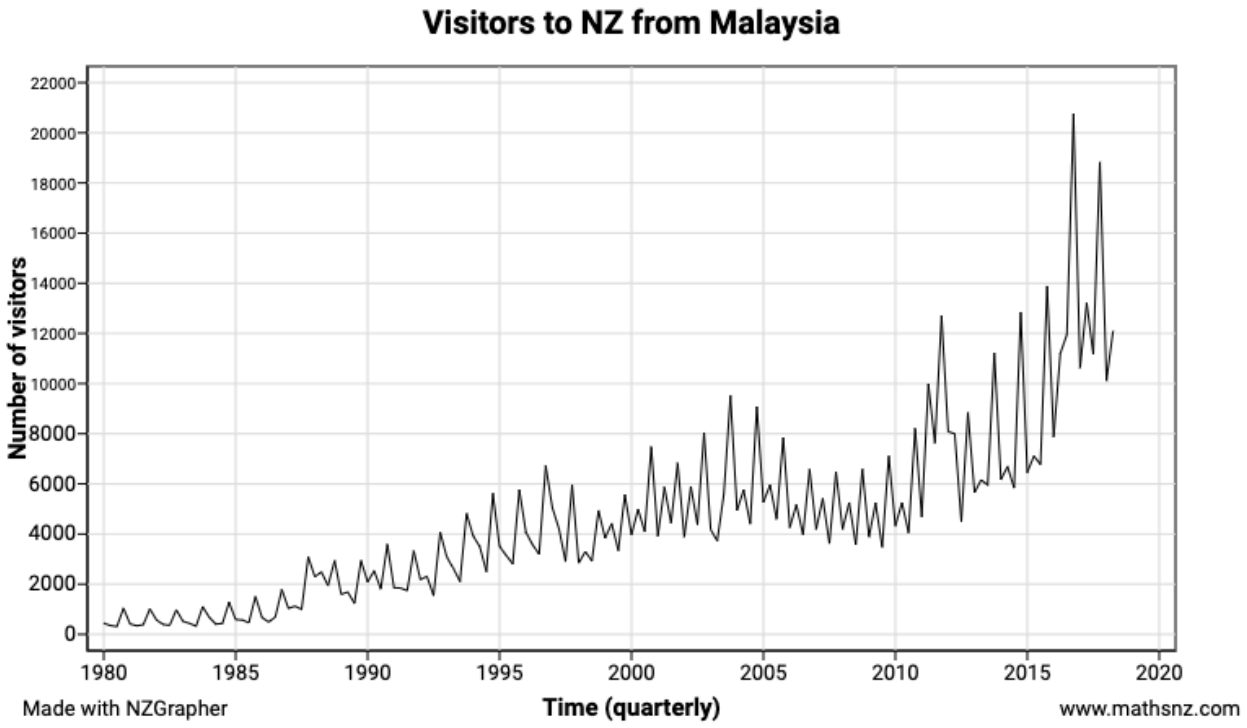
1)
2)

Exercise 11:

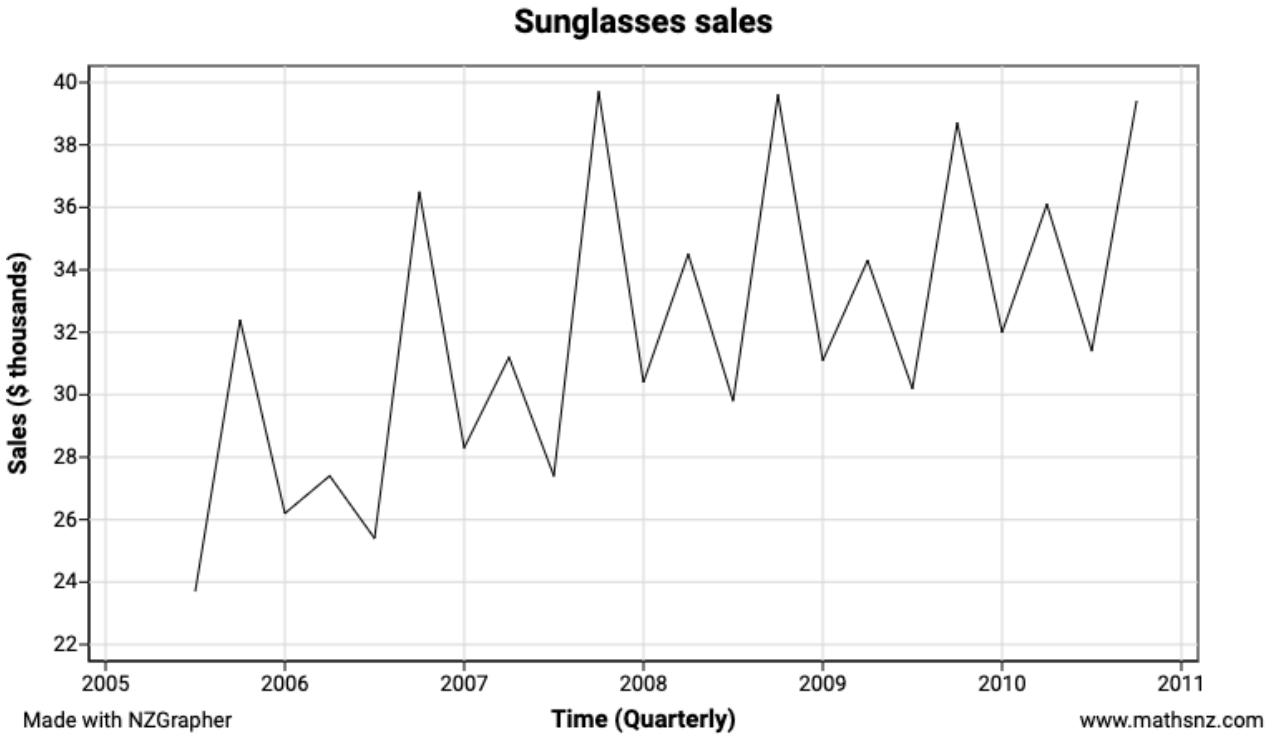
1)



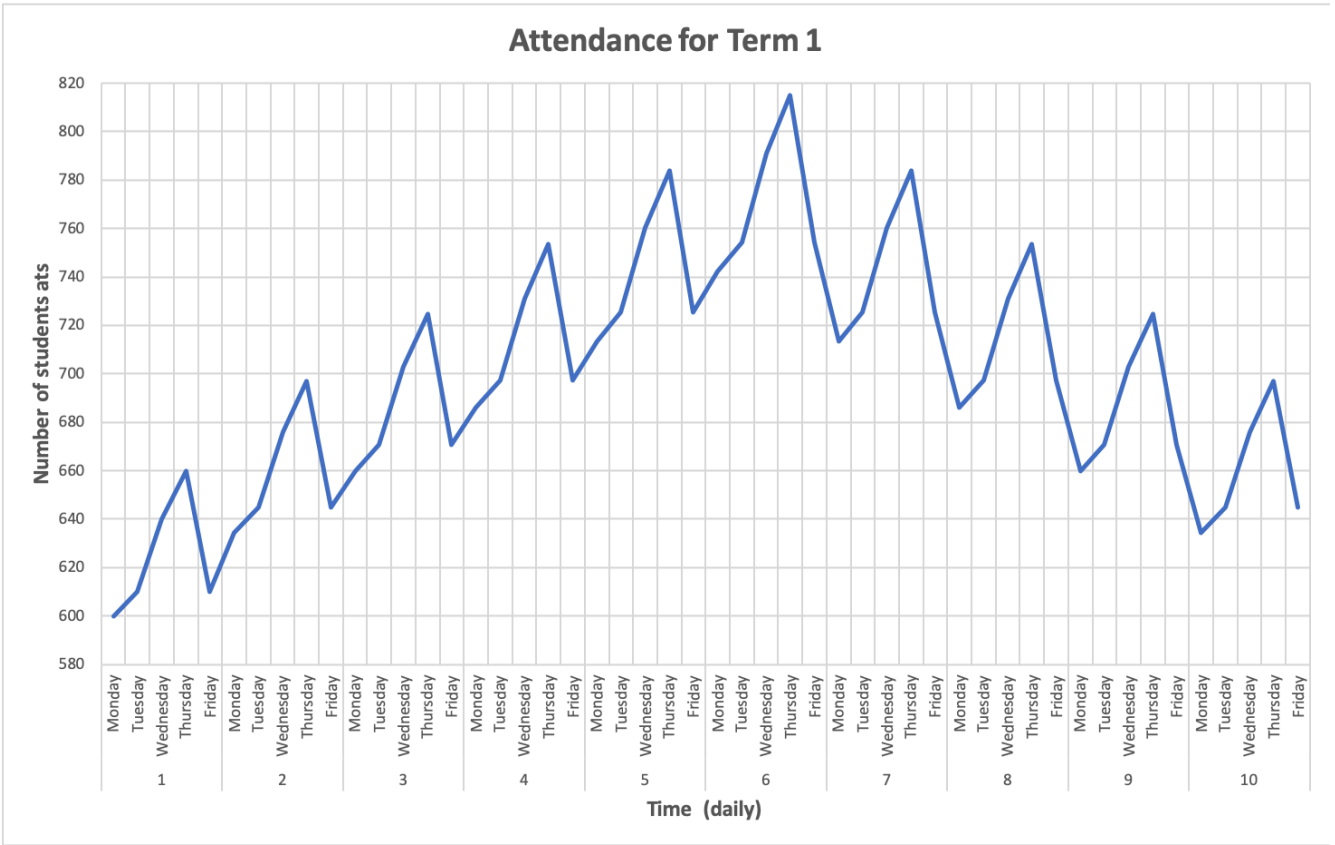
2)



3)

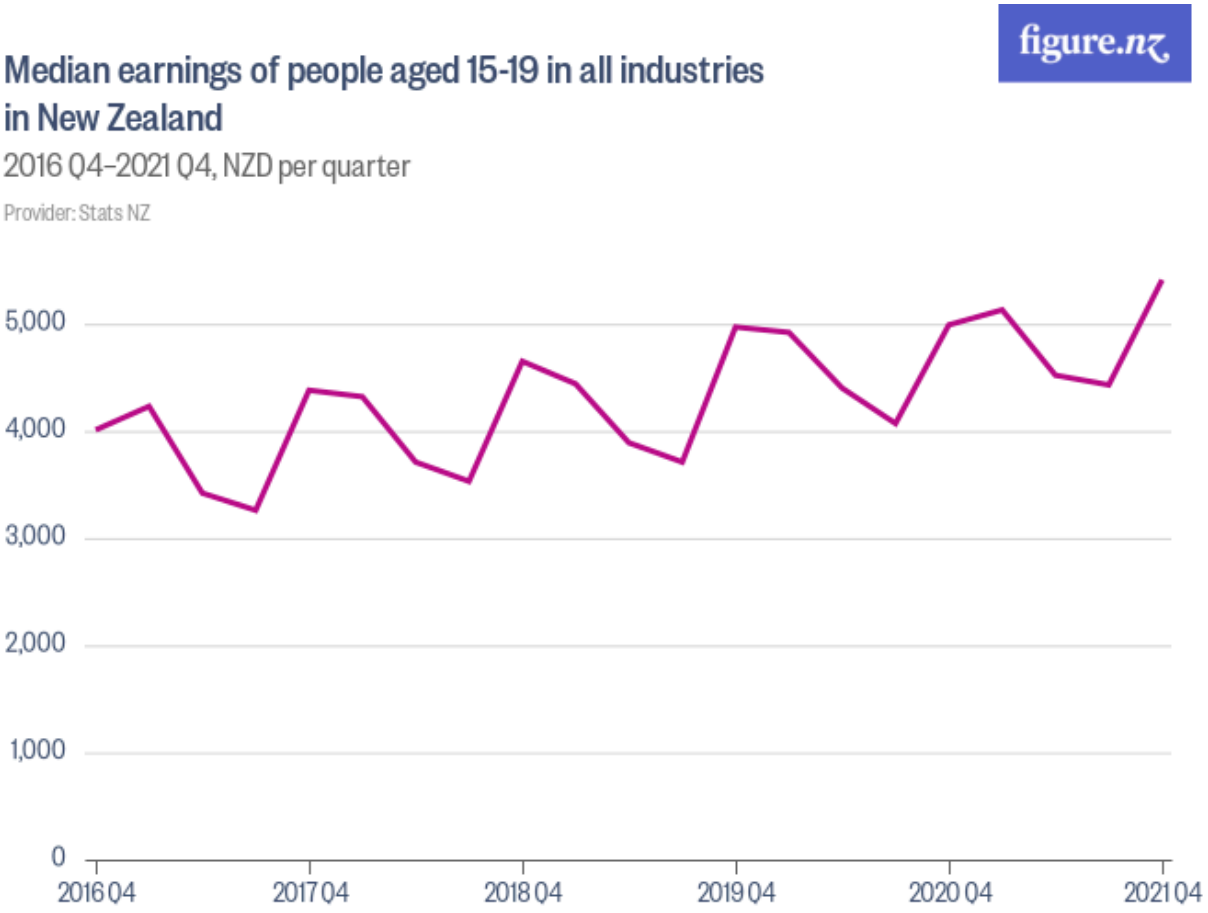

Sunglasses sales
Sales ($ thousands)
40
38
36
34
32
30
28
26
24
22
2005
2006
2007
2008
2009
2010
2011
Time (Quarterly)
Made with NZGrapher
www.mathsnz.com

4)


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
Time (daily)

Exercise 12:

1)



2)

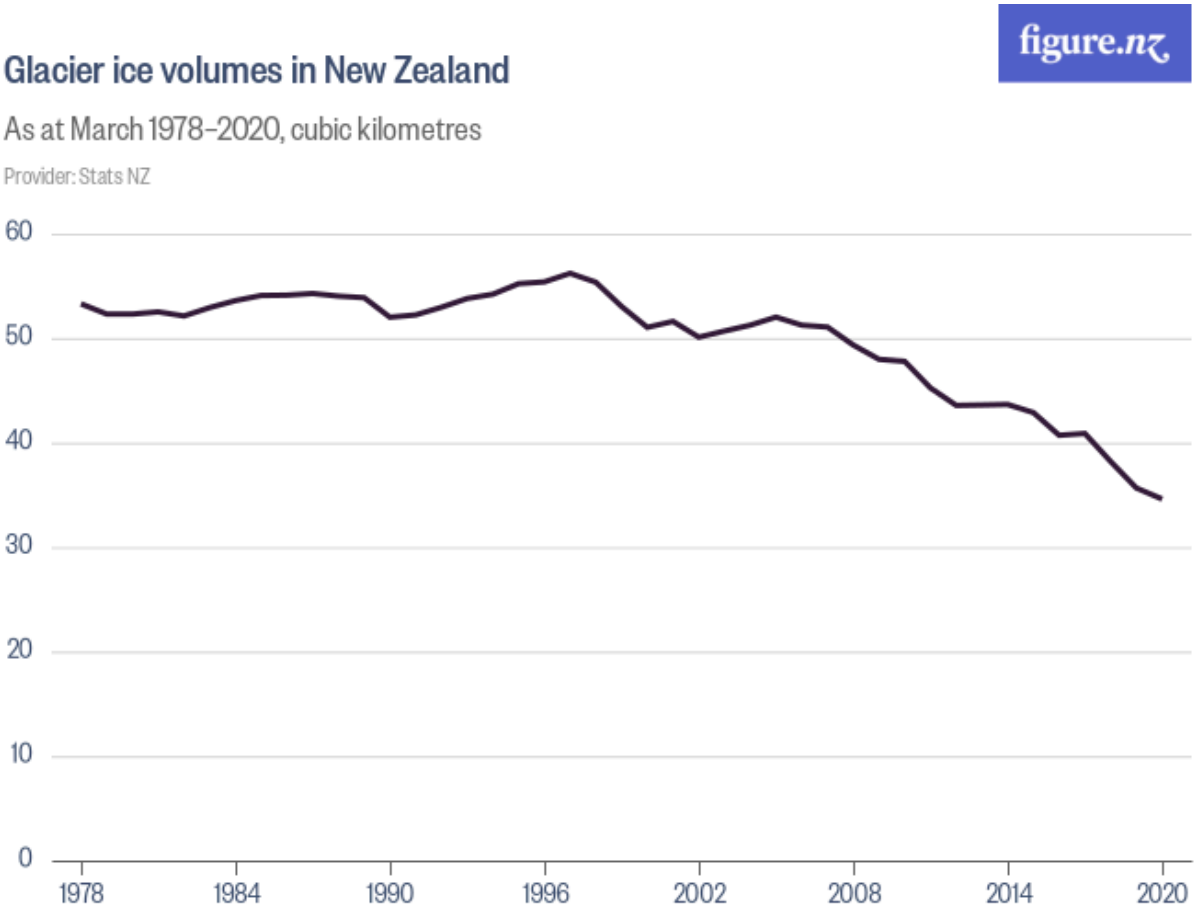


figure.nz
Glacier ice volumes in New Zealand
As at March 1978–2020, cubic kilometres
Provider: Stats NZ
60
50
40
30
20
10
0
1978
1984
1990
1996
2002
2008
2014
2020

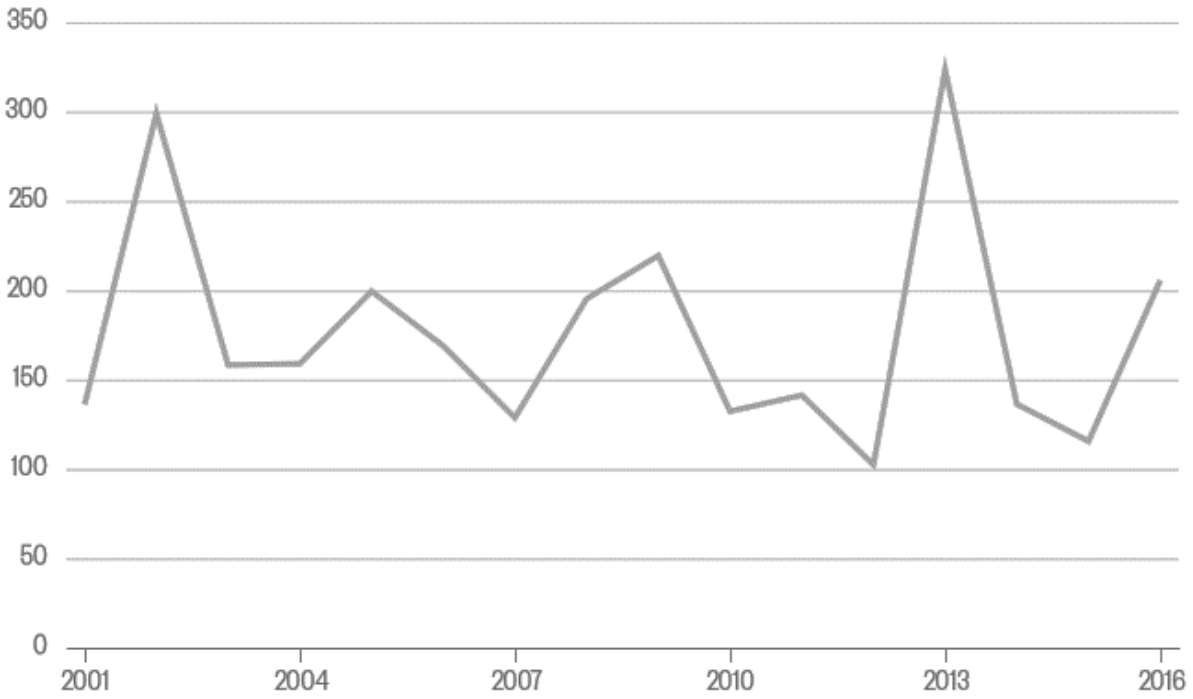
3)

figure.nz

Annual lightning strikes on New Zealand and surrounding waters

2001–2016, thousands

Provider: Ministry for the Environment



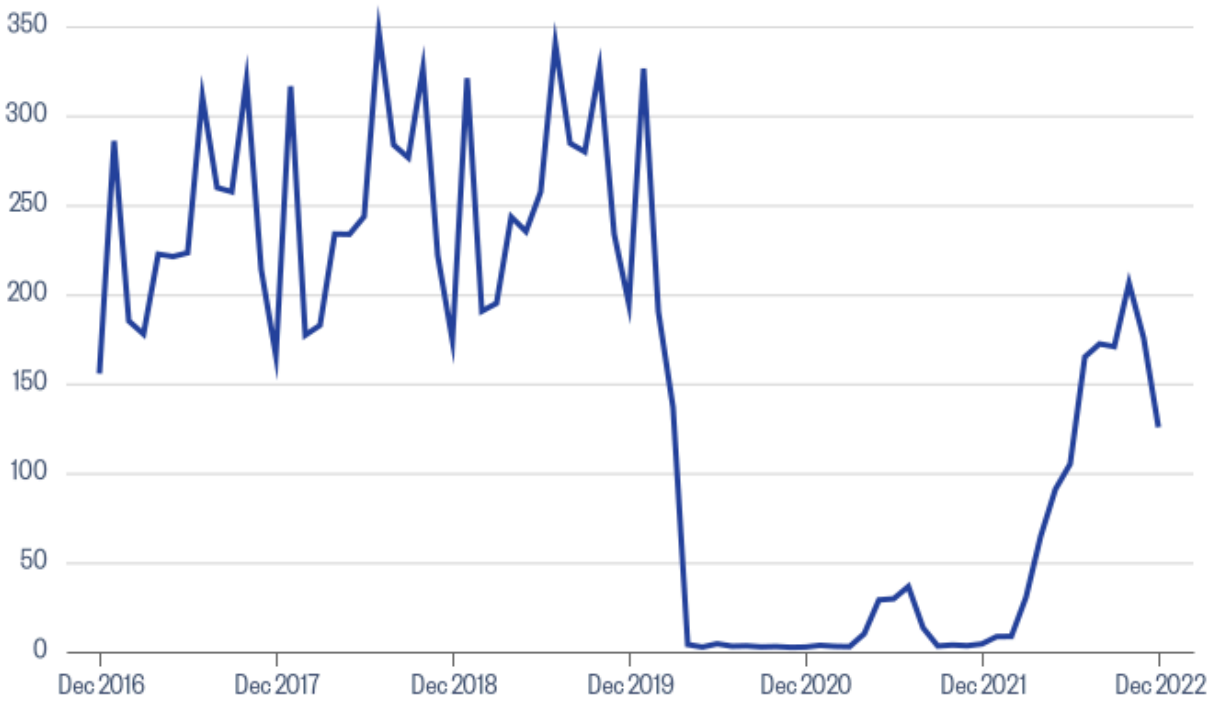
4)

figure.nz

Overseas trips taken by people living in New Zealand

Dec 2016–Dec 2022, thousands of arrivals from short-term trips

Provider: Stats NZ



5)

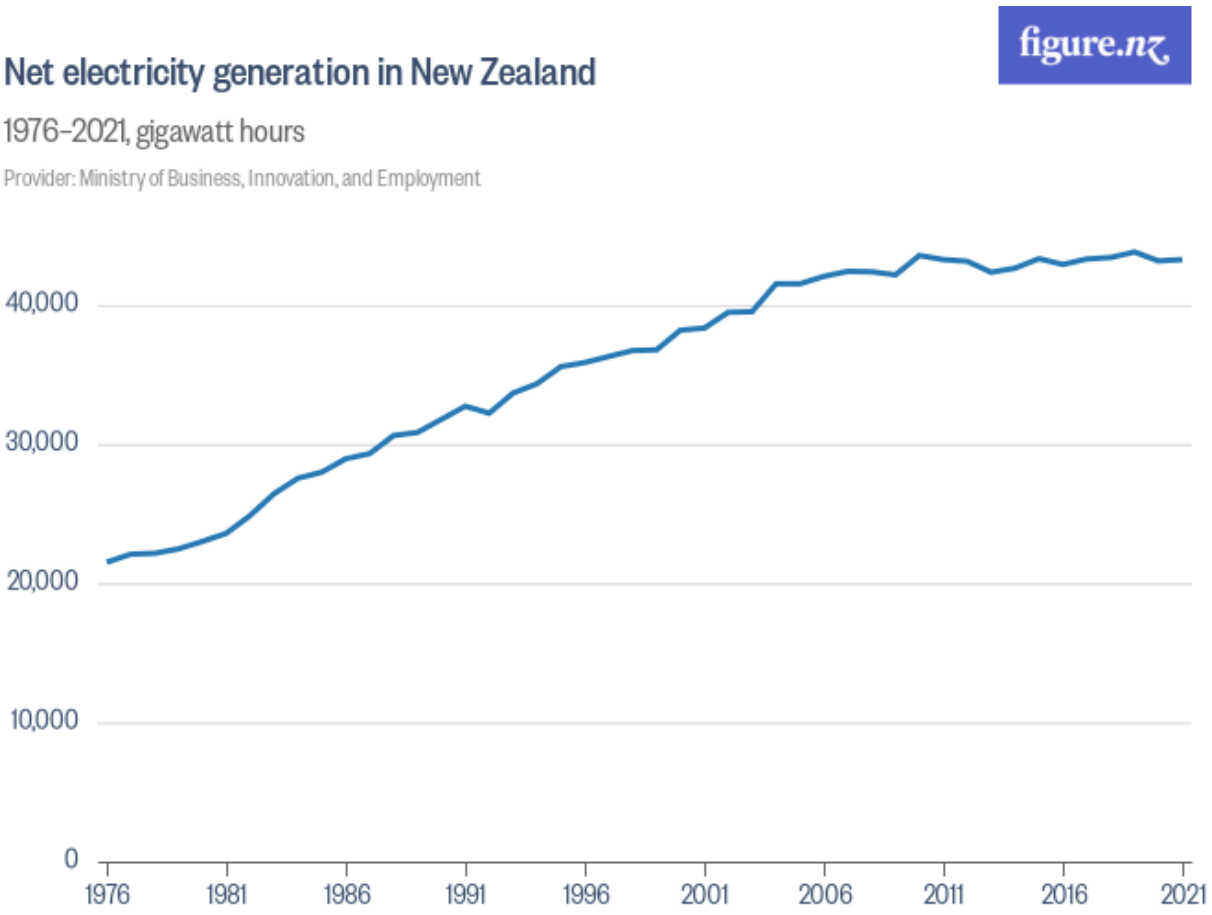


figure.nz
Net electricity generation in New Zealand
1976–2021, gigawatt hours
Provider: Ministry of Business, Innovation, and Employment
40,000
30,000
20,000
10,000
0
1976
1981
1986
1991
1996
2001
2006
2011
2016
2021

6)

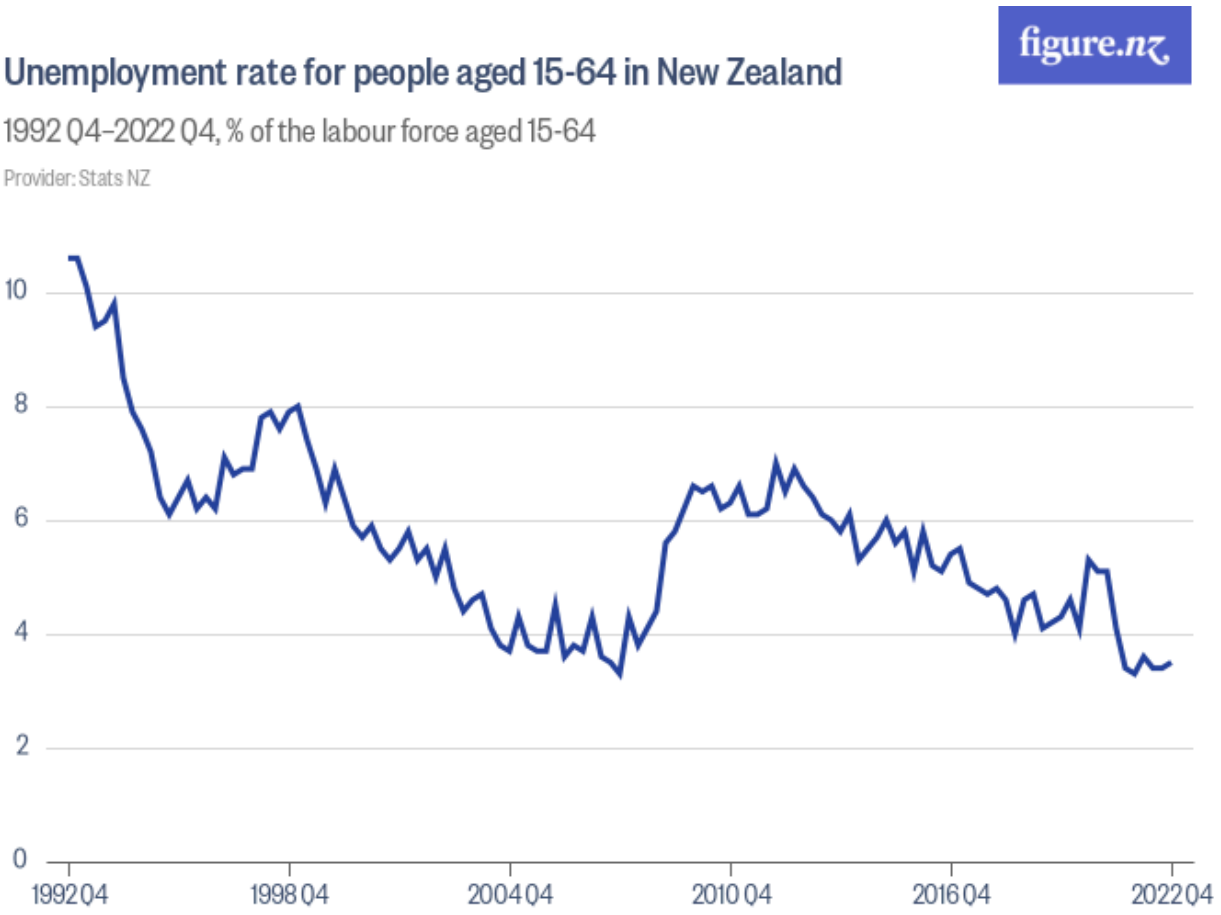


figure.nz
Unemployment rate for people aged 15-64 in New Zealand
1992 Q4–2022 Q4, % of the labour force aged 15-64
Provider: Stats NZ
10
8
6
4
2
0
1992 Q4
1998 Q4
2004 Q4
2010 Q4
2016 Q4
2022 Q4

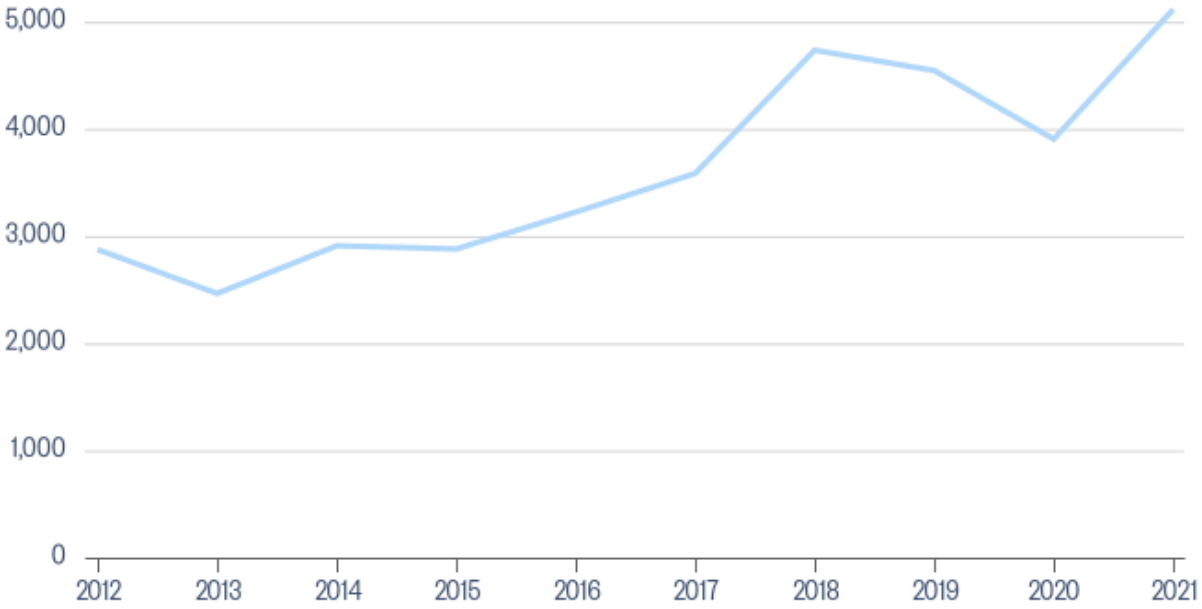
7)

figure.nz

Tertiary students learning Te Reo Māori through non-formal qualifications in New Zealand

2012–2021, number of students enrolled

Provider: Ministry of Education



8)

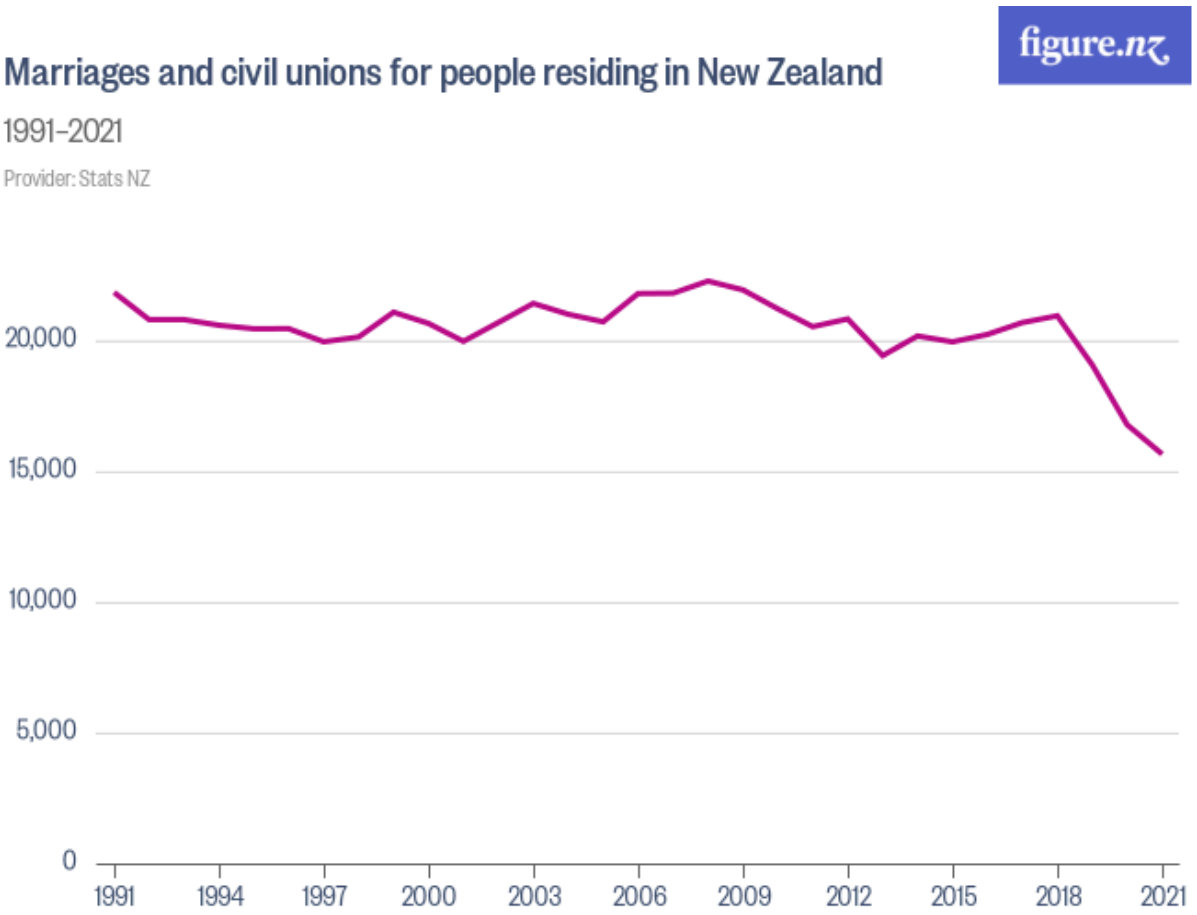


figure.nz
Marriages and civil unions for people residing in New Zealand
1991–2021
Provider: Stats NZ
20,000
15,000
10,000
5,000
0
1991
1994
1997
2000
2003
2006
2009
2012
2015
2018
2021

9)

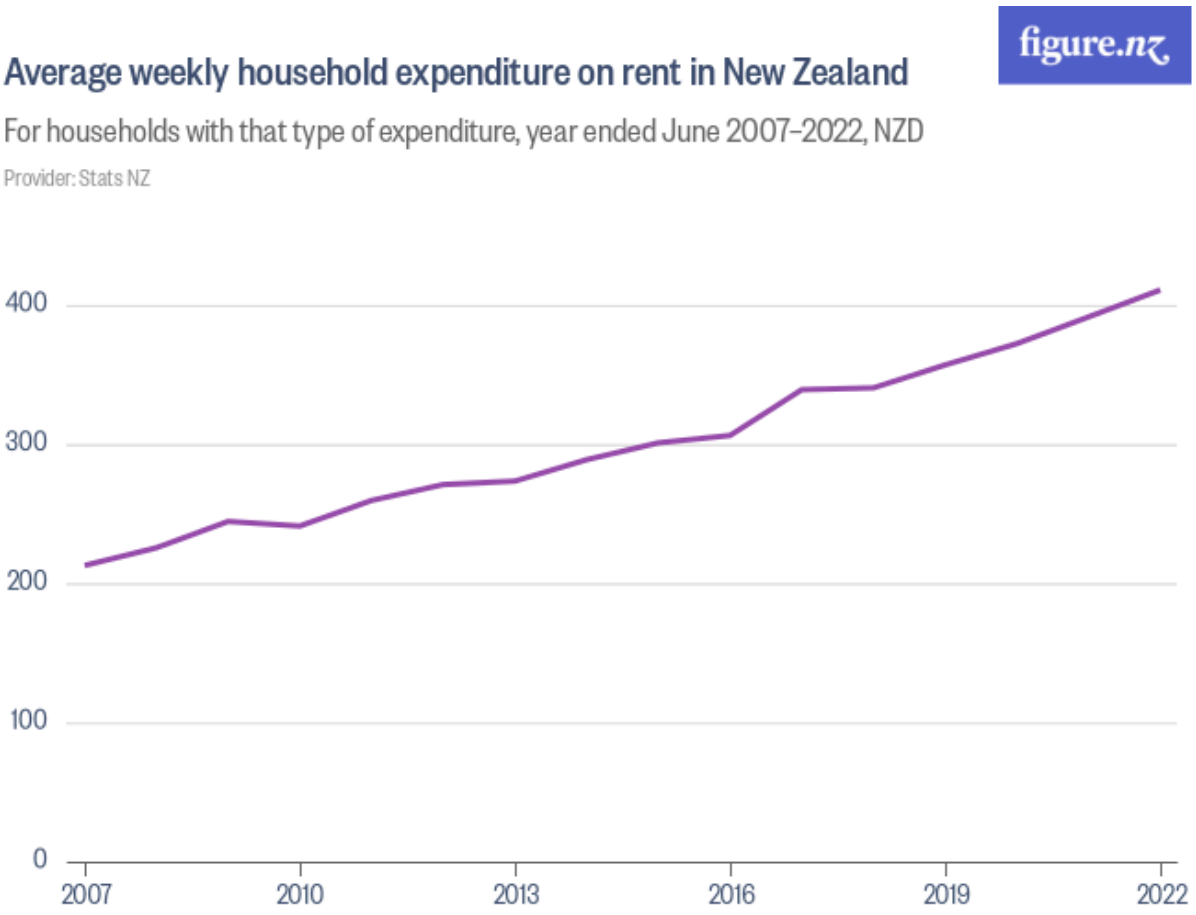
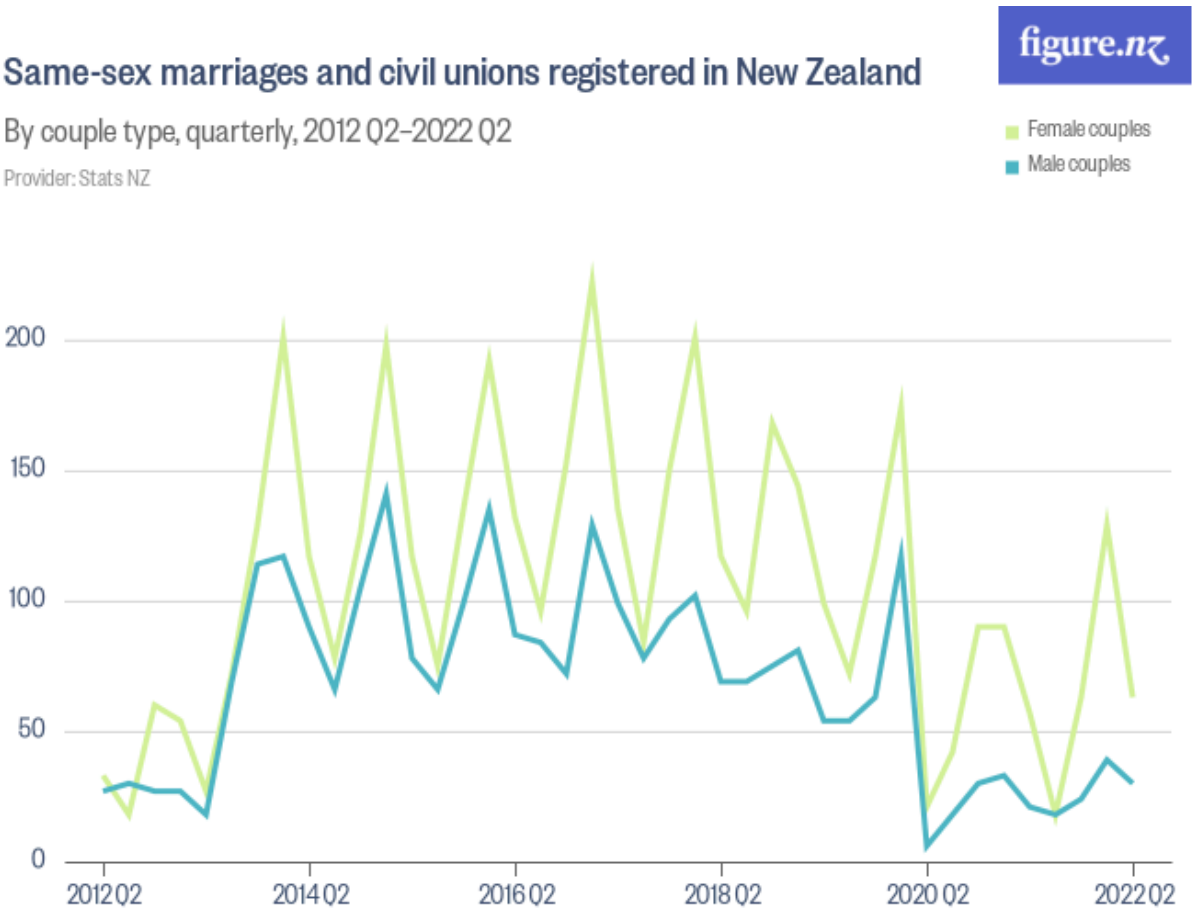


figure.nz
Average weekly household expenditure on rent in New Zealand
For households with that type of expenditure, year ended June 2007–2022, NZD
Provider: Stats NZ
400
300
200
100
0
2007
2010
2013
2016
2019
2022

10)



Exercise 13:

1) a) 6 times a day

b)

Period	Time
1	12 midnight - 4am
2	4am – 8am
3	8am – 12 noon
4	12 noon – 4pm
5	4pm – 8pm
6	8pm - midnight

2) a) 4

b)

Quarter	Months
1	January, February, March
2	April, May, June
3	July, August, September
4	October, November, December

c)

d)

e)

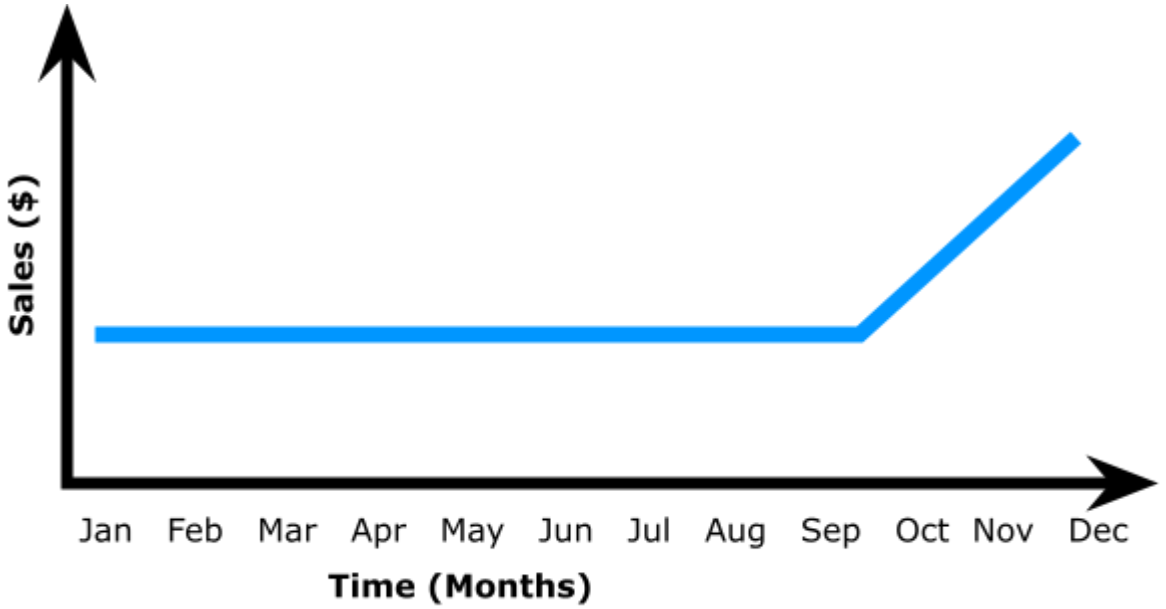
3) a) Its likely that more umbrellas are sold in winter due to the weather. When it rains more often, people are more likely to buy umbrellas.

b) It still rains even in Summer, or people buy umbrellas to stay out of the sun, or they may be travelling to an area where it is winter.

c) The pattern of more sales in winter and less in summer is likely to repeat itself each year, as it rains more in winter each year which is a main reason to buy umbrellas.

d) We want several years of data so that we can identify if there are patterns that repeat each year, as well as if there is a pattern occurring over a long period of time (e.g., is the umbrella sales increasing each year, as well as increasing in winter each year).

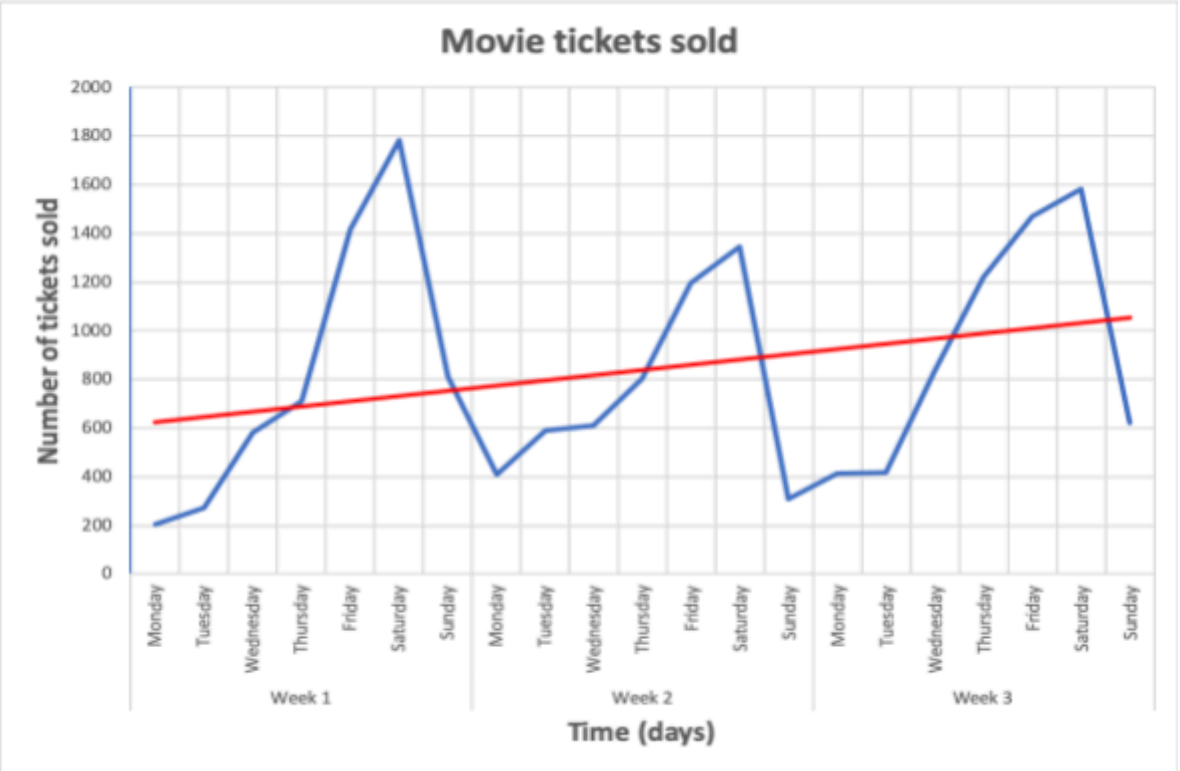
4) a)



b) I think toy sales will be higher as it gets closer to Christmas as people buy toys for Christmas presents.

Exercise 14:

1)

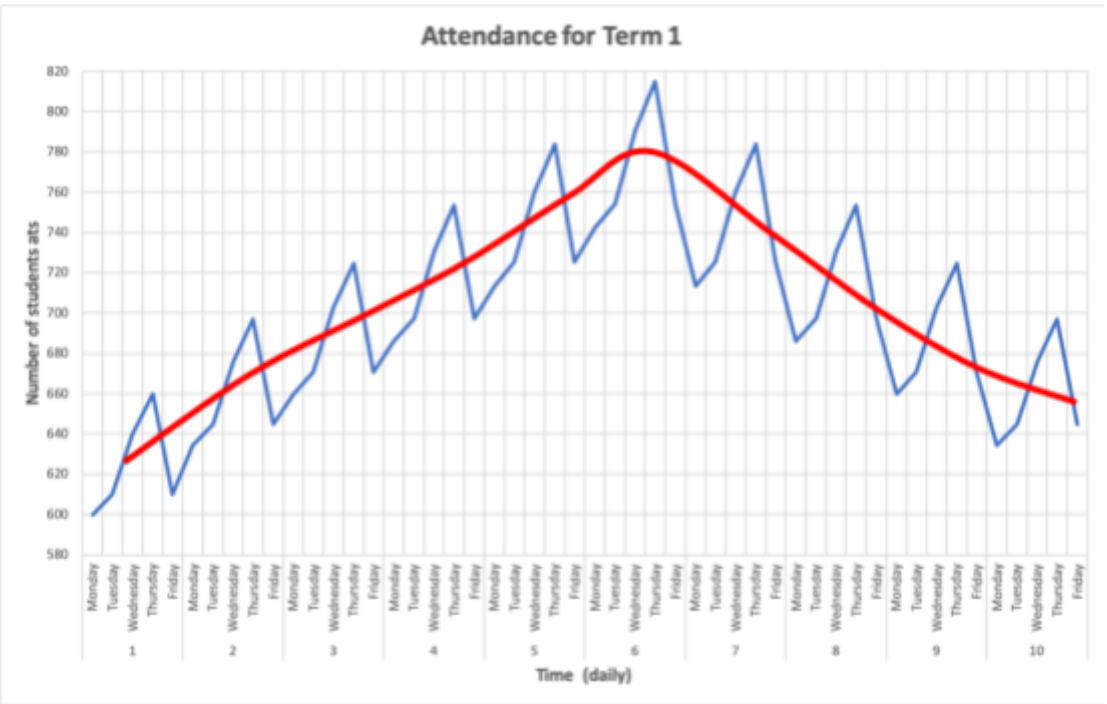


There is a consistent repeating pattern each week, where the number of movie tickets sold are low on Monday, rise during the week to peak on Saturday, and then drop on Sunday.

I expect that the number of tickets sold are highest on Saturday as the majority of adults in NZ work Monday to Friday, leading to weekend being time they do activities with their family and friends, which includes activities such as going to the movies.

I expect that the number of movie tickets sold would be lowest on Monday due to the majority of adults returning to work on Monday, leaving them less time to socialise and do activities outside of work.

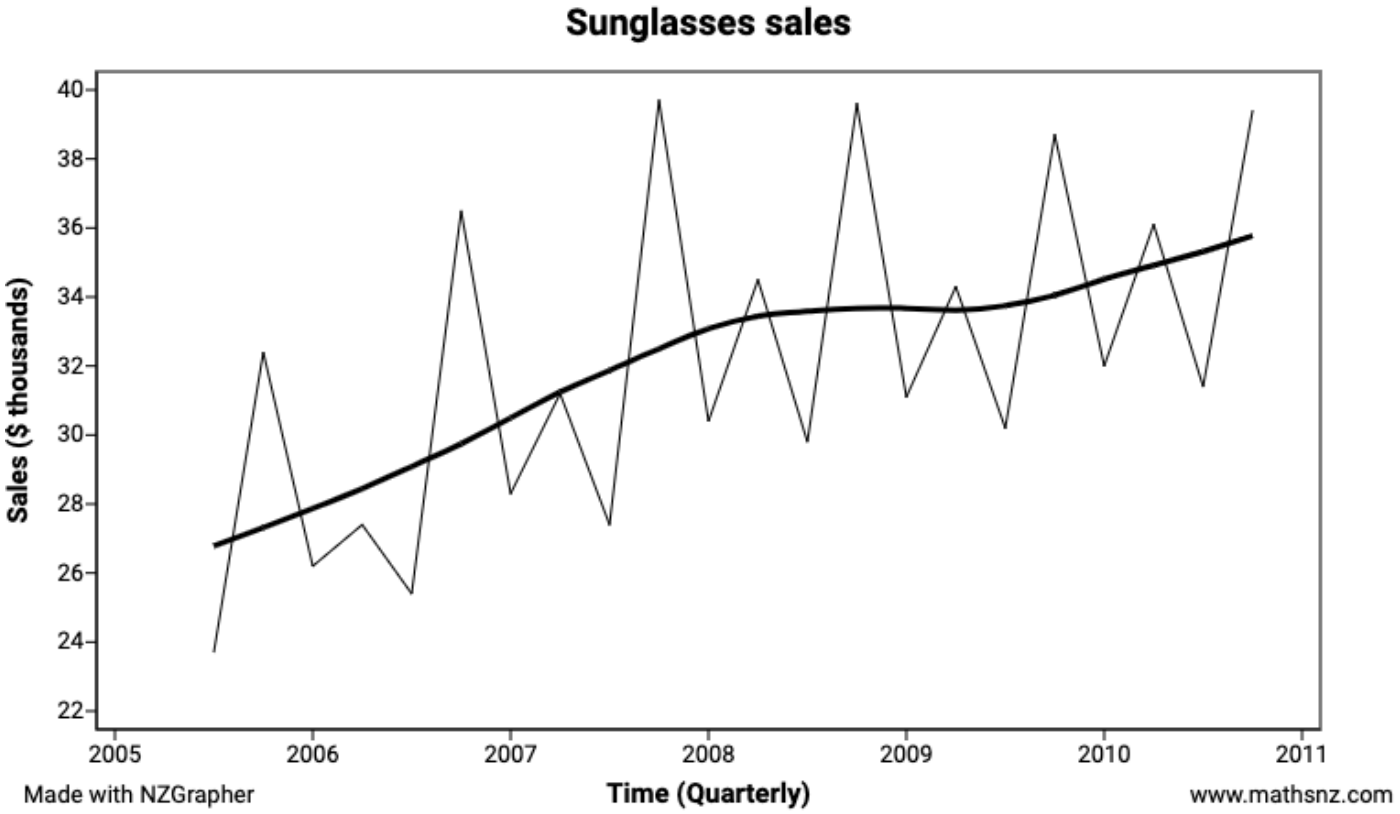
2)



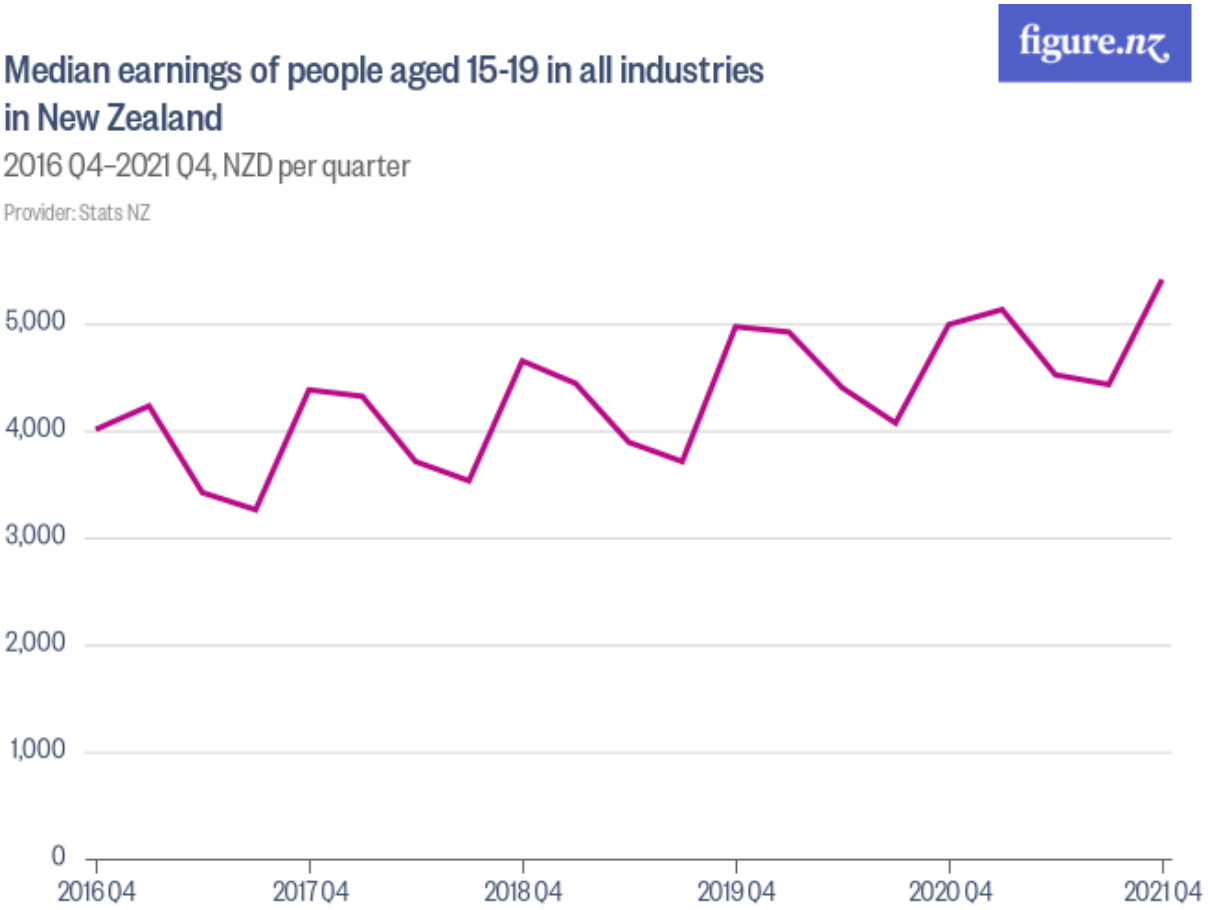
I notice that there is a consistent repeating pattern each week, where the number of students attending school is lower on Monday, rising to a peak on Wednesday or Thursday and then dropping again on Friday's. It is possible that the attendance is lower on Mondays

and Fridays as this may be days which are public holidays, or students/families taking a long weekend when they wanted.

3)



4)

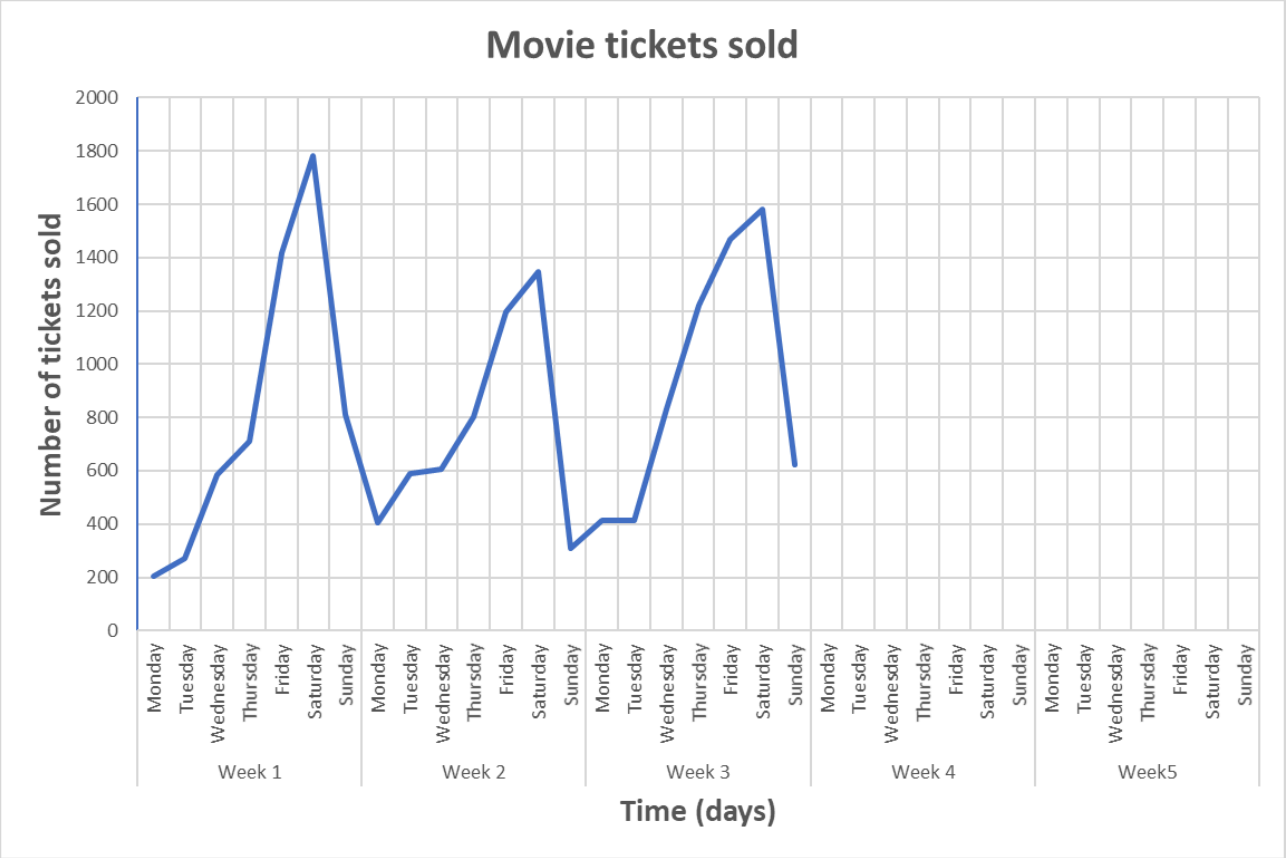


Exercise 15:

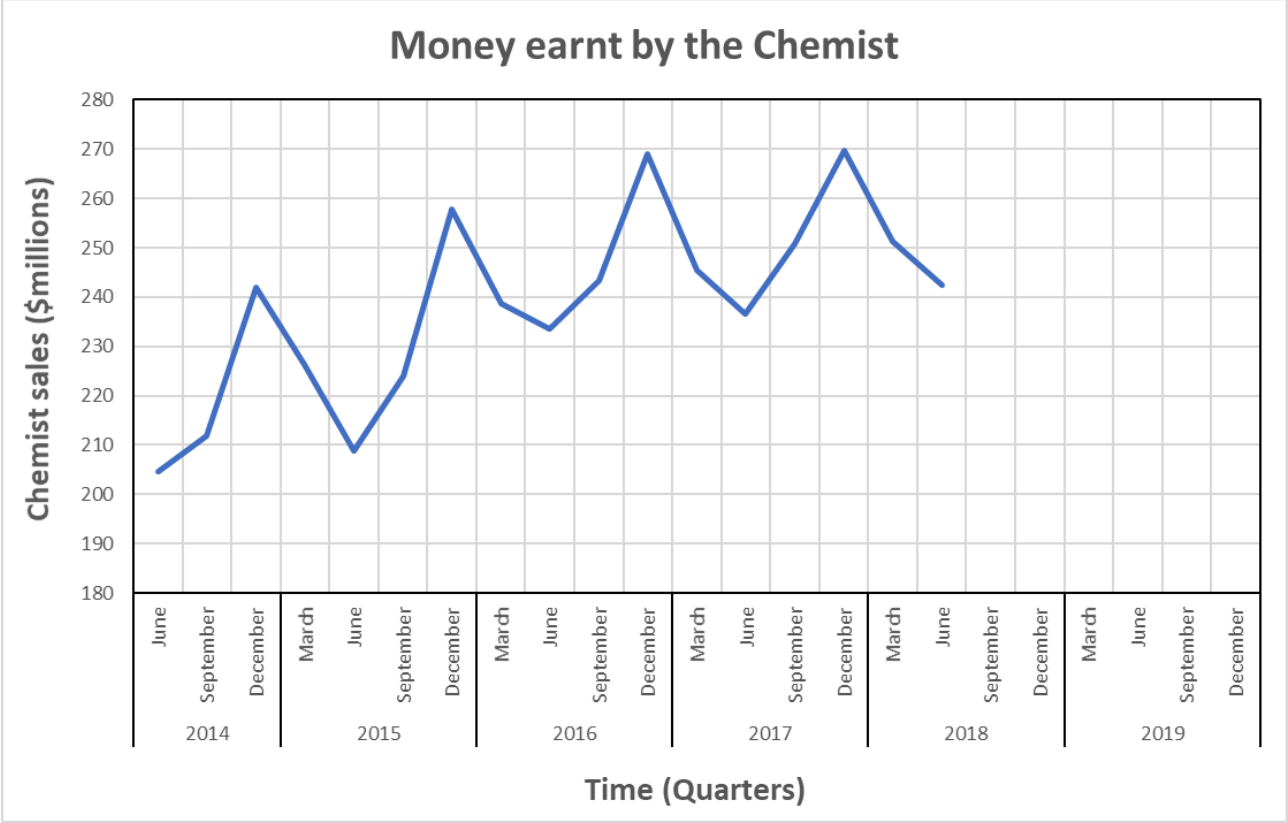
Students will have slightly different graphs but their prediction model should follow the trend and seasonality patterns.

1)

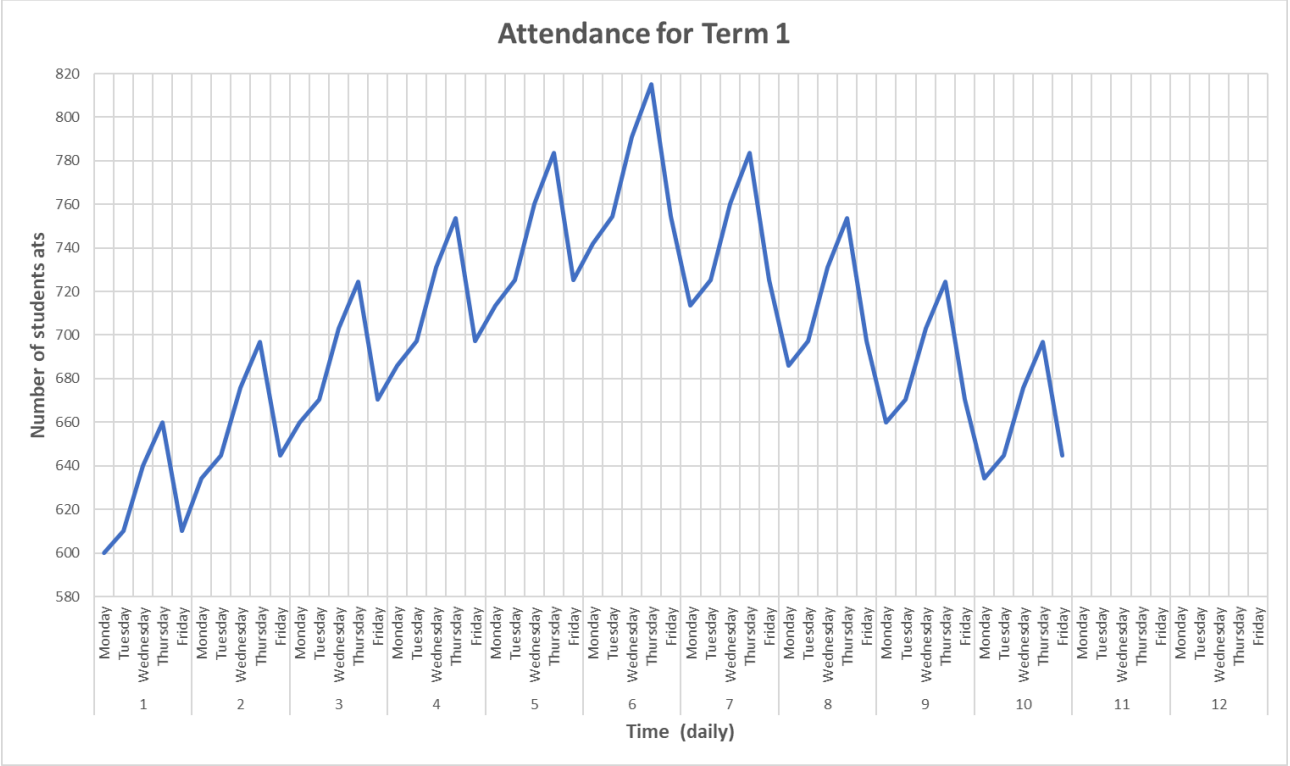
a)


Movie tickets sold
Number of tickets sold
2000
1800
1600
1400
1200
1000
800
600
400
200
0
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
Week 1
Week 2
Week 3
Week 4
Week5
Time (days)

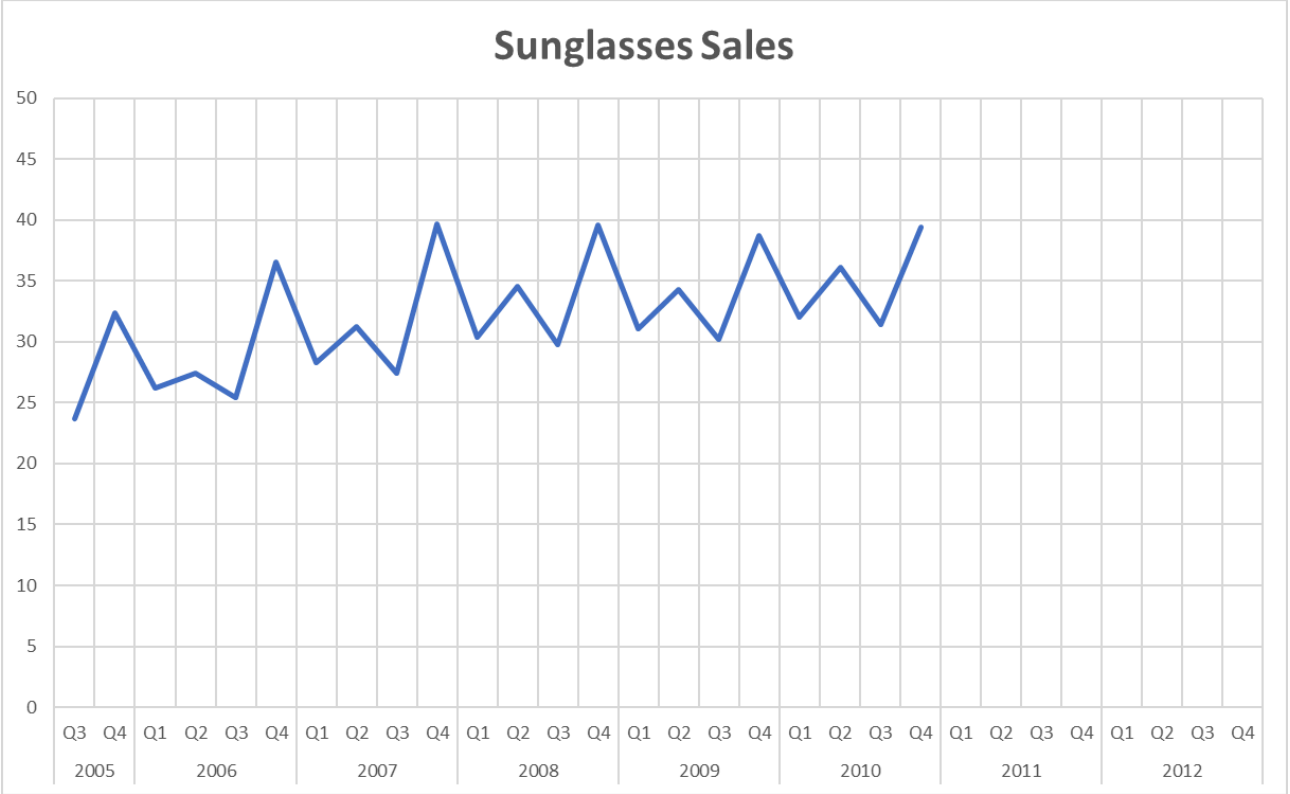
b)


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

c)



d)



2) 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.