

# PICTON HIGH SCHOOL

Creating Opportunities Achieving Success



## Year 12 Mathematics Task 1 - Data Assignment

<b>Due Date:</b> Wednesday 6 December Term 4 Week 9 9:00am			<b>Assessment Name:</b> Data Assignment		
<b>Mark:</b>			<b>Weighting:</b> 20%		
Part A	10 marks	All students			
Part B	9 marks	Advanced and Standard 2 only			
Part C	11 marks	All Students			
Part D	26 marks	Advanced only			
Part E	20 marks	Advanced only			

### TASK DESCRIPTION:

You are to use your knowledge and understanding of the skills covered in the preliminary and HSC Mathematics courses to answer a series of questions within the topics of:

#### Advanced

- Data and summary statistics and
- Bivariate data analysis.

#### Standard 2

- Bivariate data analysis

#### Standard 1

- Further statistical analysis

Your submission must include the use of graphing technology such as Excel to present your data.

You will be required to complete a statistical investigation to gather and record your data.

You will be given different parts to complete depending on the level of mathematics you are studying.

Each part will be submitted separately through CANVAS or by arrangement with your teacher

**Parts A will need to be completed by ALL students.**

**Part B will need to be completed by Standard 2 and Advanced students only**

**Part C will be completed by ALL students**

**Part D will be required to be completed by Advanced students only**

**Part E will be completed by Advanced students only**

Each part needs to be individually saved as a PDF document and uploaded onto Canvas. All parts will be due on the same day, but submission for each individual part can be made prior to the due date. You can submit an unlimited number of times up until the cut off time.

*NOTE: You will be allocated two lessons to work on this assessment task.*

## DIRECTIVES TO BE ASSESSED:

<b>Analyses</b>	To identify causes, key factors, relationships and possible results.
<b>Apply</b>	To use relevant information and skills for a given situation.
<b>Choose</b>	To select items or answer from a collection of values
<b>Communicate</b>	To choose the correct way to give a mathematical answer.
<b>Construct</b>	To create an argument or a sentence, by systematically arranging ideas or terms.
<b>Evaluate</b>	To figure out or compute.
<b>Justify</b>	To provide evidence to support your solution.
<b>Make</b>	To produce; cause to exist or happen; bring about
<b>Model</b>	To give a representation of mathematical problem obtained.
<b>Prove</b>	To provide logical evidence to support mathematical statements so support your mathematical claim.
<b>Provide</b>	To give a suitable solution or justification in context of the mathematical problem.
<b>Recognise</b>	To identify a mathematical relationship.
<b>Solve</b>	To manipulate something for a particular purpose to find the answer for mathematical problems.
<b>Use</b>	To manipulate something for a particular purpose to solve mathematical problems.

## ADVANCED SYLLABUS OUTCOMES TO BE ASSESSED:

<b>MA12-8</b>	<b>solves</b> problems using appropriate statistical processes
<b>MA12-9</b>	<b>chooses</b> and <b>uses</b> appropriate technology effectively in a range of contexts, <b>models</b> and <b>applies</b> critical thinking to <b>recognise</b> appropriate times for such use
<b>MA12-10</b>	<b>constructs</b> arguments to <b>prove</b> and <b>justify</b> results and <b>provides</b> reasoning to support conclusions which are appropriate to the context

## STNADARD 2 SYLLABUS OUTCOMES TO BE ASSESSED:

<b>MS12-Pre</b>	<b>Knowledge</b> and <b>skills</b> aquired in order to solve problems.
<b>MS2-12-2</b>	<b>analyses</b> representations of data in order to <b>make</b> inferences, predictions and draw conclusions
<b>MS2-12-7</b>	<b>solves</b> problems requiring statistical processes, <del>including the use of normal distribution and</del> the correlation of bivariate data
<b>MS2-12-9</b>	<b>chooses</b> and <b>uses</b> appropriate technology effectively in a range of contexts, and <b>applies</b> critical thinking to <b>recognise</b> appropriate times and methods for such use
<b>MS2-12-10</b>	<b>uses</b> mathematical argument and reasoning to <b>evaluate</b> conclusions, <b>communicating</b> a position clearly to others and <b>justifying</b> a response

## STNADARD 1 SYLLABUS OUTCOMES TO BE ASSESSED:

<b>MS12-Pre</b>	<b>Knowledge</b> and <b>skills</b> aquired in order to solve problems.
<b>MS1-12-2</b>	<b>analyses</b> representations of data in order to <b>make</b> predictions and draw conclusions
<b>MS1-12-7</b>	<b>solves</b> problems requiring statistical processes
<b>MS1-12-9</b>	<b>chooses</b> and <b>uses</b> appropriate technology effectively and <b>recognises</b> appropriate times for such use
<b>MS1-12-10</b>	<b>uses</b> mathematical argument and reasoning to <b>evaluate</b> conclusions, <b>communicating</b> a position clearly to others

## ASSESSMENT CRITERIA – STUDENT CHECKLIST:

Have you completed the questions in the relevant chapters to ensure you are aware of the content in this unit of work?

Have you completed all requirements of each part required saving each part in a pdf document?

Have you uploaded your files to canvas?

## Part A: Bivariate Data Analysis

### All students MUST complete Part A

In this part you are to investigate a situation that involves bivariate data. You will either collect first-hand bivariate data or find publicly available datasets relating **two** things which interest you.

(MAKE SURE YOU PROVIDE THE SOURCE).

1. You need to choose **two** measurements to collect numerical data.

You will need *at least* **50** data points.

For example:

- height of a person and length of their arm.
- number of hours of study each day and number of hours watching TV.
- time taken to travel to school and number of pets.
- outside temperature and humidity
- population of males versus females

*Research the data you may choose to collect to ensure you can easily record 50 data points.*

Some data can be found at:

[Australian Bureau of Statistics](#)

[Census at School](#) – a NZ website (use the Explore the Data – 2021/2022 / Sample to help choose)

[Our World in Data](#)

**Before collecting your data, discuss your choice with your teacher to ensure that it is suitable.**

**NO TWO students should be choosing the same sets of data!**

When submitting your assignment on canvas, begin by writing your name and the two measurements you have chosen to investigate.

For example:

Name: Jane Smith

Measurement 1: \_\_\_\_\_

Measurement 2: \_\_\_\_\_

2. Record and submit your data in a table similar to the one below (or attach the EXCEL printout clearly displaying the 50 data points you have collected)

DATA POINT	MEASUREMENT 1	MEASUREMENT 2
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		
25		
26		
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37		
38		
39		
40		
41		
42		
43		
44		
45		
46		
47		
48		
49		
50		

3. By inputting the data into EXCEL or otherwise, create a scatterplot to display your data.  
Ensure that there are appropriate for each axes and submit the scatterplot.
4. Describe the correlation of the data.
5. Draw a line of best fit, ensuring that there are appropriate labels for your graph.

**Part B: The following is for Standard 2 and Advanced only**

**This part will require analysis of the data that was acquired in Part A. This will be submitted through CANVAS, or other arrangement.**

**Question 1**

By using EXCEL or otherwise, calculate Pearson's correlation coefficient ( $r$ ) for your dataset. Show all working out through formulas, calculations and annotations.

**Question 2**

By observing your scatterplot and referring to  $r$ , make a statement about any association you have found. Justify your statement by referring to the form (linear/non linear), the direction (positive/negative) and strength (strong/moderate/weak).

**Question 3**

Using EXCEL or otherwise, find the equation of the least-squares line of best

**Question 4**

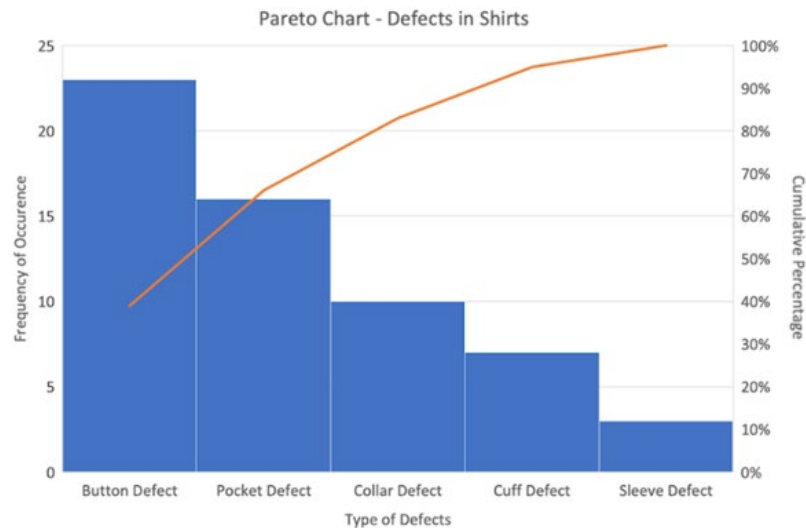
Evaluate how reliable your least-squares line of best fit would be for interpolating or extrapolating with.

## Part C: Pareto Charts.

**All students are to attempt this part and submitted on CANVAS.**

### Question 1

A Pareto chart is a way of displaying data.



A Pareto chart is useful in that it highlights the main contributors to a data set.

a) State three examples of where Pareto charts are used.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

The Pareto charts are linked to the **Pareto Principle**. This is commonly expressed as the rule of 80:20.

b) Explain what the 80:20 rule is in relation to the Pareto Principle, giving two examples of

where it has been observed.

---

---

---

---

---

A school is investigating the reasons why students are late to class.

Data was collected over the course of a week.

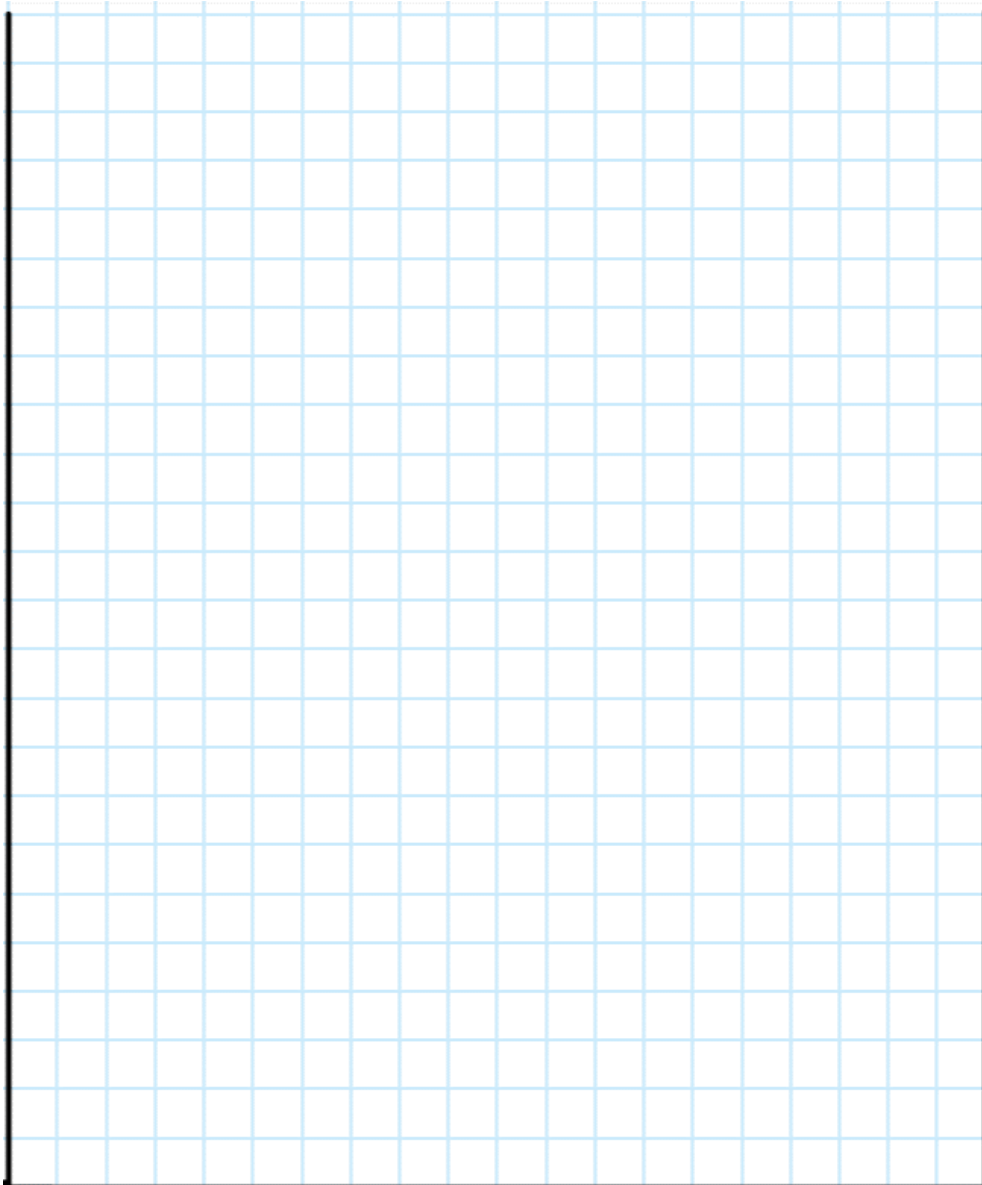
c) Enter your data into a table as below. Complete the cumulative frequency column and the cumulative percentage column.

<b>Reason</b>	<b>Frequency</b>	<b>Cumulative Frequency</b>	<b>Cumulative Percentage</b>
<b>Didn't hear the bell</b>			
<b>Toilet</b>			
<b>With another teacher</b>			
<b>Getting a drink</b>			
<b>Went to Student Sentral</b>			
<b>Went to wrong class</b>			
<b>Wellbeing</b>			
<b>Helping a friend</b>			
<b>Room Change</b>			
<b>Other</b>			



Part C is continued on the next page

d) Construct a Pareto chart of the data using the grid below and submit the completed chart.



This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.

**Part D Advanced students only – Data**

**provided Measures of Data**

- a. List three measures of central tendency.

---

---

---

- b. List three measures of spread.

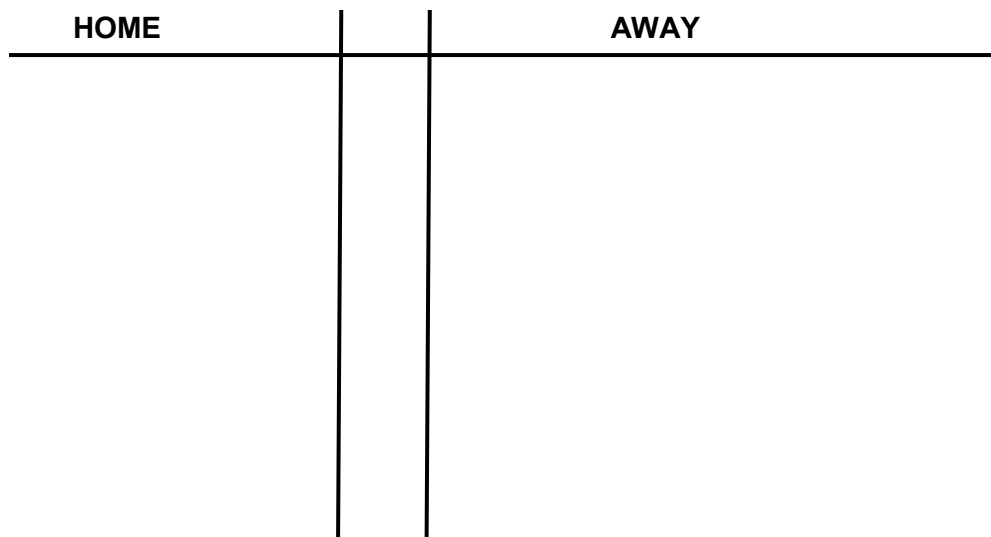
---

---

---

The number of points scored by a netball team in home and away games has been recorded on your data sheet.

- c. Display the data in an ordered back-to-back stem-and-leaf plot in the space below.



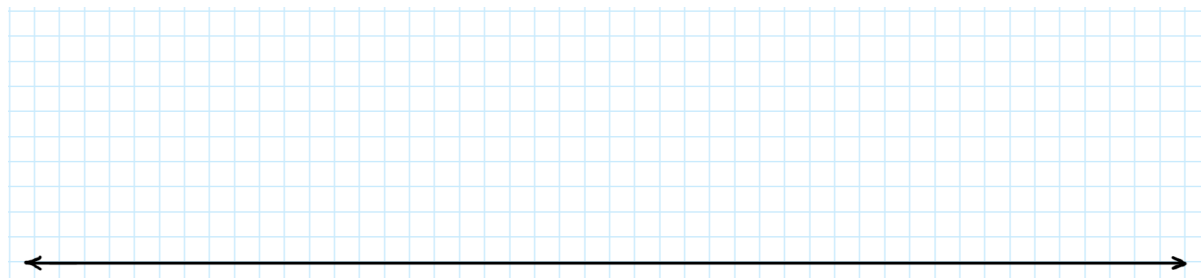
- d. Find the five-figure summary for the home data and the away data.

	HOME	AWAY
MIN		
Q1		
MEDIAN		
Q3		
MAX		

- e. Calculate the mean, range, standard deviation and IQR for the home data.

- i. Mean \_\_\_\_\_
- ii. Range \_\_\_\_\_
- iii. S.D \_\_\_\_\_
- iv. IQR \_\_\_\_\_

- f. Construct a parallel box-and-whisker plot for the home and away data.  
(If there are any outliers, do not include them in your plot.)



- g. Compare the shape of the two sets of data.

---

---

---

---

---

---

- h. Explain, with reference to appropriate measures of data, whether the home or away team is more consistent.

---

---

---

---

---

---

---

---

- i. Mean, mode and median can all be used to give an average value, but each can be considered more appropriate in different situations.  
Give an example for each measure where it is the most appropriate average value and explain why it is the most appropriate measure to use.

**MEAN**

---

---

---

---

---

---

**MEDIAN**

---

---

---

---

---

---

**MODE**

---

---

---

---

---

---

**Outliers (6 marks)**

A group of students had their heights measured to the nearest cm. The results are provided on your data sheet.

Copy your set of data below in ascending order :


- a. Calculate the mean and median for the set of data.

MEAN: \_\_\_\_\_

MEDIAN: \_\_\_\_\_

- b. Determine if there are any outliers for each set of data, using the formula below.  
(Show your working.)

**Lower Limit:**  $Q_1 - 1.5 \times IQR$

**Upper Limit:**  $Q_3 + 1.5 \times IQR$

- c. Calculate the mean and median, excluding any outliers.

**MEAN:** \_\_\_\_\_

**MEDIAN:** \_\_\_\_\_

- d. Describe the effect that the outlier had on the mean and median.

---

---

---

---

---

---

---

---



## Part E: Advanced only

## How well can Mathematics predict outcomes?

### Is the wisdom of crowds superior to the wisdom of any given individual?

Over 100 years ago at an agricultural fair, a competition was run asking participants to guess the weight of an ox displayed at the fair. Over 800 people participated and no-one guessed the exact weight; however, Francis Galton, a highly reputable statistician of the time, was intrigued by the competition. He analysed the guesses and was surprised to find that the average of all the guesses was almost exactly equal to the weight of the ox. The ox weighed 1198 pounds and the average guess was 1197 pounds. This led to a theory called the Wisdom of Crowds.

Before attempting this task, read the theory of the Wisdom of Crowds. Here are some websites to consider:

[The parable of the ox](#)

[The wisdoms of the crowd](#)

For this task you are to:

### Question 1

Design and deliver an experiment in which participants freely and privately provide a guess to the outcome of a guessing competition where the response provides numerical data

eg height of a tree, age of a person, lollies in a jar

Please be creative. Examples of experiments can be found on the internet.

You must submit

- The question you are going to ask the participants  
eg How many lollies do you think are in this jar?
- a copy of an image of what you are expecting participants to guess
- the result of a correct guess eg there are 98 lollies in the jar if participants were to correctly guess the number of lollies.



### Question 2

Ask 100 participants to take part in your guessing competition.

You must submit

- every guess you collect in any form you choose to use
- frequency table including a cumulative frequency column with all the guesses included displayed as shown below

Your submission can be using excel or any other form.

For example:

Guess	Frequency	Cumulative frequency
	Total	Total

- Using your data, calculate the mean and standard deviation showing all working
- A statement describing the shape/skewness of the distribution

### Question 3

Summarise and display your results using technology.

- Create two different graphs of the data you collected. You may submit your graph using technology eg excel. You can choose any type of graph to display your results eg bar graph, histogram, dot plot etc
- Ensure you include and labels needed

### Question 4

Using all your calculations and the data collected how valid is the driving question

**“Is the wisdom of crowds superior to the wisdom of any given individual?”**

Justify your answer using all the calculations in Part C