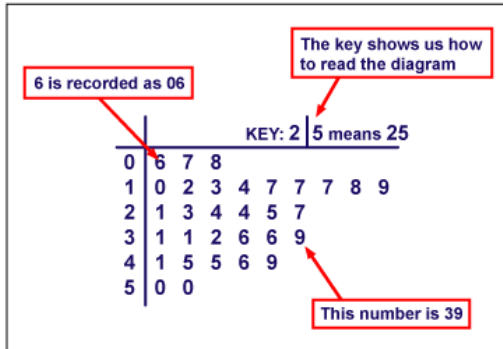


## Goals

Goals for this week:

- Identify examples of categorical data
- Identify examples of numerical data
- Display categorical data in tables and column graphs



## Theoretical Components

### STEP 1

#### Resources:

PDF file: Week 1 Notes and Exercises

#### This Week:

We will be learning:

- Classifying data – categorical, numerical
- Frequency tables
- Column graphs
- Using spreadsheets

## Practical Components

### STEP 2

Read through Week 1 Notes and Exercises for instructions on what to do.

There are 3 Exercises in this booklet. Read any worked examples before you begin.

**Remember to regularly check Google Classroom for messages.**

## Portfolio Task

### STEP 3

Complete the task at the end of the brief and submit your weekly work. 😊

Other

**Remember to check Google Classroom or [hawkermaths.com](http://hawkermaths.com) for each week's learning brief**

Make sure you have joined the Google Classroom. If you have not, see your teacher.



## ESSENTIAL MATHEMATICS 2

### WEEK 1 – CATEGORICAL AND NUMERICAL DATA

#### How are we ever going to use this?

- If you need to organise information you have collected
- When preparing a presentation of information for a group of people
- When evaluating data presented in the media

#### Classifying and Presenting Data

Statistics involves the collection of information. This is usually called data and collected in the form of numbers. This data is then organised – usually into tables and then analysed. This analysed data is used to pick out trends (e.g. is the average daily temperature rising) and importantly to make predictions (e.g. the average temperature of the earth in 50 years).

#### TYPES OF DATA

There are two main types of data.

**Categorical data** – also called qualitative data – is data that is grouped into categories such as colour of cars or favourite TV shows.

**Numerical data** – also called quantitative data – is information that is counted or measured such as the number of goals scored or height.

#### Example:

Classify each of the following as categorical or numerical.

- a. type of pet
- b. your part-time job salary
- c. heights of people
- d. favourite TV shows

#### Solution:

- a. involves words or categories – categorical data
- b. involves numbers – numerical data
- c. involves measurement – numerical data
- d. involves words or categories – categorical data

## Exercise 1

1. Classify each type of data as numerical (N) or categorical (C)

- a. number of people in our class
- b. number of pets in a family
- c. most popular sports
- d. ages of people
- e. types of cancer
- f. colours of cars passing a particular location each day
- g. number of cars passing a particular location each day
- h. route numbers on a bus
- i. goals scored in a football match
- j. favourite types of fast food
- k. time taken to get to school
- l. distances between suburbs

## REPRESENTING CATEGORICAL DATA – FREQUENCY TABLES & COLUMN GRAPHS

The **frequency** of a particular data value is the number of times the data value occurs. For example, if four students have a score of 80 in mathematics, then the score of 80 is said to have a frequency of 4. The frequency of a data value is often represented by  $f$ .

A **frequency table** is constructed by arranging collected data values in ascending order of magnitude with their corresponding frequencies.

### Example:

Heidi asked a group of her fellow students which night of the week they would prefer to have the school ball. She recorded the responses as T (Thursday), F (Friday), Sa (Saturday) and Su (Sunday). This is her data.

F, F, T, Sa, F, Sa, F, Sa, Sa, F, Sa, T, Sa,  
F, F, T, T, Su, F, Sa, T, Sa, F, F, F, F, T, T

Arrange this data in a frequency table.

### Solution:

To construct a frequency table, we proceed as follows:

**Step 1:** Construct a table with three columns. The first column shows what is being arranged in ascending order (i.e. the day of the week from Thursday to Sunday).

| Day of the week | Tally | Frequency |
|-----------------|-------|-----------|
| Thursday        |       |           |
| Friday          |       |           |
| Saturday        |       |           |
| Sunday          |       |           |

**Step 2:** Go through the list of data. The first one in the list is F, so put a tally mark against Friday in the second column. The second one in the list is F, so put another tally mark against Friday in the second column. The third one in the list is T, so put a tally mark against Thursday in the third column as shown below.

We continue this process until all marks in the list are tallied.

| Day of the week | Tally | Frequency |
|-----------------|-------|-----------|
| Thursday        |       |           |
| Friday          |       |           |
| Saturday        |       |           |
| Sunday          |       |           |

**Step 3:** Count the number of tally marks for each day and write it in the third column. The finished frequency table is as follows:

| Day of the week | Tally | Frequency |
|-----------------|-------|-----------|
| Thursday        |       | 7         |
| Friday          |       | 12        |
| Saturday        |       | 8         |
| Sunday          |       | 1         |
| <b>Total</b>    |       | <b>28</b> |

*Remember:*

We use the following steps to construct a frequency table:

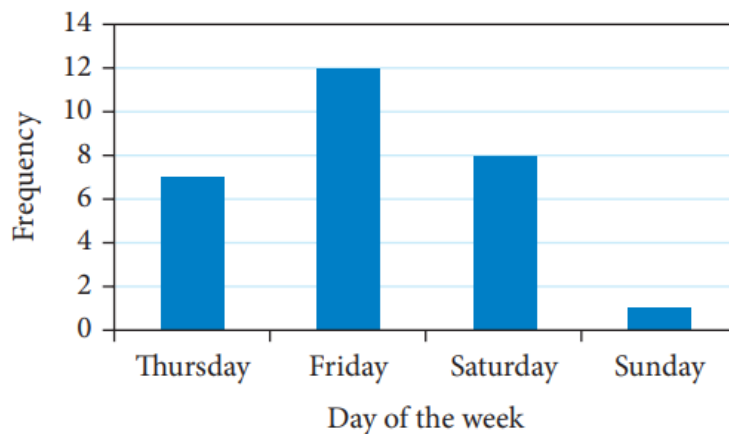
**Step 1:** construct a table with three columns. In the first column, write down all the data values in ascending order of magnitude.

**Step 2:** to complete the second column, go through the list of data values and place one tally mark at the appropriate place in the second column for every data value. When the fifth tally is reached for a mark, draw a horizontal line through the first four tally marks as shown for in the above frequency table. We continue this process until all data values in the list are tallied.

**Step 3:** count the number of tally marks for each data value and write it in the third column.

A **column graph** can then be used to provide a visual representation of the data.

The column graph for the above example is below:



The horizontal axis will be the days of the week.

The vertical axis will be the frequency.

Columns will have spaces between them.

## Exercise 2

1. Tina surveyed a selection of homes in her suburb to find out the ages of each child. She recorded the data as B for babies up to 2 years, P for pre-schoolers, I for those who attend infant school and O for children older than 8 years. This is the data:

B B O I O    O B P P P    O B I I O    O I I I P    O B B O I  
 P O O P I    P P O B I    I O P O O    B I P B I

- a. Arrange the data in a frequency table.

| Ages         | Tally | Frequency |
|--------------|-------|-----------|
|              |       |           |
|              |       |           |
|              |       |           |
|              |       |           |
| <b>Total</b> |       |           |

- b. What category of children contains the largest number of children?
- c. What percentage of children in the survey are babies?

2. Tina also undertook a survey of the number and type of pets owned by the families. She used D for dog, C for cat, M for mice, R for reptile, F for fish, O for other and N for none. The results were:

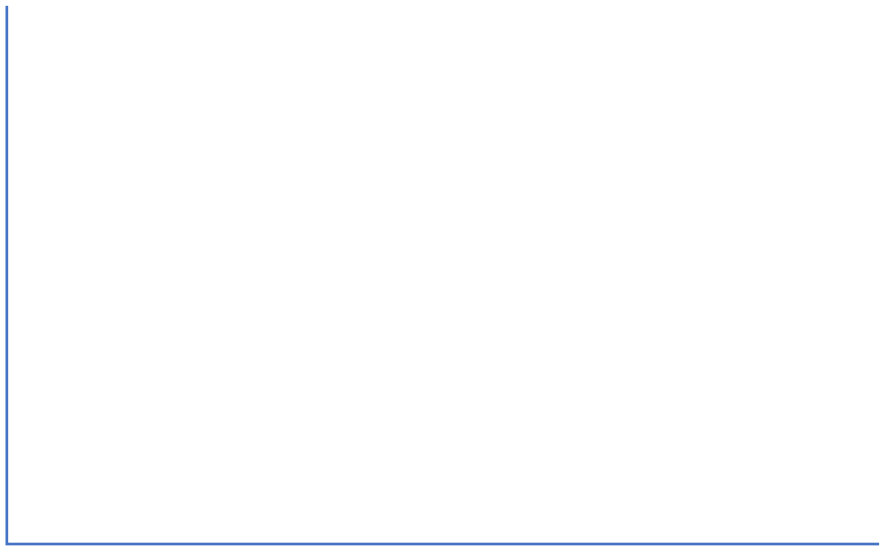
ROFDD      DRCCM      DCNDD      ORCCD  
 FNOND      NDDCM      MDMND      NMCDC

a. Arrange the data in the frequency table.

|              | Tally | Frequency |
|--------------|-------|-----------|
|              |       |           |
|              |       |           |
|              |       |           |
|              |       |           |
|              |       |           |
|              |       |           |
|              |       |           |
| <b>Total</b> |       |           |

b. What percentage of people had no pets?

c. Construct a bar chart of the data.





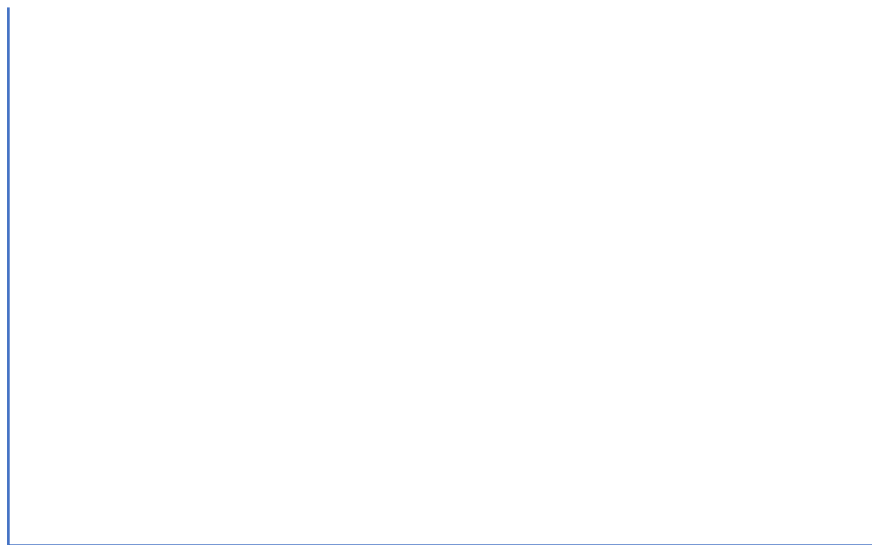
3. A survey of the colour of cars that passed Hawker College was made over a two hour period. The results were listed as black B, white W, blue b, silver S, red R, green G and other O. The results were as follows:

R B O W G    B B W O b    W S O R B    W b S O R    O W B b R  
 B b W B R    G S B S R    B G S R W    S b B G W    b S B W S

- a. Arrange the data in the frequency table. (4<sup>th</sup> column to be filled in part b)

|              | Tally | Frequency |  |
|--------------|-------|-----------|--|
|              |       |           |  |
|              |       |           |  |
|              |       |           |  |
|              |       |           |  |
|              |       |           |  |
|              |       |           |  |
|              |       |           |  |
| <b>Total</b> |       |           |  |

- b. In the 4<sup>th</sup> column, give the percentage breakdown of each colour.
- c. Construct a column graph of this data.



## USING SPREADSHEETS TO DISPLAY CATEGORICAL DATA

We can also use technology to summarise and display categorical data.

### Example

A survey is taken of a group of Math students' eye colour. The results are as follows:

|      |       |       |       |       |
|------|-------|-------|-------|-------|
| Blue | Brown | Green | Hazel | Hazel |
| Blue | Blue  | Brown | Green | Brown |

The raw data is entered into the Google Sheet as follows:

|    | A          |
|----|------------|
| 1  | Eye colour |
| 2  | blue       |
| 3  | brown      |
| 4  | green      |
| 5  | hazel      |
| 6  | hazel      |
| 7  | blue       |
| 8  | blue       |
| 9  | brown      |
| 10 | green      |
| 11 | brown      |

To create a frequency table:

1. Select the cells with source data you want to use.  
**Important:** Each column needs a header.
2. In the menu at the top, click **Insert > Pivot table**.
3. In the pop-up box, select where you want the pivot table to appear. Insert to existing sheet and select a cell for the table to appear. Click **create**.
4. In the side panel, next to "Rows" click Add, then select your header.
5. In the side panel, next to "Values," click Add, then select your header again.
6. You can change how your data is listed, sorted, summarized, or filtered. Next to what you want to change, click the Down Arrow ▾. We want "COUNTA" to count the frequencies.
7. Your frequency table should now be complete. Change the heading of the 2<sup>nd</sup> column from COUNTA to frequency.

The screenshot shows the 'Pivot table editor' window in Google Sheets. The data source is 'Sheet1!A1:A11'. The 'Rows' section has 'Eye colour' selected. The 'Values' section has 'Eye colour (Frequency)' selected, with 'Summarise by' set to 'COUNTA' and 'Show as' set to 'Default'. The 'Order' is set to 'Ascending' and 'Sort by' is 'Eye colour'. The 'Show totals' checkbox is checked. There are 'Add' buttons for Rows, Columns, Values, and Filters.

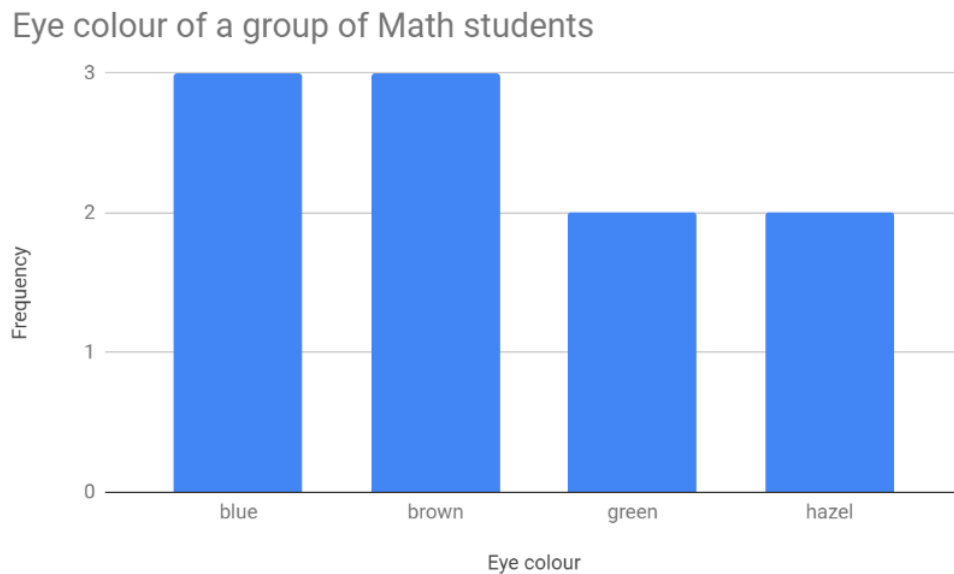
The frequency table is as follows:

| <i>Eye colour</i>  | Frequency |
|--------------------|-----------|
| blue               | 3         |
| brown              | 3         |
| green              | 2         |
| hazel              | 2         |
| <b>Grand Total</b> | <b>10</b> |

To create a chart:

1. Highlight the data in the frequency table (including the headings but excluding the grand total).
2. In the menu at the top, click **Insert > Chart**
3. A chart will appear. In the side panel, under “Chart type,” click the down arrow and select the chart you want to use to display your data.
4. You can customise your chart (including the title) by clicking on the “customise” tab on the side panel.

A column graph of the data is as follows:



### Exercise 3

Use Google Sheets to answer the following questions. Submit your Google Sheet via the assignment on Google Classroom.

1. Peter recorded the methods that students in his year use to travel to school. He recorded the data as W for walk, R for ride a bike, B for travel by bus, C for travel by car and T for train travel. This is his data:

B B C T W    R W W T C    T T C B R    W W R R R  
W W C R B    B W T W R    W W B R B    R W W T C  
R R W W T    C W R W W    C B W W R    R R W B R  
W R R W C    T R W W B    R R C B T    W R R B C

- Arrange this data in a frequency table.
  - Display your data in a column chart.
  - What is the most common way for students in Peter's year to travel to school?
  - What is the least common travel method?
2. Anna is organising a guessing competition with a jar of jellybeans. She counted the colours of the jellybeans in the jar.

| Colour    | Red | Black | Purple | Pink | Orange | White |
|-----------|-----|-------|--------|------|--------|-------|
| Frequency | 110 | 50    | 20     | 40   | 60     | 80    |

Display this data as a column graph.

3. Jasmine asked thirty students in Year 11 'What is your preferred brand of car?' Her results are shown below and coded as follows:

Holden = H, Ford = F, Toyota = T, Mazda = M, Subaru = S, Other = O

H H T F F    F M T O S    T H H H F    S M T T H    F F H H O    S T M H F

- Arrange Jasmine's data in a frequency table.
- Display your data in a bar chart.
- What is the most popular choice of car amongst these students?
- What percentage of students preferred Mazda?

## Week 1 Portfolio Task

### Olympic Records

Below are ten graphs showing how Olympic records have changed over time in ten athletic events.

The list of the ten events is given, in no particular order, to help you deduce which event belongs to each graph.

- |                          |                               |
|--------------------------|-------------------------------|
| 1. Men's High Jump       | 6. Men's Decathlon            |
| 2. Women's 10,000 metres | 7. Men's 4 x 100 metres relay |
| 3. Men's 100 metres      | 8. Women's 100 metres         |
| 4. Women's High Jump     | 9. Men's Javelin              |
| 5. Men's Long Jump       | 10. Women's 1500 metres       |

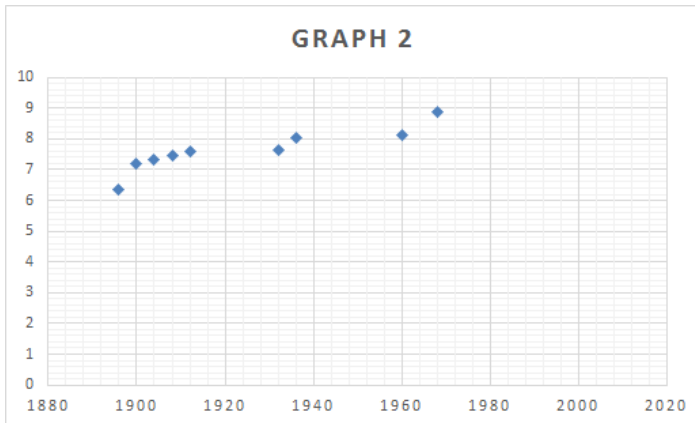
### Can you deduce which event each graph represents?

- Determine what the units might be on the vertical axis for each graph.
  - The x-axis represents the year of the event
- Some graphs show a decreasing trend and some an increasing trend. Identify those graphs and describe the trend.
- Are there any unusual features on any of the graphs? What might be a plausible explanation for them?

Be sure to write up your solutions next to each graph listing the **event**, labelling the **vertical axis with the appropriate units**, and discussing any increasing or decreasing trends and any **unusual features** (with explanations).

*The first one has been done for you.*

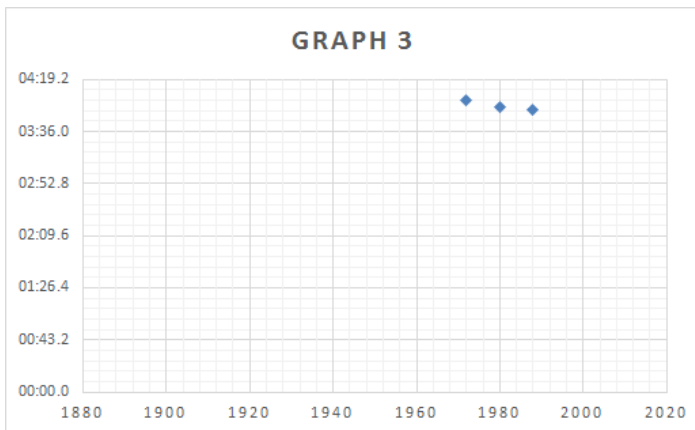
| Graph   | Description   |
|---|---|
| <p style="text-align: center;"><b>GRAPH 1</b></p> | <p>Event:<br/><i>Men's 100 metres</i></p> <p>Vertical Axis and Units:<br/><i>Time – seconds</i></p> <p>Features:</p> <ul style="list-style-type: none"> <li>• <i>Decreasing (ie. getting faster)</i></li> <li>• <i>The Olympic record of 9.63 seconds was set in 2012.</i></li> </ul> |



Event:

Vertical Axis and Units:

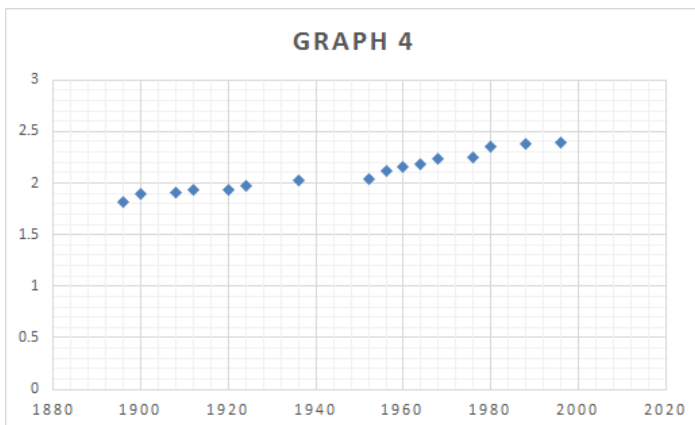
Features:



Event:

Vertical Axis and Units:

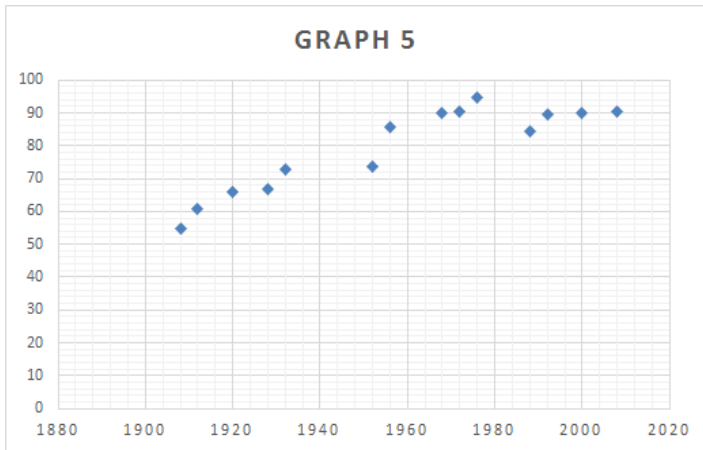
Features:



Event:

Vertical Axis and Units:

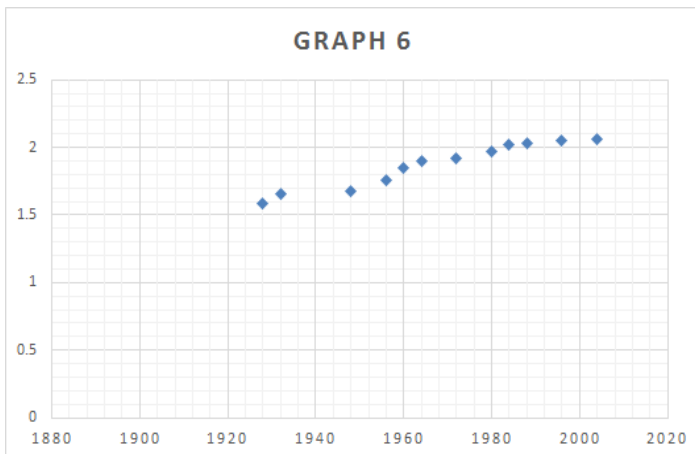
Features:



Event:

Vertical Axis and Units:

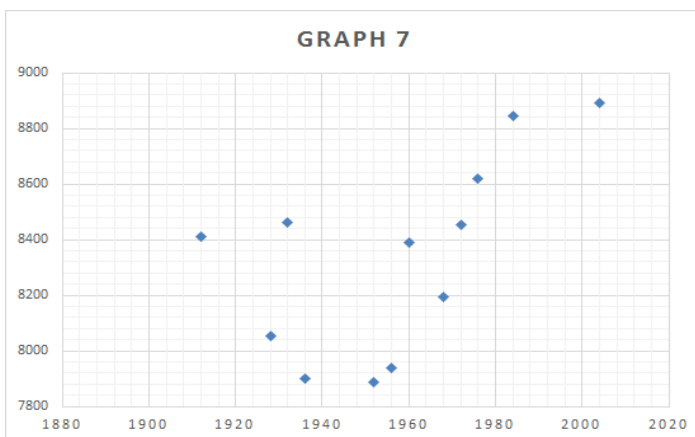
Features:



Event:

Vertical Axis and Units:

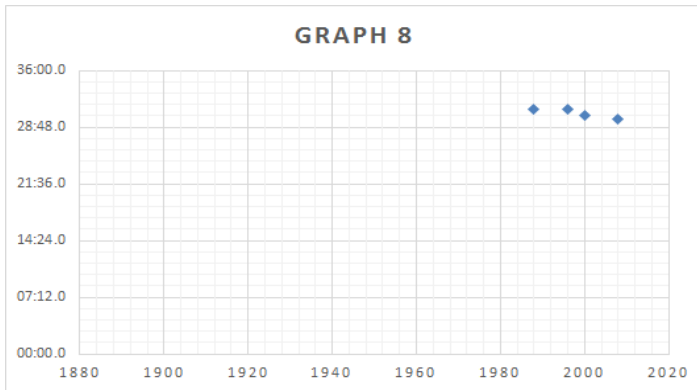
Features:



Event:

Vertical Axis and Units:

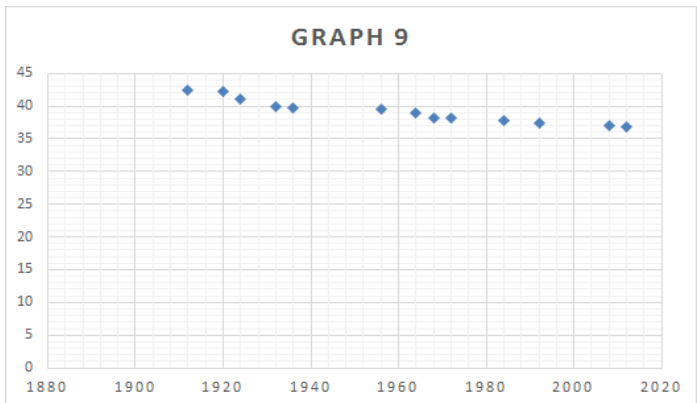
Features:



Event:

Vertical Axis and Units:

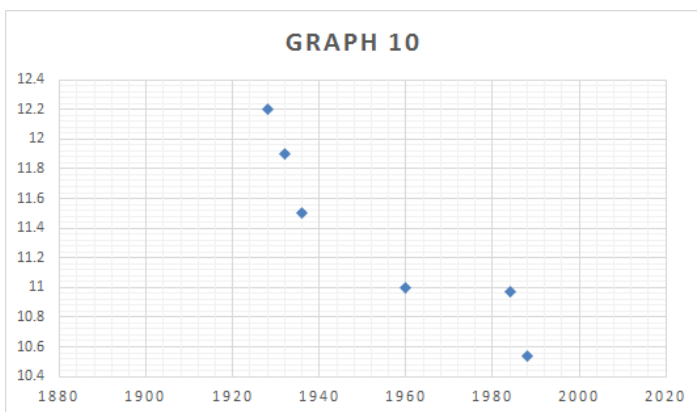
Features:



Event:

Vertical Axis and Units:

Features:



Event:

Vertical Axis and Units:

Features:



## MARKING RUBRIC

| CRITERIA                            | EXPECTATIONS  | POSS         | MULT | GIVEN | TOTAL      |
|-------------------------------------|---|--------------|------|-------|------------|
|                                     |   |              |      |       |            |
| <b>Practical</b>                    | Student completes practical work, including exercises of the brief to an acceptable standard set by the teacher.  | 2            | 3    |       | /6         |
| <b>Portfolio Task</b>               | Student completes the portfolio task of the week to an acceptable standard set by the teacher.  | 2            | 2    |       | /4         |
|                                     |   |              |      |       |            |
| <b>Reasoning and Communications</b> | Student responses are <b>accurate</b> and appropriate in presentation of mathematical ideas, with <b>clear</b> and logical <b>working out</b> shown.  | 4            | -    |       | /4         |
| <b>Concepts and Techniques</b>      | Student submitted work selects and applies <b>appropriate</b> mathematical modelling and <b>problem solving techniques</b> to solve practical problems, and demonstrates <b>proficiency</b> in the use of <b>mathematical facts, techniques</b> and <b>formulae</b> | 4            | -    |       | /4         |
|                                     | <b>Submission Guidelines</b>  |              |      |       |            |
| <b>Timeliness</b>                   | Student submits the exercises and portfolio tasks by the set deadline. See scoring guidelines for specific details.   | 2            | -    |       | /2         |
|                                     |   | <b>FINAL</b> |      |       | <b>/20</b> |

### Student Reflection:

How did you go with this week's work?

What was interesting?

What did you find easy?

What do you need to work on?