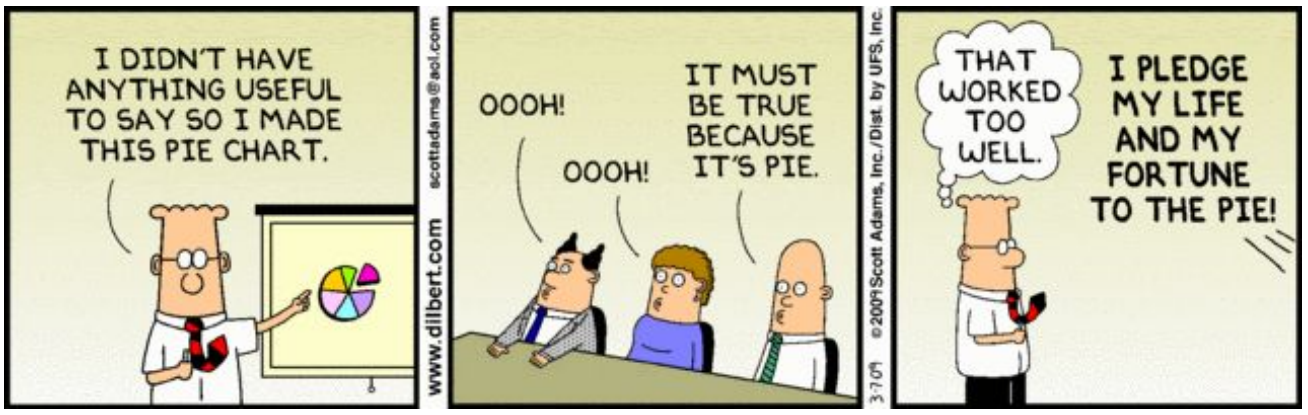
Year 9 Statistics booklet

Teacher Name: Mrs Meera Phadke

Student Name:_____

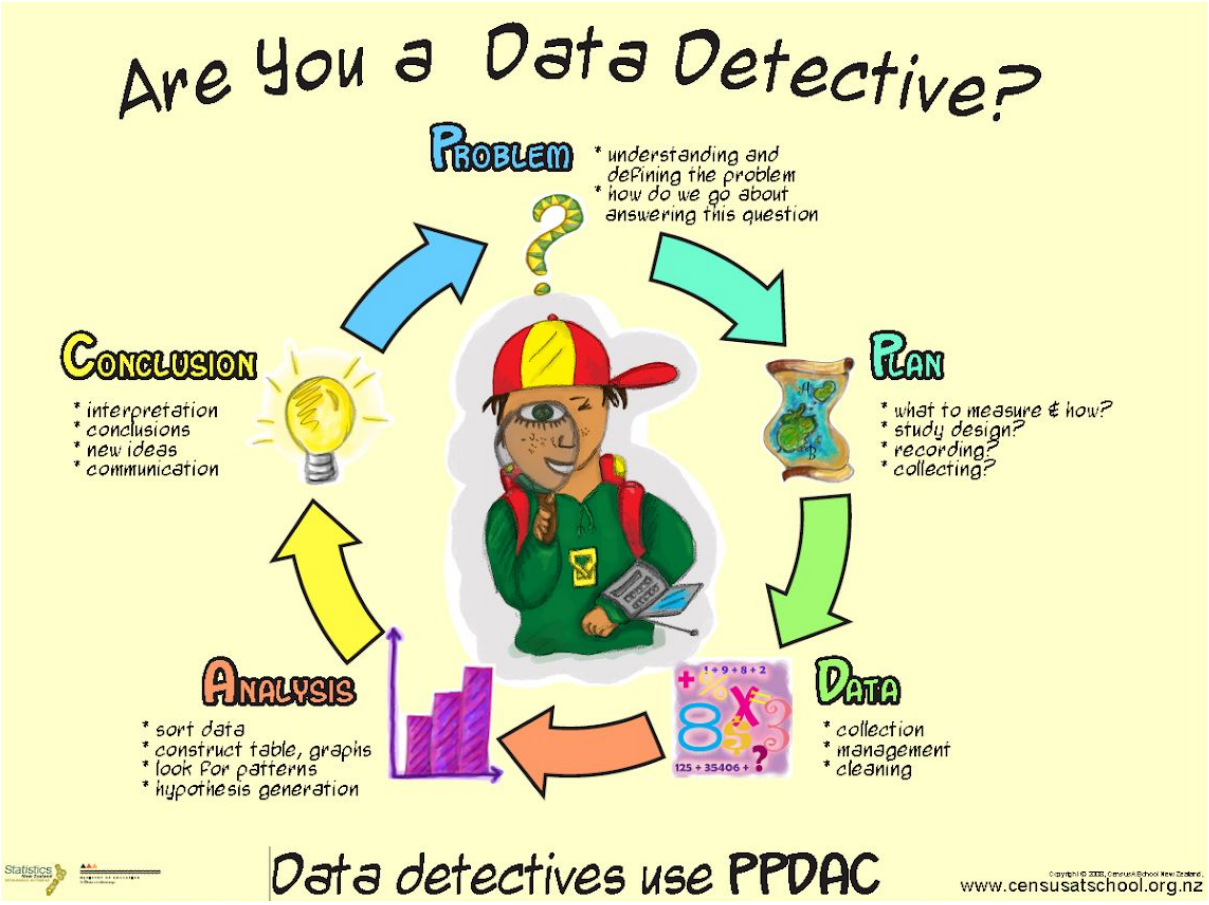


"Data don't make any sense,
we will have to resort to statistics."

Statistical Vocabulary or Glossary:

Average, Bar Graph, Bias ,Box and whisker plot, Certain, Cluster, Conclusion, Continuous, Comparative questions, Data, Discrete, Distribution, Dot plot, Shape distribution.

Experiment, Event, Frequency, Histogram, Inter-quartile range, Lower quartile, Mean, Median, Outcome, outlier , Pictogram, Pie Graph, Population, Trend, Predict, Probability, Range, Relative frequency, Relationship Questions, Scatter diagrams, Spread, Statistics, Stem and Leaf plot, Skew, Summary questions, Upper quartile, lower quartile, inter quartile.



PROBLEM: Write your "I wonder" question here that you are exploring.

PLAN/DATA: List the variables you will explore to answer your "I wonder" question.

ANALYSIS: From the tables and/or plots/graphs make four I notice statements about the data you have displayed. You should compare the shape of the data, spread of the data, the middle 50% of the data, and the summary statistics.
I notice...

I notice...

I notice...

I notice...

CONCLUSION

Your question you started with (from PROBLEM)...

Answer to your question...

Support for this answer.

Title: Nosey Parker Part 1

Introduction/Background as appropriate

Are you a Nosey Parker?
Do you have lots of questions that you want to find the answers to?

We can use statistics to answer all sorts of questions and to investigate lots of ideas.

Problem

Add your data to the last row of the table.

Student	Gender	Age	Height (cm)	Length of arm span (cm)	*Main* way of travel to school*	Time taken to get to school (min)	Did *most* at lunchtime *
1	male	12	163	163	walk	Less 10	Ran
2	female	14	155	155	bus	20 - 30	Sat
3	female	12	155	155	walk	10 - 20	Ran
4	male	10	141	144	motor	Less 10	Ran
5	female	14	163	164	motor	20 - 30	Walked
6	male	9	144	144	bus	30 plus	Walked
7	female	13	164	165	bus	30 plus	Sat
8	female	14	158	118	motor	10 - 20	Sat
9	female	14	166	162	bus	10 - 20	Sat
10	female	10	143	138	motor	10 - 20	Walked
11	male	11	149	144	bike	Less 10	Ran
12	female	9	140	140	motor	10 - 20	Ran
13	male	9	127	128	walk	10 - 20	Ran
14	male	13	163	163	motor	10 - 20	Ran
15	female	13	150	147	walk	10 - 20	Ran
16	male	11	146	125	bike	Less 10	Ran
17	male	13	165	154	motor	Less 10	Walked

18	female	12	159	159	motor	Less 10	Walked
19	female	15	160	156	walk	30 plus	Stood
20	male	13	168	175	walk	Less 10	Ran
21	female	15	170	175	motor	Less 10	Sat
22	female	9	132	130	motor	Less 10	Ran
23	male	14	174	182	motor	Less 10	Ran
24	female	12	150	150	bus	30 plus	Stood
Me							

* Questionnaire wording
Main way to travel to school options: walk, motor vehicle, bus, bike, other.
What you did most at lunchtime options: sat down, stood around, walked around, ran around or played

Source: CensusAtSchool.org.nz

Analysis

I notice …	I wonder…

Reflection

I thought…

I was surprised…

To extend this activity

Look over all the 'I notice…' and 'I wonder…' statements and sort them into groups. Investigate different ways of sorting and choose the one which seems most useful. Explain your choice.

Types of investigative questions:

Relationship Questions/Statements

- I notice that their height is similar to their arm span.
- I wonder if height has anything to do with how long it takes to get to school.
- I notice that the older the students are the taller they are.

Summary Questions/Statements

- I wonder what the average height of these students is.
- I notice that most students run around at lunchtime.
- I notice that the most common way to get to school is using a motorcar.

Comparison Questions/Statements

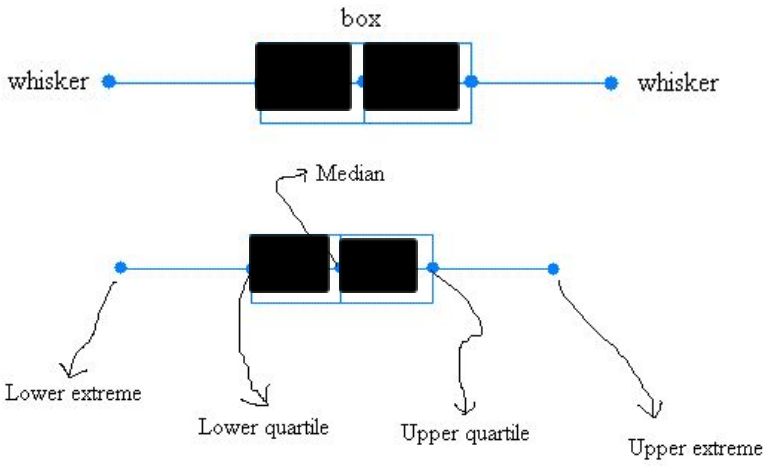
- I wonder if students who walk to school take longer to get to school.
- I wonder if female students are more active at lunchtime than male students.
- I wonder if younger students are more active than older students.
- I wonder if females are shorter than males.

Other Questions/Statements

- I wonder if students who went to school using a car could have used the bus.
- I wonder if the older students travel further to school than the younger students.
- I wonder if the results would be different for our class.
- I wonder why students don't ride bikes more.

Where to from here:
Now that we know what sorts of questions we have we can identify the specific data we need and use statistical techniques to analyse the data. Each type of question uses different techniques.

How to make a box and whisker plot:



Lower extreme or Minimum: the lowest or smallest value in a set of data

Lower quartile or first quartile: the median of all data below the median

Median or second quartile: the middle value of the set of data. If there are two values in the middle, the median is the average of the two values

Upper quartile or third quartile: the median of all data above the median

Upper extreme or Maximum: The biggest value in the set

Example:
Construct a box and whiskers plot for the data set: {5, 2, 16, 9, 13, 7, 10}

1. Put the data set in order from least to greatest
   From least to greatest we get : 2 5 7 9 10 13 16

2. Since the smallest value in the set is 2, the lower extreme is **2**
   Since the greatest value in the set is 16, the upper extreme is **16**

3. Now, look carefully at the set: 2 5 7 **9** 10 13 16
   You can see that 9 is located right in the middle of the set of data, therefore, 9 is the median

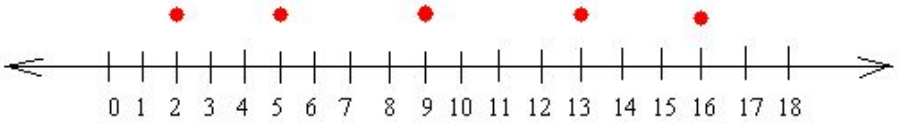
4. Now to get the lower quartile, you need all data before the median of 9
   2 5 7 9 10 13 16
   In bold right above we show all data before 9, so **2 5 7**
   Since the value in the middle for the set **2 5 7** is 5, the lower quartile is 5

5. Finally, to get the upper quartile, you need all data after the median or 9
   2 5 7 9 **10 13 16**
   In bold right above we show all data after 9, so **10 13 16**
   Since the value in the middle for the set **10 13 16** is 13, the **upper quartile is 13**

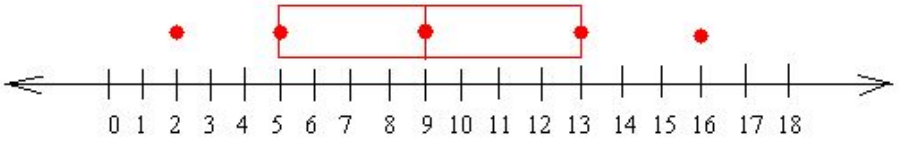
6. This is called a 5-point statistics and can be summarised as below:

Minimum	Lower Quartile	Median	Upper Quartile	Maximum
2	5	9	13	16

7. Now we make a number line and graph above the number line 2, 5, 9,13, and 16 with five dots: one dot will represent the median, one dot will represent each extreme, finally, one dot will represent each quartile.



8. Draw a rectangle or box starting from the lower quartile to the upper quartile. Draw a vertical segment too to represent the median



9. Finally, draw horizontal segments or whiskers that connect all five dots together.

The box and whiskers plot for {5, 2, 16, 9, 13, 7, 10} is :

Creating your own box and whisker plot:

We want to investigate the question 'How many whiskers does a cat have?'

1. We find cats with the following number of whiskers: 27, 21, 23, 25, 24, 23, 28, 27, and 20 whiskers
2. Rearrange the numbers in numerical order, including repeats (from smallest to largest)

3. What is the lowest and highest number? Write them here:
   Minimum = _____ **Maximum** = _____

4. Find the middle number. This is your **median**. Write it here: **Med**=_____

5. Look at the numbers before your median. What is the middle value between them? (for even numbers of data, find the middle number by adding the number either side and dividing by 2). This is your **Lower Quartile**. Write it here: **LQ** = _____

6. Repeat the previous step for the numbers after your median. This is your **Upper Quartile**. Write it here: **UQ** = _____

7. Now you are ready to draw your plot below. Plot dots for your 5-point statistics.
8. Draw a box around your Lower quartile, Median and Upper Quartile.
9. Draw lines from your minimum and maximum to the edge of the box.

Bigger data sets (Stem and leaf graphs):

If you have a big data set, it can be tedious ordering the numbers from smallest to largest. In this case we use a stem and leaf graph to help us order the data and find the 5-point statistics.

These are results from a maths test taken: **13, 24, 22, 15, 33, 32, 12, 31, 26, 28, 14, 19, 20, 22, 31, 15**

1. Find the lowest and the greatest number in the data set. These are: 12 and 33

2. Then we draw a vertical line. On the left hand side of the line we write the numbers that corresponds to the tens, 12 has 1 in the tens place and 33 has 3 in the tens place.

1
2
3

3. On the right hand side of the line we will write the numbers that corresponds with the ones. Now we pair each unit's digit into the plot.

1	3 5 2 4 9 5
2	4 2 6 8 0 2
3	3 2 1 1

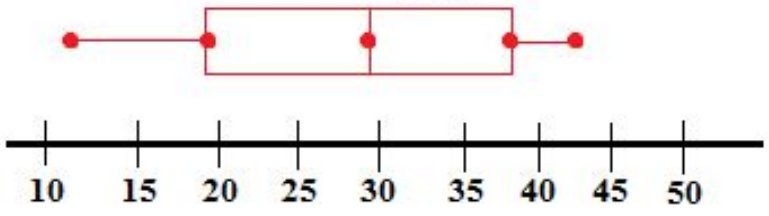
5. Then we arrange the digits in ordered, from the lowest to the greatest value to get our finished stem-and-leaf plot.

1	2 3 4 5 5 9
2	0 2 2 4 6 8
3	1 1 2 3

6. You can use a steam-and-leaf plot to find and display the median, the LQ and the UQ.
The median is at (22 + 22)/2 = 22 and is marked by a box. The LQ and UQ are marked by circles. The LQ is 15 while the UQ is 31.

1	2 3 4 (5) 5 9
2	0 [2 2] 4 6 8
3	(1) 1 2 3

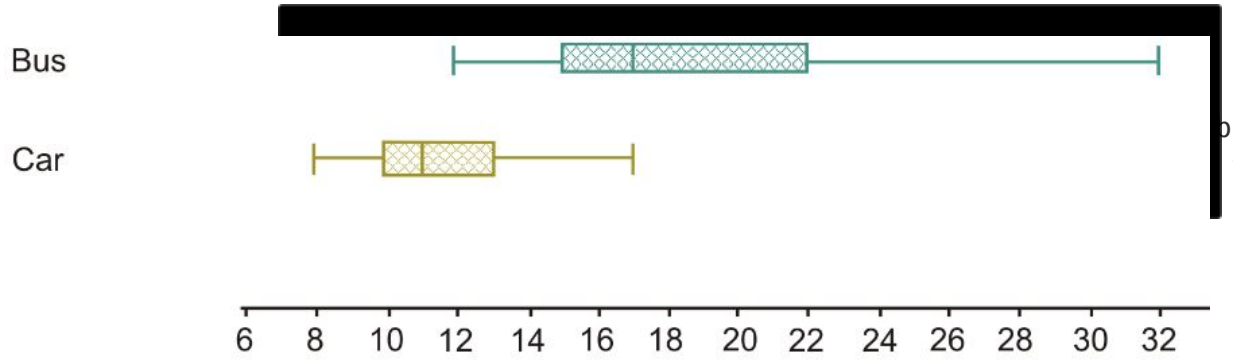
7. From this we can now draw our box and whisker plot



8. Emma and Daniel are surveying the times it takes students to arrive at school from home. There are 2 main groups of commuters who were in the survey. There were those who drove their own cars to school, and there were those who took the school bus. Emma and Daniel collected the following data:

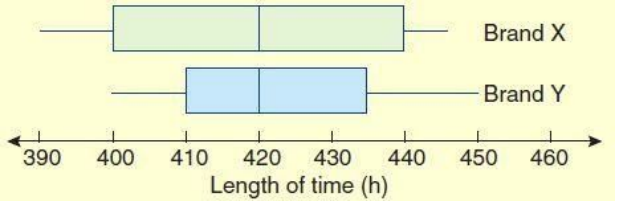
Bus times (min)	14	18	16	22	25	12	32	16	15	18
Car times (min)	12	10	13	14	9	17	11	10	8	11

a) Draw a box-and-whisker plot for both sets of data on the same number line.

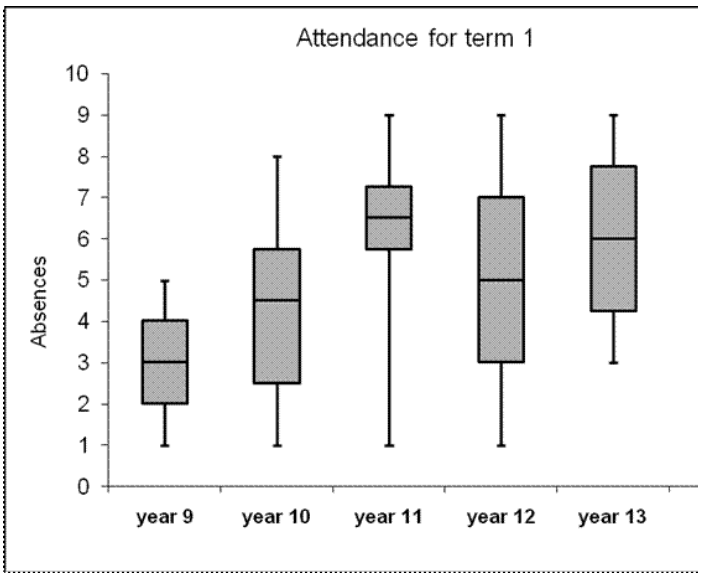


b) Use the double box-and-whisker plots to compare the times it takes for students to arrive at school either by car or by bus

9. A researcher tested two different brands of batteries to see how long they lasted. The results are shown in the double box-and-whisker plot alongside. Use the box-and-whisker plots to compare the performance of Brand X and Brand Y.



10. Below is a box and whisker plot of absentees of all tutor classes during term 1 in a certain school.

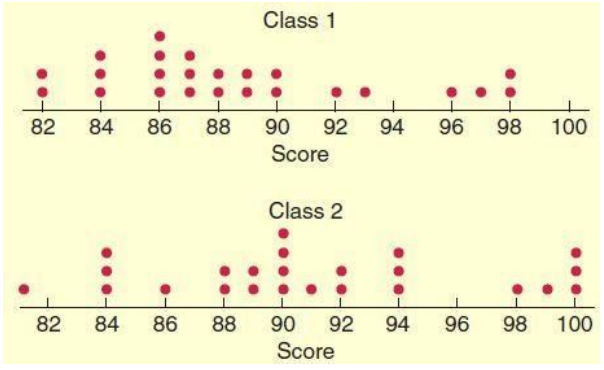


a) What is the median number of absentees in year 9?

b) The principal thinks year 13's are absent more often than year 9's. Would you say this is correct? Why/why not?

c) Which year group tends to have more absentees? Justify your answer.

11. The marks for two classes on the same test are shown in the dot plot below.



a) What is the mode score for each class?

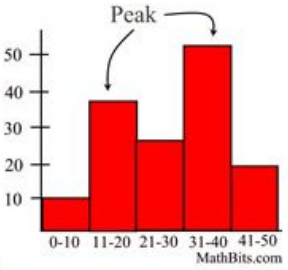
b) Which class would you say has the higher average score? Justify your answer.

Shapes of Distributions

http://mathbitsnotebook.com/Algebra1/StatisticsData/STShapes.html

The shape of a distribution is described by its number of peaks and by its possession of symmetry, its tendency to skew, or its uniformity. (Distributions that are skewed have more points plotted on one side of the graph than on the other.)

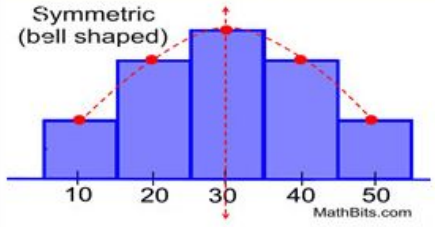
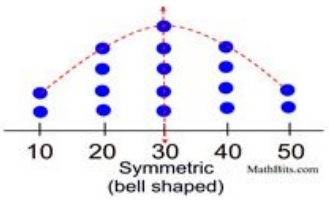
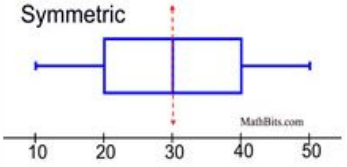
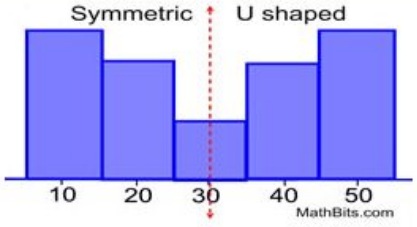
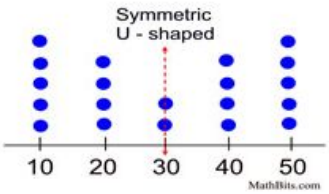
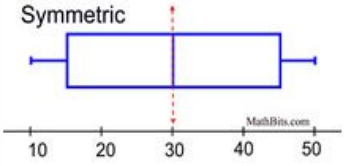
PEAKS: Graphs often display peaks, or local maximums. It can be seen from the graph that the data count is visibly higher in certain sections of the graph.



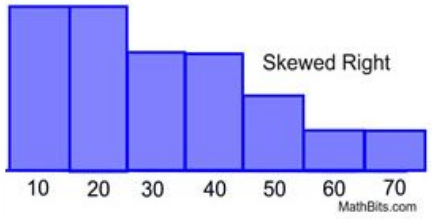
1. one clear peak is called a *unimodal* distribution.
2. two clear peaks are called a *bimodal* distribution.
(Here, the term "mode" is used to describe a local maximum in a chart (such as the midpoint of the a peak interval in a histogram). It does not necessarily refer to the most frequently appearing score, as in the "central tendency mode".

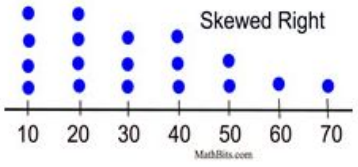
3. single peak at the center is called *bell shaped* distribution.
Note: A bell shaped graph (bell curve), is a frequency distribution that resembles the outline of a bell when plotted on a graph.

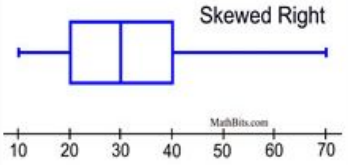

Bell Shaped

Histograms	Dot Plots	Box Plots
Note: The graphs shown below demonstrate the *shapes* of various sets of data. The histogram, dot plot and box plot in each separate section represent the same data set.		
Symmetric (bell shaped) - when graphed, a vertical line drawn at the center will form mirror images, with the left half of the graph being the mirror image of the right half of the graph. In the histogram and dot plot, this shape is referred to as being a "bell shape" or a "mound". The *most typical* symmetric histogram or dot plot has the highest vertical column in the center. This shape is often referred to as being a "normal curve" (or normal distribution). Not all symmetric graphs, however, have this shape (see Symmetric U-shaped below).		
		
Symmetric (U-shaped) - as mentioned above, a symmetric graph forms a mirror image of itself when reflected in its vertical center line. Unlike the previous graphs, these histograms and dot plots have more of a U shape.		
		

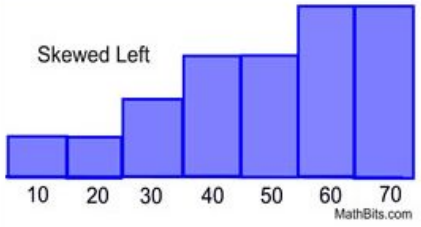
Skewed Right (positively skewed) - fewer data plots are found to the right of the graph (toward the larger numeric values). The "tail" of the graph is pulled toward higher positive numbers, or to the right. The mean typically gets pulled toward the tail, and is greater than the median. (There may be exceptions to the this last statement.)

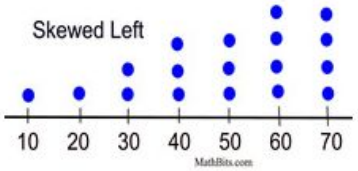


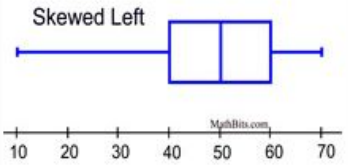




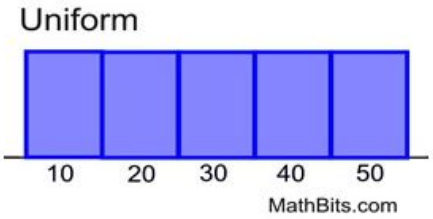
Skewed Left (negatively skewed) - fewer data plots are found to the left of the graph (toward the smaller numeric values). The "tail" of the graph is pulled toward the lower or negative numbers, or to the left. The mean typically gets pulled toward the tail, and is less than the median. (There may be exceptions to the this last statement.)

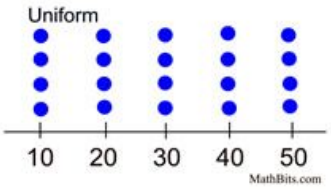


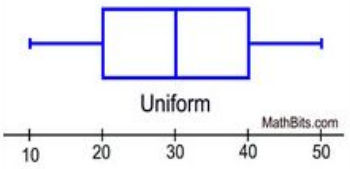




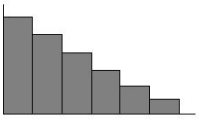
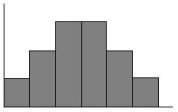
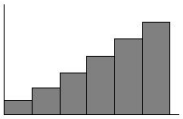
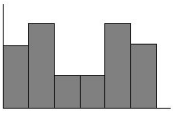
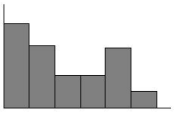
Uniform - The data is spread equally across the range. There are no clear peaks in these graphs, since each data entry appears the same number of times in the set. Notice in the boxplot how each section is of equal length: min to Q_1, Q_1 to median, median to Q_3, and Q_3 to max. These graphs are also symmetric.

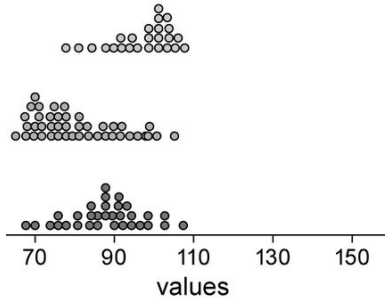






Place a suitable shape name for the following dot plot:

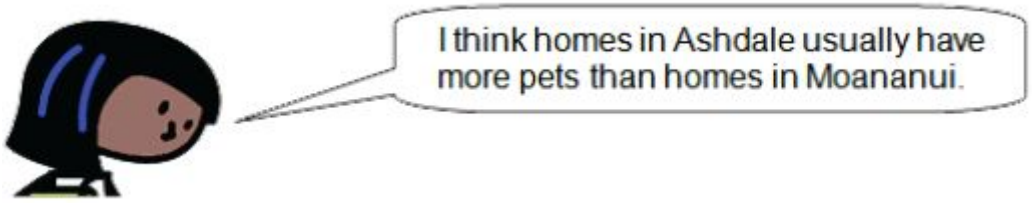


Critical Thinking questions based on dot plot:

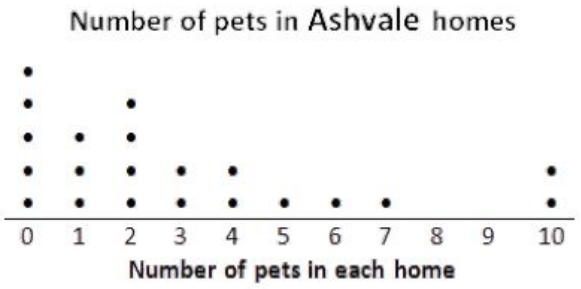
Question 1:

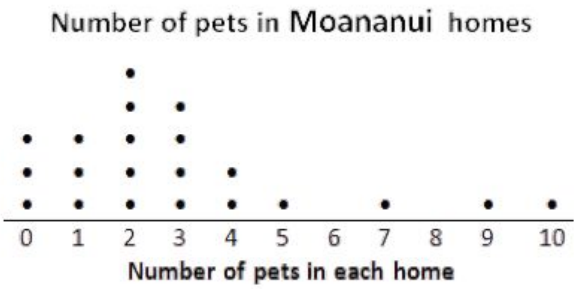
People and their pets

This resource is about comparing two dot plots.



Lena wants to find out if homes in Ashvale usually have more pets than homes in Moananui.





In which town do homes usually have more pets?

a) Ashdale
b) Moananui
c) You cannot tell which town usually has more pets in each home
d) Homes in Ashvale have about the same number of pets as homes in Moananui

Explain why you chose your answer. Hint: Look at the overall shape of each graph. How similar or different are they?

2. Make a frequency table that shows the number of sibling of each student in your maths class. Use the table to make a dot plot of the data, and describe the distribution.

Number of Siblings	Frequency

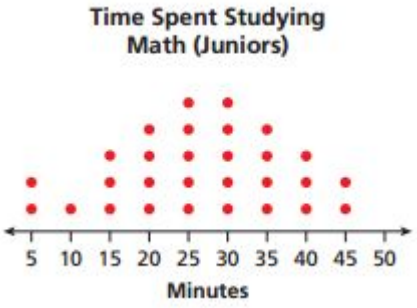
Make a dot plot

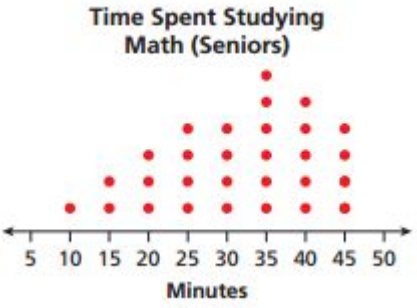
Describe the distribution.

Question 2:
Mrs Graham asked her junior and senior students how many minutes each of them spent studying math in one day, rounded to the nearest five minutes. The results are shown below.

Time Spent Studying Math (min)	Frequency (Juniors)	Frequency (Seniors)
5	2	0
10	1	1
15	3	2
20	4	3
25	5	4
30	5	4
35	4	6
40	3	5
45	2	4

She made a dot plot showing the data for juniors and a dot plot showing the data for seniors



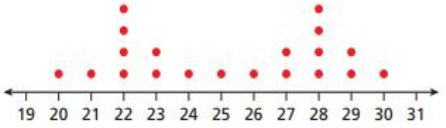


Describe the shape of each distribution

What does the shape of each distribution mean in terms of junior and senior students

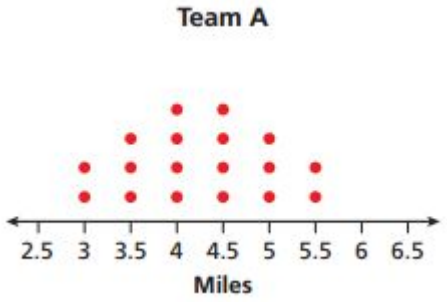
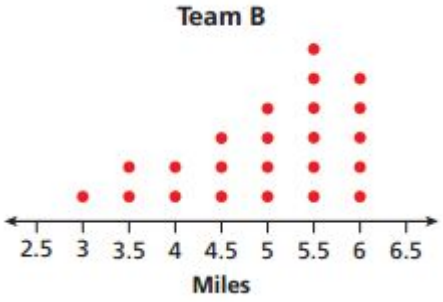
Question 3:

The data plot at right shows an example of a bimodal distribution. Why is this an appropriate name for this type of distribution?



Question 4:

The dot plot shows the number of miles run by members of two track teams during one day. Using the dot plot below determine the type of distribution for each team. Explain what the distribution means for each

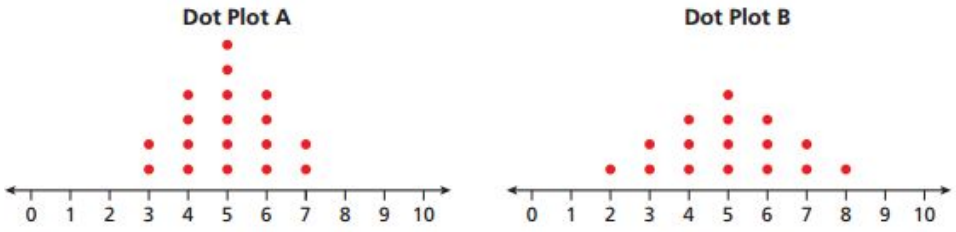
Data for team C members are shown below. Make a dot plot and determine the type of distribution. Explain what the distribution means.

Miles	3	3.5	4	4.5	5	5.5	6
Team C	3	2	2	2	3	2	2

Make a dot plot here:	Expected answer:

Question 5:

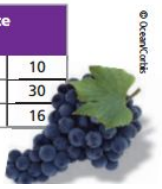
Magdalene and Peter conducted the same experiment. Both of their data sets had the same mean. Both made dot plots of their data that showed symmetric distributions, but Peter's dot plot shows a greater range than Magdalene's dot plot. Identify which plot below belongs to Peter and which belongs to Magdalene. Justify your findings.



Question 6:

Nutrition Julia researched graph juice brands to determine how many grams of sugar each brand contained per serving (8 fluid ounces = 1 serving).

Grams of Sugar in Grape Juice (per serving)					
15	0	36	18	30	10
30	15	35	30	36	30
36	30	38	16	35	16



The data she collected is shown in the table.

a) Identify any outlier(s) in the data set. (Expected answer =0)
b) Make a dot plot for the data with the outlier(s) and a dot plot for the data without the outliers. What information you can get from each dot plot.

Dot plot with outlier	Dot plot without outlier

c) Describe the distribution of data with or without outlier(s)

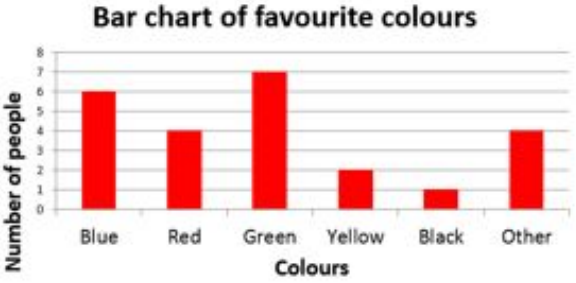
d) How does excluding the outlier(s) affect the mean, median and mode of the data set?

Extension:
Gather data on the heights of people in your classroom. Separate the data for males from the data for females. Make

two dot plots representing the data collected for each group. Compare the dot plots and the distributions of the data.

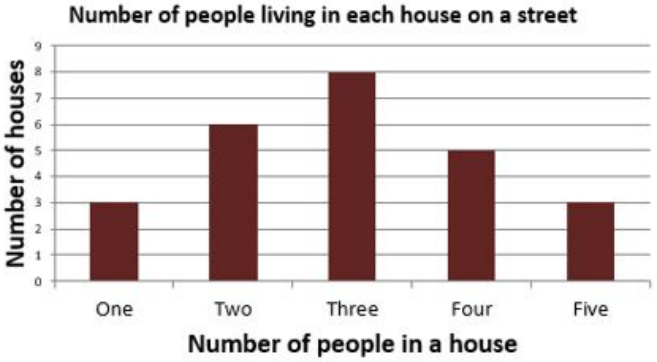
Interpretation of bar graphs:

What is this bar chart showing?



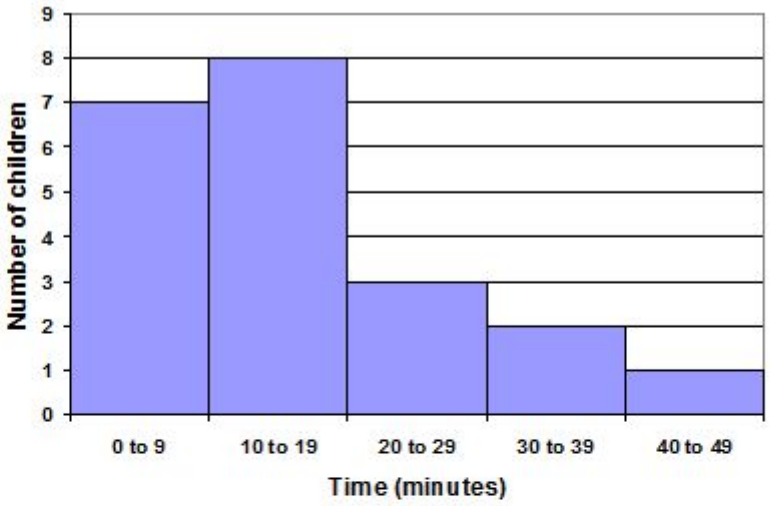
1. Which was the most popular colour?
2. How many people chose red as their favourite?
3. How many people were asked?

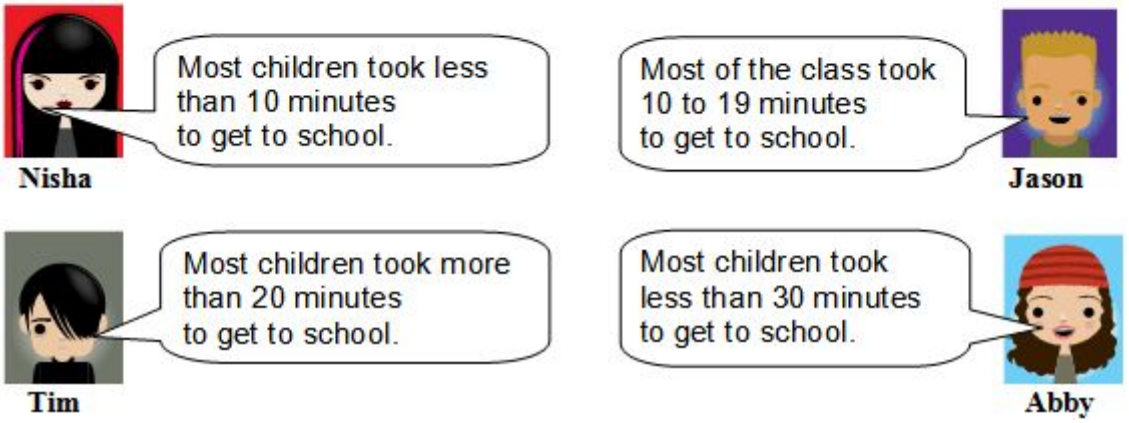
One for you to try:



1. How many houses have two people living in them?
2. How many houses have more than 3 people living in them?
3. What is the modal number of people living in a house?
4. How many houses are there on the street?

Time to get to school:





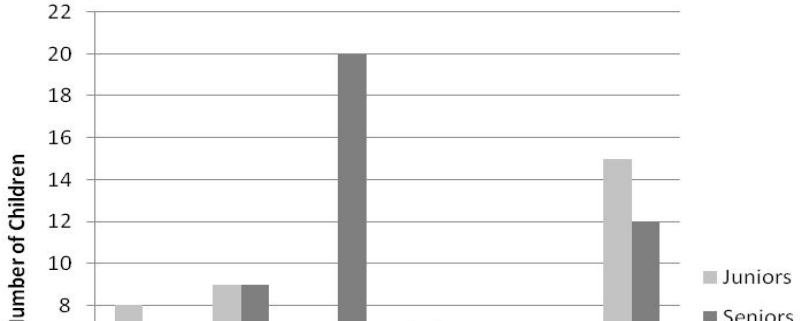
This graph shows the time it took the children in Room 8 to get to school one day. Which person made a correct statement about the graph?

a) Nisha
b) Jason
c) Tim
d) Abby
e) They all made correct statements

Explain why you decided on your answer.

1. The teachers at Sunshine school wanted to know where the most children play at lunchtime. After one lunchtime they asked all the children where they had spent most of the lunchtime and made a bar graph.

Lunchtime Places for Children



Read the following statements and write down if you agree with the statement, disagree with the statement or can't tell from the results. Justify your answer by referring to the graph.

a) The library is equally popular with juniors and seniors.

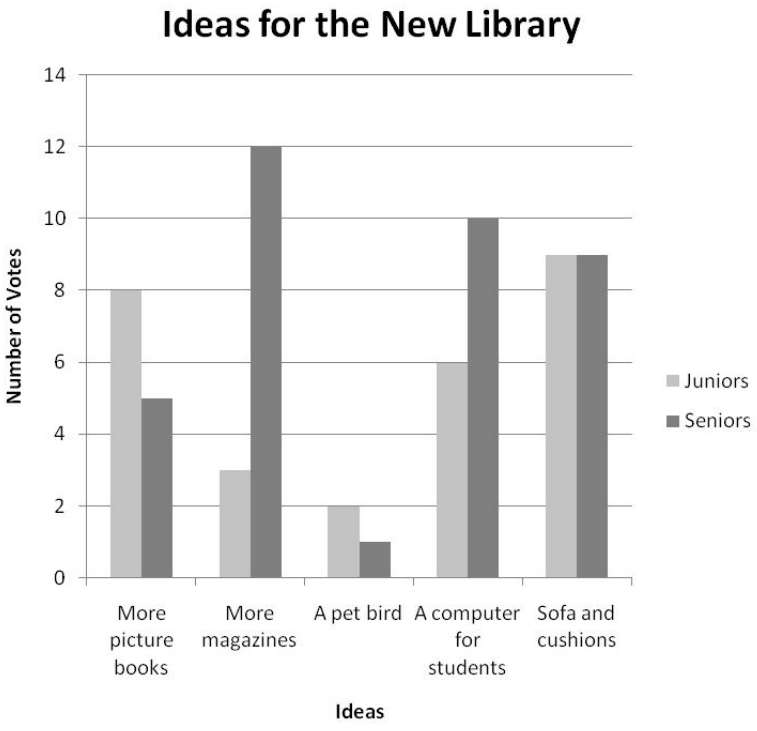
b) Everyone's favourite is the adventure playground.

c) The juniors play on the concrete because the seniors take over the sports field.

d) The tree house doesn't hold many people.

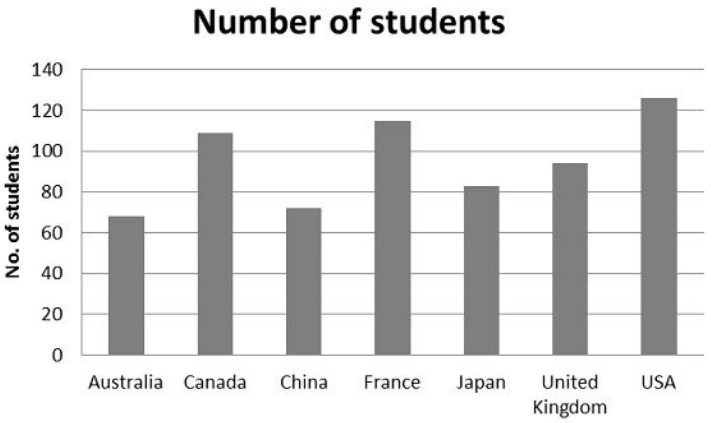
e) The sandpit is more popular with juniors.

2. Write at least 3 recommendations based on the survey results shown in the bar graph alongside.
Share your recommendations with the person you are sitting next to and discuss whether you agree with each other's recommendations. Remember to back up your statements by referring to the graph.



3. The table below shows the number of students from various countries who attend an international school.

Country	Number of students
Australia	68
Canada	109
China	72
France	115
Japan	83
United Kingdom	94
USA	126



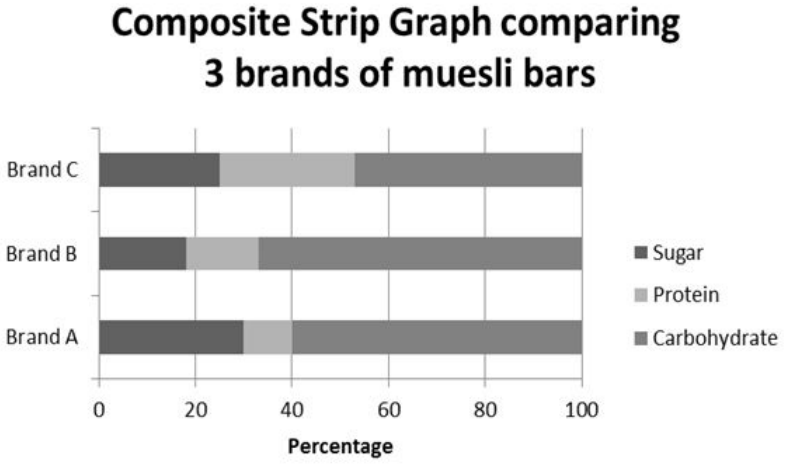
a) Give a reason as to why a bar graph is the most appropriate display for this data.

b) Which country has the fewest students attending the international school?

c) How many students attend the international school?

d) What is the difference in numbers attending from China and Japan?

4. This graph compares 3 different brands of muesli bars with their sugar, protein and carbohydrate content.

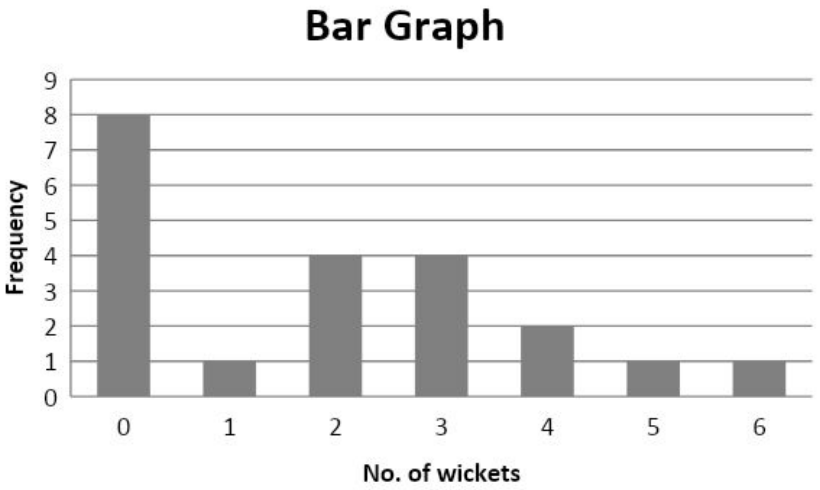


a) Which brand of muesli bar has the least sugar?

b) Rank the muesli bars from the one with the lowest protein content to the one with the most protein content.

c) Which muesli bar do you think is the most healthy to eat. Justify your answer by referring to the graph.

5. Danny Morrison played cricket for New Zealand as a fast bowler. The following display shows the number of wickets he took in each innings in test matches from November 1994 to March 1997.



How many times did Danny Morrison take

a) four wickets in an innings?

b) three wickets in an innings?

c) no wickets in an innings?

d) What was the highest number of wickets Danny Morrison took in any innings?

e) How many wickets did Danny Morrison take most often?

6. Dipak Patel also played cricket for New Zealand. He was a spin bowler and the number of wickets he took in test matches over the same period is shown in the table below:

No. of wickets	0	
	1	
	2	
	3	
	4	

No. of wickets in an inning	Frequency
0	6
1	3
2	8
3	1
4	2

a) Above (right) is Daniel's attempt at a pictograph for Dipak Patel's bowling, but it is not drawn correctly. Give at least 2 things that need to be corrected.

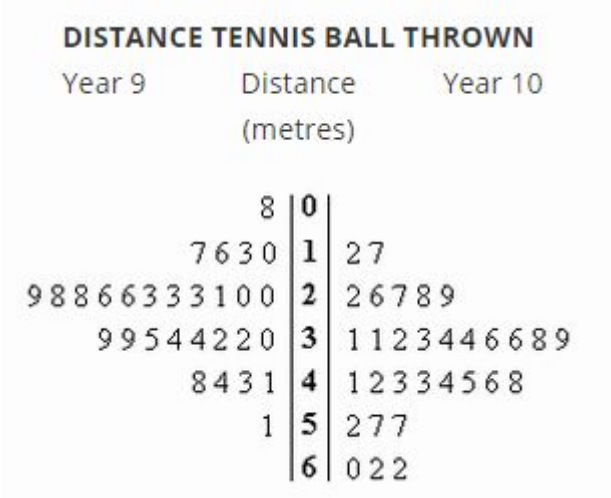
b) Who is the better bowler? Justify your answer.

Interpretation of stem and leaf graphs:

Tennis ball throw:

At Defoe College, the Year 9 students challenged the Year 10 students to a ball throwing contest. Each student threw a tennis ball and this distance was measured and recorded to the nearest metre.

Their results are plotted on the back-to-back stem-and-leaf graph below.



a) What was the distance of the:

i) longest throw? _____ metres

ii) shortest throw? _____ metres

b) What was the median distance thrown by:

i) Year 9 students? _____ metres

ii) Year 10 students? _____ metres

c) i) Tamiti said that Year 10 students threw the ball the furthest.
Is he correct? YES / NO (circle one)

ii) Explain your answer.

2. Two groups underwent a simple fitness test and their heart rates were measured after one minute of exercise. The results are shown in the back-to-back stem-and-leaf plot.

Heart rates

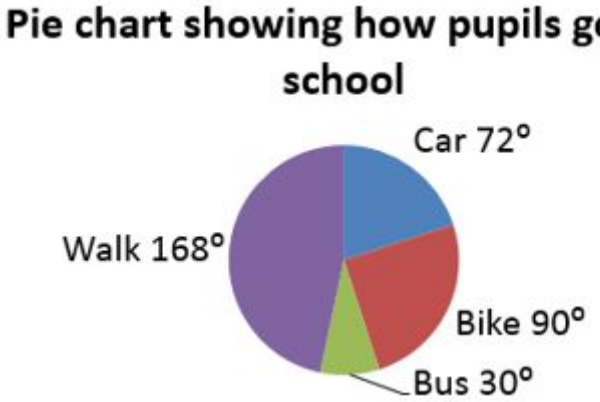
Group 1	*Stem*	*Group 2*
7 5 5	11	
9 9 9 9 8 8 7 7 6	12	5 5 6
6 6 4 4 0	13	4 6 8 8
4 2 0	14	2 3 6 6 7 8 8
	15	3 5 5 7
	16	2 4

a) What does the shape of the stem-and-leaf plot suggest about the data?

a) Calculate the median and interquartile range for each group and use them to compare the results for each group.

Interpretation of pie graphs:

1. Can you answer these questions?

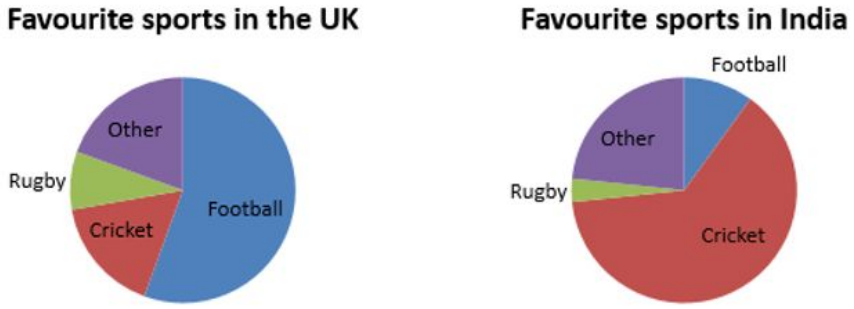


a) What is the most popular way for pupils to get to school?

b) If 15 people ride their bike, how many are driven by car?

c) How many people were surveyed?

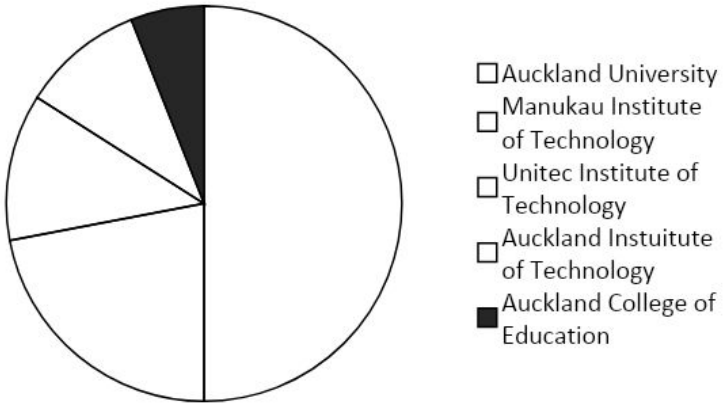
2. Can you compare these two pie graphs?



a) In which country was cricket is most popular sports?

b) Which country had the most people who prefer football?

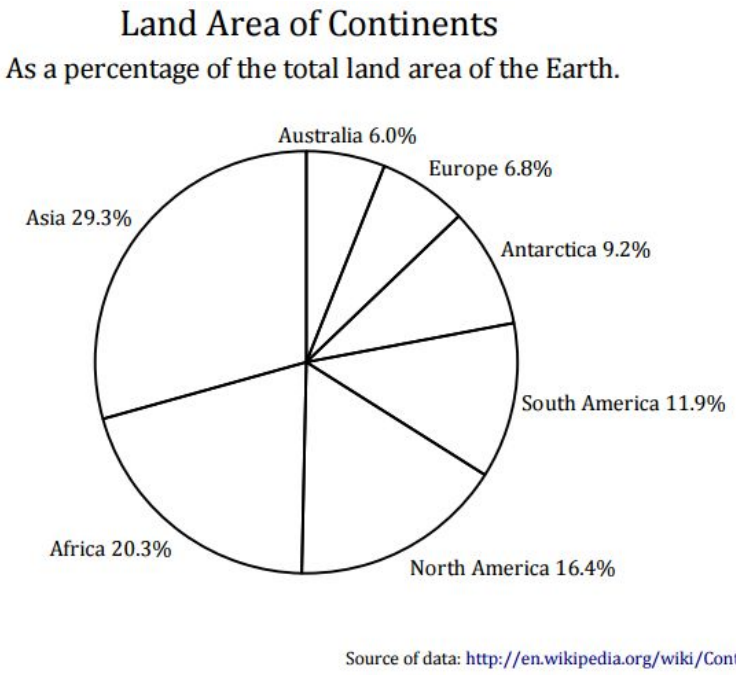
1. This pie graph was constructed from the amounts owed by students from 5 of Auckland's tertiary institutions in 1995.



b) Use the pie graph to complete the following sentences:
Students from _____ owe the most money, about _____% of the total amount owed. Students from _____ owe the second largest amount, about _____% of the total amount. Students from _____ owe the smallest amount.

c) The total amount owed by the students at these five places was $99.1 million. Students at Unitech owed $12.3 million. Explain why the angle at the centre of the Unitec sector is 45°, to the nearest degree.

2)



Source of data: http://en.wikipedia.org/wiki/Continents

a) What are the largest and smallest continents?

b) What percentage of the world's land area is made up of the Americas?

c) Which is larger: Africa or Australia, Europe and Antarctica put together?

d) If the land area of Africa is about 30 million square kilometres, what is the approximate land area of the Earth?

e) Is the size of the continent related to the number of people who live on that continent? Explain your answer.

Interpretation of line graphs and time series graphs:

What are time series?

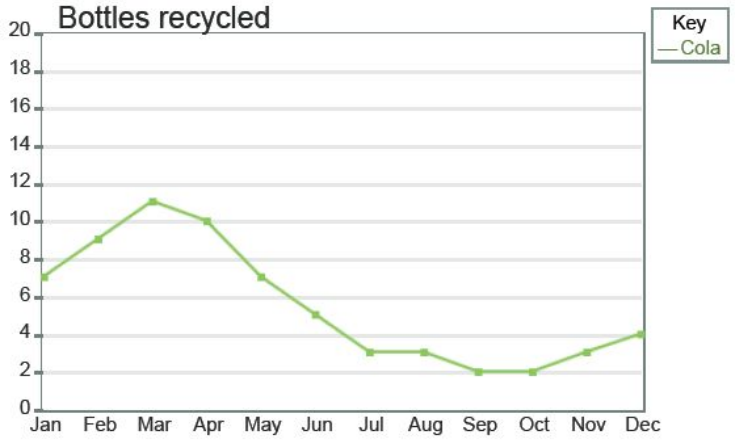
Time series show trend.

They plot results over periods of time – hence the name.

They are used to predict what could happen in the future.

Question one:

The graph below shows the number of Cola bottles recycled per household each month, over a one year period.



a) In which month were the most cola bottles recycled?

_____

b) In which month were the least cola bottles recycled?

_____

c) How many cola bottles were recycled in August?

_____

d) Why do you think the number of cola bottles recycled starts decreasing after March?

_____

_____

_____

e) Why do you think the number of cola bottles recycled starts increasing after October?

f) _____

_____

_____

g) Describe what this graphs shows you about cola bottles being recycled over a year and justify why this might be:

_____

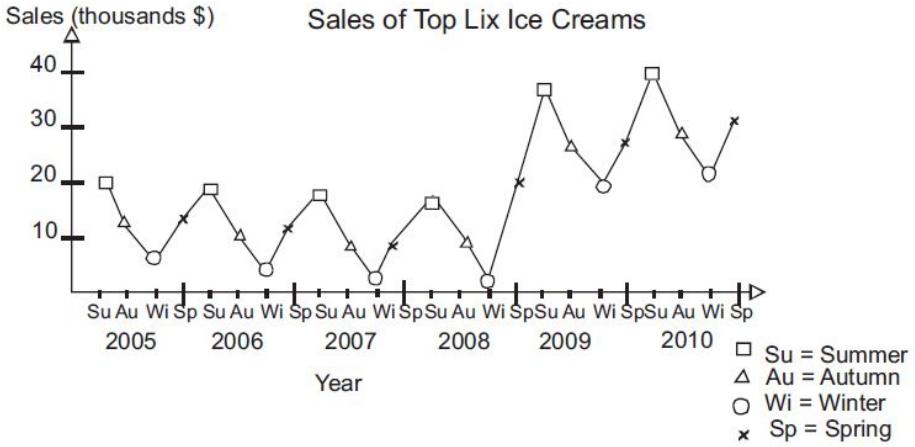
_____

_____

_____

____

2. This graphs shows Top Lix Ice cream Truck's sales (in thousands of dollars) for each season from 2005-2010.



a) In which year and month were the most Top Lix ice cream sales?

_____

b) In which year and month were the least Top Lix ice cream sales?

_____

c) Are Top Lix ice cream sales increasing or decreasing or decreasing over time? Give reasons for your answer from the graph.

_____

_____

_____

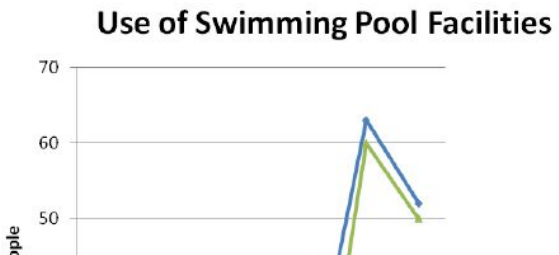
d) Describe the effect that the seasons have on the sale of Top Lix ice cream, justify your answer with evidence from the graph.

_____

_____

_____

3. The graph below shows the average number of people who use each area of a swimming pool facility over the course of one week.



a) Which day of the week represents a peak in the graph for the recreational pool and many people used the recreational pool this day?

_____

b) On which day do the least number of people use the Hydroslide and how many people used the hydroslide this day?

_____

c) On which day do two of the areas have the highest number of people using them? Why do you think this might be?

_____

_____

_____

d) Can you describe the **trend** for the number of people using the Recreational Pool and Hydroslide over one week and explain why this may be:

_____

_____

_____

_____

e) Can you describe the **trend** for the number of people using the Lane Swimming pool over one week and explain why this may be:

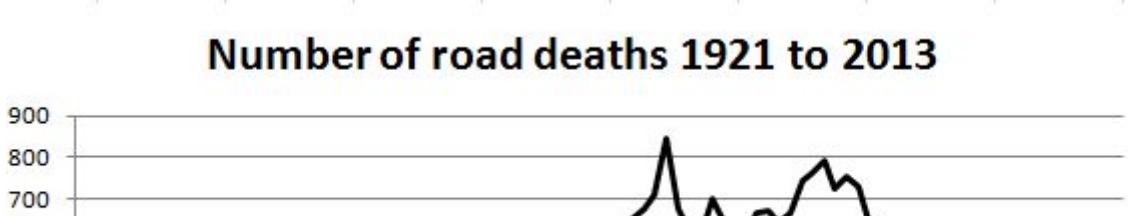
_____

_____

_____

_____

4. The graph below shows the number of people who died on New Zealand roads from 1921 to 2013.



a) Which year had the most road deaths in NZ and approximately how many were there?

_____

b) How many NZ road deaths were there (approximately) in 1951?

_____

c) Are the number of deaths on NZ roads increasing or decreasing from 1921-1972? Can you think of a reason why this might be?

_____
_____
_____
_____

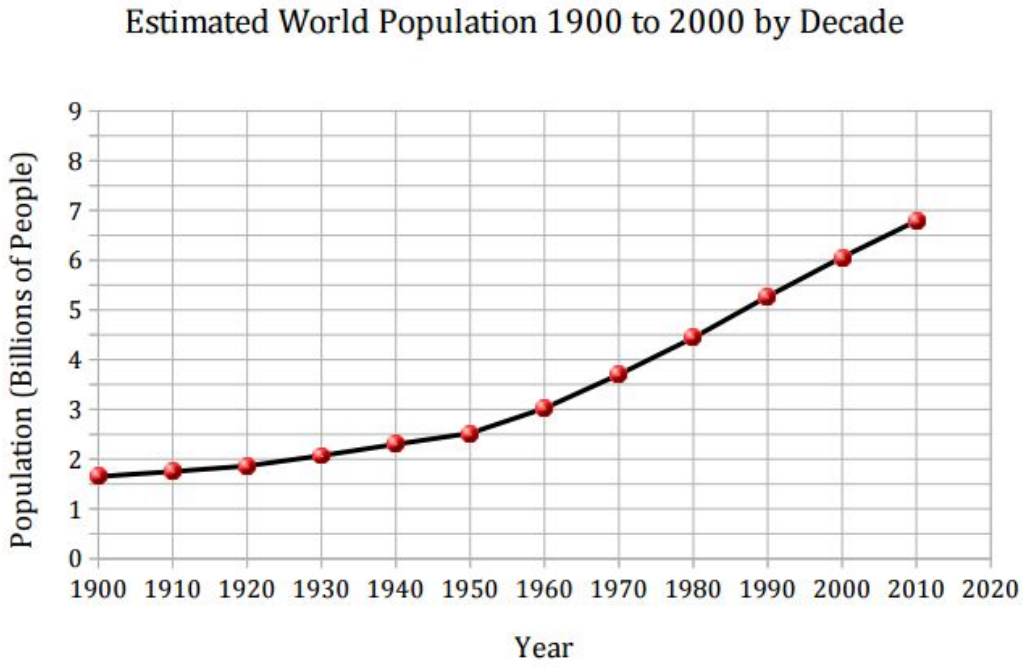
d) Describe what happens to the number of deaths on NZ roads after 1987. What do you think the reason is behind this trend?

_____
_____
_____
_____

e) What do you think the trend for the number of NZ road deaths will be in the long-term future? Give reasons for your answer.

_____
_____
_____
_____

5.



Source of data: http://www.un.org/esa/population/publications/sixbillion/sixbilpart1.pdf

a) Estimate the population of the world in 1970 based on this graph.

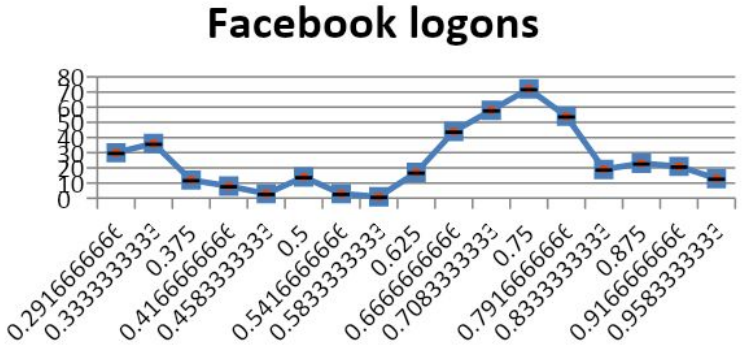
b) In what decade did the population increase the least?

c) In what decade did the population increase the most?

d) Estimate what the population will be in 2020 and extend the graph.

e) In what years did the population reach 2, 3, 4, 5 and 6 billion people?

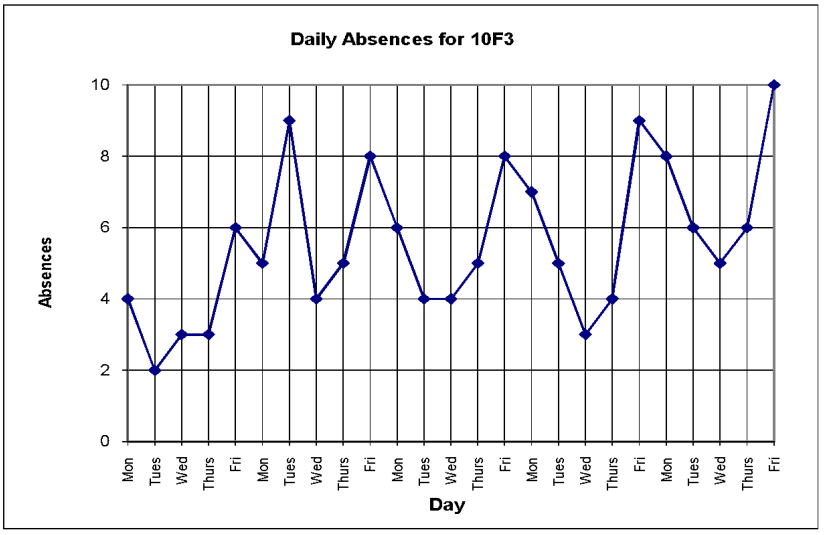
6. The graph below shows the number of year 9's that were recorded as logging onto facebook during a certain day



a) At about what time was the highest number of logons?
b) How many logons were there at 12:00?
c) Would you expect this to be a weekday or a weekend day? Why?

d) Describe what this graph shows you about facebook logons during this day and justify why this may be?

7. The number of absences for a tutor class each day over a period of five weeks at the start of the year is presented on the time series graph below.



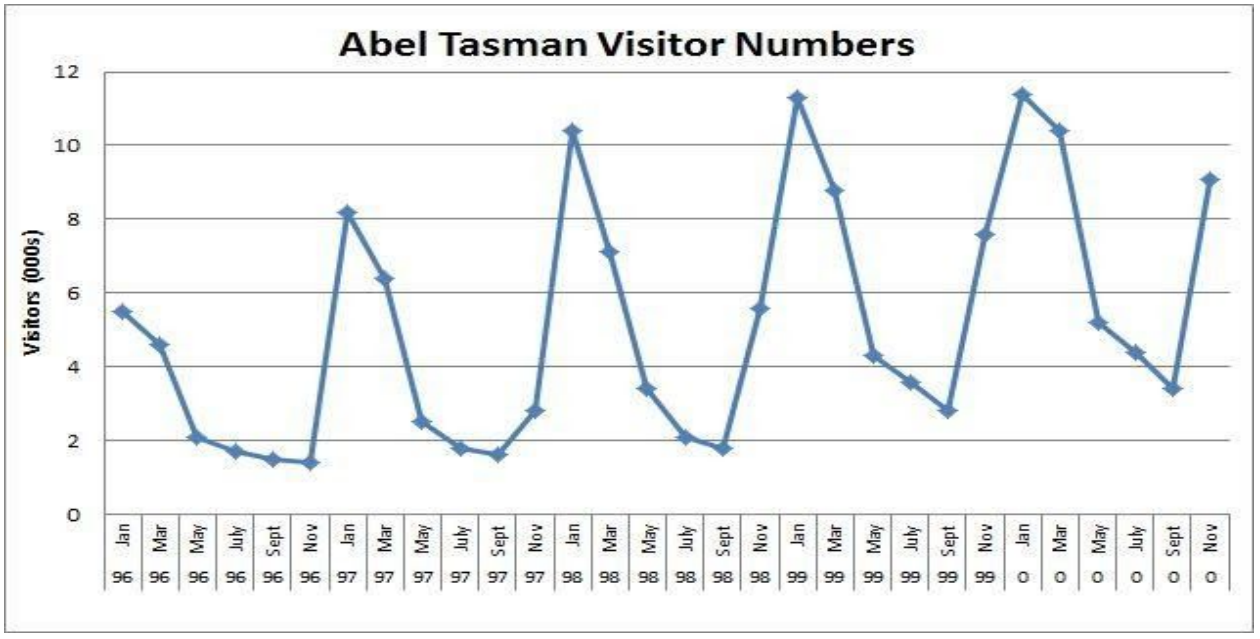
Use the graph to answer the following:

a) What is the long term trend in the number of absences?

b) Describe the seasonal pattern in the time series data.

c) Use the graph to estimate how many absences there would be on Tuesday of week 6.

8. The graph below shows the number of visitors to Abel Tasman from 1996 to 2000.



a) Which time period had the most visitors and how many were there?

b) How many visitors where there approximately during May ’96?

c) Describe the short term and long term trends of this graph.

9.

How do you draw them?

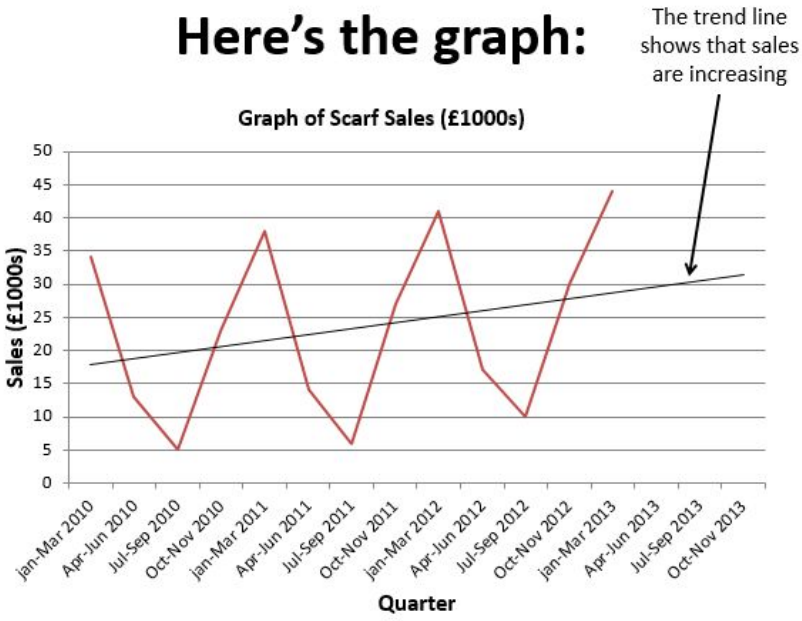
Below is a table showing the sales made by a small scarf company:

Quarter	Jan-Mar 2010	Apr-Jun 2010	Jul-Sep 2010	Oct-Dec 2010	Jan-Mar 2011	Apr-Jun 2011	Jul-Sep 2011	Oct-Dec 2011
Sales (£1000s)	34	13	5	23	38	14	6	27
Quarter	**Jan-Mar 2012**	**Apr-Jun 2012**	**Jul-Sep 2012**	**Oct-Dec 2012**	**Jan-Mar 2013**	**Apr-Jun 2013**	**Jul-Sep 2013**	**Oct-Dec 2013**
Sales (£1000s)	41	17	10	30	44	?	?	?

Are sales on the increase?

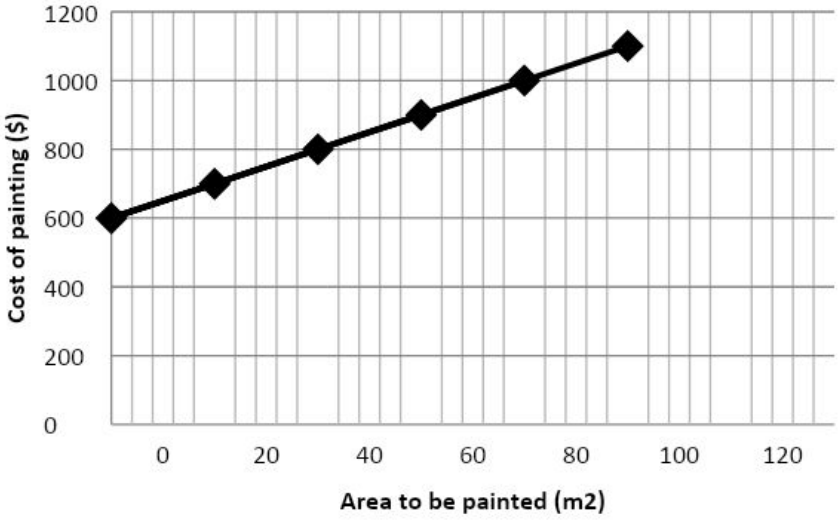
It’s difficult to tell, but a time series graph should show the sales’ trend.

Here’s the graph:



Write a description about the sales made a small scarf company:

Mixed graphs Interpretation:



1. Kingdom Decorators charge a fixed rate of \$600 and then \$50 for every $10m^2$ for painting a house. The graph of the charges is shown:

a Use the graph to work out the cost of painting $70m^2$.

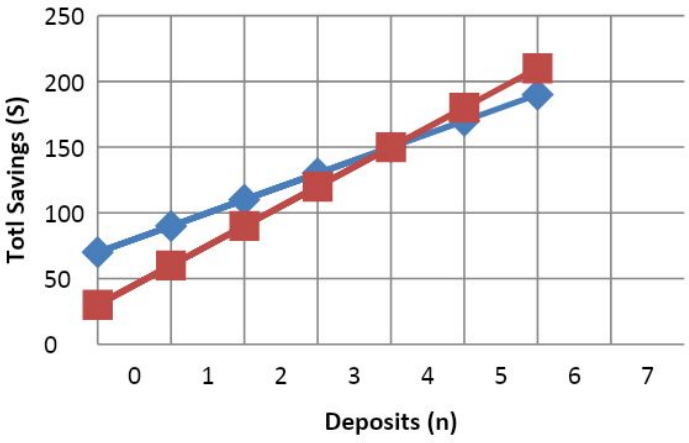
b The firm quotes \$1000 for a painting job. What area are they expecting to paint?

On the other hand, Quality Painters have a fixed charge of \$400 and then \$200 for every $20m^2$ they paint.

c How much will they charge for an area of $60m^2$?

d Graph the line for Quality Painters.

e What is the area that can be painted where both companies charge the same amount? How is this shown on your graph?



2. Harry and Cath both have jobs delivering newspapers to save money to use while on holiday at Christmas time. At the beginning of each

month, they deposit a regular amount of money. S represents the total amount of money they have saved in their bank accounts after n deposits.

Cath: S = 20n + 70 Harry : S = 30n + 30

a How much money does Cath have after she made 3 deposits?

b How much money does Harry have after 3 deposits?

c Which graph shows Cath's savings? Justify your answer.

d How much money did Harry have in his bank account to start with?

e The 2 graphs cross when the value of n is 4. Explain what this means.

Title: Chocolicious	
Introduction/Background Chocolicious is a new brand of cereal developed by Dodgycereal Limited. This cereal is not fussy to eat like muesli. Instead of pouring it into a bowl and then adding milk you simply peel the foil back from the rectangular block and eat it. The milk has already been mixed into the rich brown chocolicious block. You can even eat it on the way to school. How discerning are you?	
Problem 	**Are the claims provided by Dodgycereal correct or are they misleading?**
Plan/Data 	Dodgycereals had a plan. They surveyed 30 New Zealand teenagers about breakfast foods. To help you decide if Dodgycereal's claims are misleading they have provided you with the survey they used, the data they gathered and their analysis. The survey looked like this:

Employee number:_____

Dodgycereals Limited, your employer, believes students don't eat breakfast because the options parents buy are for old people. We have developed a new chocolate flavoured cereal block 'Chocolicious' for the young discerning intelligent gorgeous teenager.

Please ask your teenager the following questions:

1) Age _____
2) Gender: male/female
3) Do you eat breakfast Yes (go to Qu. 5)
   No (go to Qu. 4)
4) Why don't you eat breakfast? a) The cereal my parents buy is for old people
   b) It's too messy in a bowl, I'd rather eat a block of cereal
   c) I am too rushed in the morning to sit down and eat
5) Would you eat a chocolate flavoured block for breakfast? Yes/No

Thank you for completing this survey.

Dodgycereals Limited got their data from a single survey they conducted. All the 8 company employees who had teenagers took the survey home.

These tables show the results of the survey:

	Do you eat breakfast?	
Gender	Yes	No
Female	6	11
Male	4	9
Total	10	20

	Why don't you eat breakfast?			
Age	**The cereal my parents buy is for old people**	**It's too messy in a bowl, I would rather eat a block of cereal**	**I am too rushed in the morning to sit down and eat**	**Total**
9	1	1	1	3
10	2	1	1	4
11	2	1	0	3
12	4	1	1	6
13	3	0	0	3
15	1	0	0	1
Total	13	4	3	20

1. Which population did Dodgycereals claim to have investigated?

_____

2. Why do you think it is important to have more than one teenager in your sample?

_____

_____

3. Do you think 30 teenagers is a large enough sample to represent all the teenagers in New Zealand? Remember to give reasons.

_____

_____

Dodgycereals Limited got their data from a single survey they conducted. All the 8 company employees who had teenagers took the survey home.

4. Do you think this is a representative or biased sample of New Zealand teenagers? Justify your answer. _____

_____

Questions can also be biased if they try to influence the answers people give.

5. Do you think this survey is fair or biased? Justify your answer.

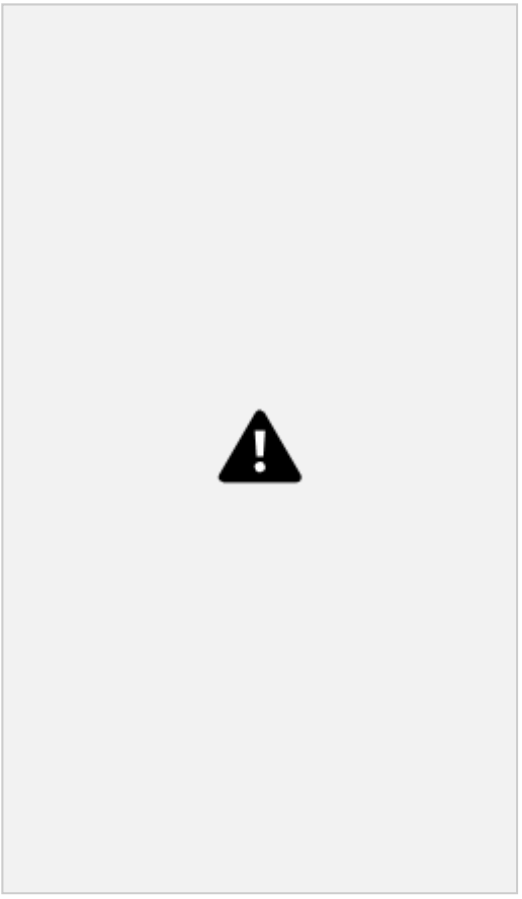
_____

_____

_____

Analysis

Here are the graphs and the claims that Dodgycereals Limited made.



- Hardly any teenagers eat breakfast – especially intelligent males.
- Females are more discerning than males because more of them don't eat breakfast.
- Females are also more gorgeous than males

Do you eat breakfast? (Graph 1)

6. What do you think about this graph and these claims?

_____

_____

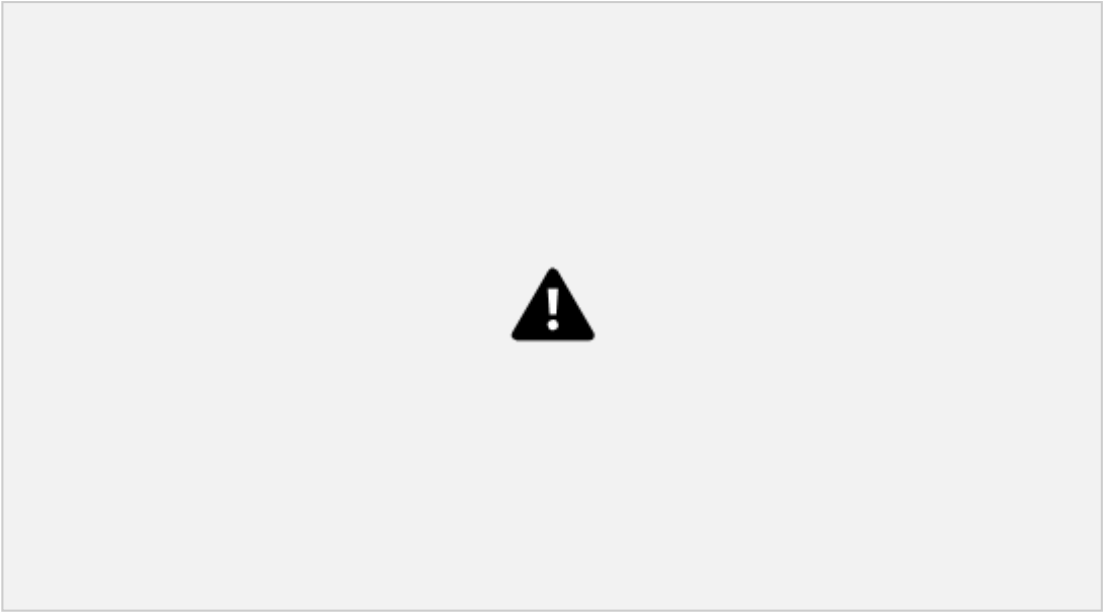
_____

7. What effect has the sample size, the way the teenagers were chosen to be in the sample and the survey questions had on the results?

_____

_____

_____



Dodgycereals Limited used this graph to claim that:

☆ Almost all teenagers don't eat breakfast because the cereal their parents buy is for old people.

☆ Younger teenagers are more disorganised than older teenagers as they are too rushed to eat breakfast in the morning.

☆ All 13-15 year old teenagers didn't eat breakfast because the cereal their parents buy is for old people.

Reasons why students don't eat breakfast (Graph 2)

8. What is misleading about this graph? (hint: check the data table for the older teenagers) _____

_____

Conclusion

You are now ready to answer the question we asked at the beginning of the work sheet.

Are the claims provided by Dodgycereal correct or are they misleading?

Remember to give reasons based on what you found out about the sample and the analysis.

Remember to use some statistical language in your conclusion.

_____

_____

_____

_____

Reflection

1. **Name two different ways Doddgycereal used graphs to mislead the reader.**

   _____

   _____

   _____

   _____

2. **Give one reason why the sample of 30 students from 8 employees is not representative of all NZ teenagers.**

   _____

   _____

   _____

   _____

Extension activity	The Dodgycereal survey suggests that 2/3 of students don't eat breakfast. Explore this finding using a sample from census at school. Go to www.censusatschool.org.nz/2007/questions/ to see the 2007 question on breakfast. Go to www.censusatschool.org.nz/2007/table-maker/ Variable 1: breakfastnone Variable 2: gender This will give you the total numbers that clicked the option "nothing" in the breakfast question and as well the number who selected "nothing" as an option for breakfast for each gender. Go to www.censusatschool.org.nz/2007/sampler to select a sample of students to explore further the types of breakfasts students had.

Reflection:

Based on your reflection which skills could you improve in the future: