

August 1998

HIGHER STILL

Mathematics 2

Intermediate 2

Statistics

Support Materials



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First published 1998

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Mathematics: Mathematics 2 (Int 2) Statistics

MATHEMATICS 2 (INT 2) (STATISTICS) STAFF NOTES

Introduction

These support materials for Mathematics were developed as part of the Higher Still Development Programme in response to needs identified at needs analysis meetings and national seminars.

Advice on learning and teaching may be found in *Achievement for All* (SOEID 1996), *Effective Learning and Teaching in Mathematics* (SOEID 1993) and in the Mathematics Subject Guide.

This support package provides student material to cover the statistical content of the course at Intermediate 2. The depth of treatment is therefore more than is required to demonstrate competence in the unit assessment; that is, it goes beyond minimum grade C. The statistical content is set out in the landscape pages of the content for Mathematics 2 (Int 2) in the Arrangements document where the requirements of the unit Mathematics 2 (Int 2) are also stated. Students may have met much of this statistical work previously. For example, simple bar charts, line graphs and pie charts may be covered in some S1 – S2 courses.

The material is designed to be directed by the teacher/lecturer who will decide on the ways of introducing topics and on the use of the exercises for consolidation and for formative assessment. The topics lend themselves to active gathering of data for subsequent analysis and to simple experiments in probability. The first section on Graphs, Charts and Tables could be introduced by the collection of data, using Appendix 1. The data collected can then be used to construct bar graphs, line graphs, scatter diagrams and stem-and-leaf charts as appropriate. Alternatively, the bar graph, line graph, pie chart and stem-and-leaf diagram could be introduced using the examples within the exercises and within the staff notes.

Technology is a powerful teaching tool and students could be shown how technology can be used to construct graphs. The use of a spreadsheet package such as Claris Works allows students to choose the most appropriate form of graph for certain types of data. The emphasis throughout the section on Graphs, Charts and Tables should be on comparison and interpretation of graphs and diagrams. However, construction of graphs by hand is an important skill at this level and students will require to demonstrate competence in the construction of graphs in the unit assessment. Students could also be shown how to calculate the mean and standard deviation using the statistical functions of a scientific or graphical calculator, possibly in preparation for further study of statistics at Higher. However, at Intermediate 2 level it may be easier to restrict the teaching of the mean to 'sum of scores divided by the number of scores' and to use the simple definition of standard deviation given later.

An attempt has been made to have the 'easy' questions at the start of each exercise leading to more testing questions towards the end of each exercise. While students may tackle most of the questions individually there are opportunities for collaborative working. Staff will wish to discuss points raised with individuals, groups and the whole class.

The specimen assessment questions at the end of the package are not intended to be only at minimum grade C. The National Assessment Bank packages for Mathematics 2 (Int 2) contain questions which meet the requirements of this unit.

This package gives opportunities to practise core skills particularly the components of the Numeracy core skill, Using Number and Using Graphical Information, and Problem Solving. There will be some contribution to students' ease in using information technology if computers can be used for the spreadsheet work. Information on the core skills embedded in the unit, Mathematics 2 (Int 2) and in the Intermediate 2 course is given in the final version of the Arrangements document. General advice and details of the Core Skills Framework can be found in the Core Skills Manual (HSDU June 1998).

Brief notes of advice on the teaching of each topic are given.

Format of the Student Materials

- Exercises on Graphs, Charts and Tables
Check-up on Graphs, Charts and Tables
- Exercises on Use of Simple Statistics
Check-up on Use of Simple Statistics
- Specimen Assessment Questions
- Answers for all exercises.

Construction of Pie Charts

(Note this topic is not included in Maths 2 Intermediate 1)

Students to be encouraged to construct a table of calculations prior to drawing a pie chart. The following example could help:

A group of twenty-five-year-old people were asked to name the decade in which they felt the best pop music was written.

sixties – 45,	seventies – 12,	eighties – 36,	nineties – 27
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Draw up a pie chart to show these results.

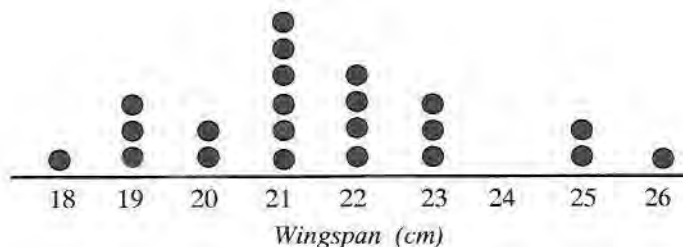
Decade	Number	Calculation	Angle (in pie chart)
Sixties	45	$\frac{45}{120} \times 360^\circ$	135°
Seventies	12	$\frac{12}{120} \times 360^\circ$	36°
Eighties	36	$\frac{36}{120} \times 360^\circ$	108°
Nineties	27	$\frac{27}{120} \times 360^\circ$	81°
Total Number	120	Total =	360°

Students should be shown how to use protractor to draw the pie chart. The importance of labelling a pie chart clearly should be stressed.

Exercise 9 may now be attempted.

Construction of a Dot Plot

Dot plots can be described as a quick simpler alternative to a bar chart (or histogram).



The above dot plot shows the wingspan of a flock of sparrows measured to the nearest centimetre. It can be presented to students and a short discussion on how to construct and interpret a dot plot will then take place.

Exercise 10 may now be attempted.

Construction of a Cumulative Frequency Table

The example below can be used to introduce cumulative frequency tables.

The table opposite shows the number of correct responses (out of 12) a group of 200 students made in a maths challenge competition.

Sometimes, it is more useful to know how many scored '5 or less' correct responses, or under 10' correct instead.

To do this, a third column, called the **cumulative frequency** has to be added.

The cumulative frequency column is formed by adding the frequencies, e.g. the cumulative frequency for '5' = $2 + 15 = 17$.

No. of correct responses	frequency
4	2
5	15
6	28
7	36
8	51
9	43
10	17
11	6
12	2
Total	200

Exercise 11 may now be attempted.

At this stage it is suggested that as an exercise, either at home or in class, Checkup Exercise 1 be attempted by the students.

This exercise tests all the topics in Graphs, Charts and Tables covered in Mathematics 2 (Int 1) and Mathematics 2 (Int 2).

Alternatively, this may be left till the end of the whole unit and used for general revision at that time.

USE OF SIMPLE STATISTICS

Range, mean, median and mode

Range

Range should be defined as **RANGE = Highest score – Lowest score**

Example: Find the range of teachers' ages in a school –

35, 42, 42, 45, 21, 36, 64, 22, 28, 27

Ans.: Highest score = 64

Lowest score = 21

RANGE = 43

Mean, median and mode all provide a measure of 'average' - they each have advantages and disadvantages depending on the data given. Examples should be given to illustrate the different uses of these three measures. Suitable examples can be found within the exercises.

Mean

The Mean is what most people think is 'the average'.

To find the mean simply ADD UP the scores and DIVIDE the sum by the number of scores, The mean should be defined as:

$$\text{MEAN} = \frac{\text{Sum of scores}}{\text{Number of scores}}$$

Note that the mean can be calculated exactly or to a specified rounding, so answers like 3.5 pupils are not uncommon. It should also be stressed that the mean does not have to be one of the numbers in the question, as in Example 2 and 3 below.

Example 1. Find the mean of:

2, 4, 6, 8, 10

Ans. MEAN = $\frac{30}{5} = 6$

Example 2. Find the mean of:

£2, £6, £12, £15

Ans. MEAN = $\frac{£35}{4} = £8.75$

Example 3. Find the mean, correct to 1 dec. pl.:

6 kg, 7 kg, 8 kg, 3 kg, 4 kg, 9 kg

Ans. MEAN = $\frac{37}{6} = 6.2 \text{ kg}$.

Median

Median should be defined as the **MIDDLE SCORE**, once the scores have been written in numerical order.

Note:

- the middle score has the same number of scores above it and below it
- for an ODD number of scores it is easier to select a median as there is a definite middle score
- for an EVEN number of scores there is no single middle score, so the median in this case is the average of the 'two middle scores'

Example 1. Find the median of:
8, 6, 4, 2, 2, 5, 8
Ans. Rearrange to:
2, 2, 4, 5, 6, 8, 8
MEDIAN = 5

Example 2. Find the median of:
8, 6, 4, 3, 2, 6, 7, 8
Ans. Rearrange to:
2, 3, 4, 6, 6, 7, 8, 8
MEDIAN = 6 (lies between the two
'middle sixes')

Example 3. Find the median of:
8, 10, 16, 19, 23, 12, 14, 15
Ans. Rearrange to:
8, 10, 12, 14, 15, 16, 19, 23

$$\text{MEDIAN} = \frac{14 + 15}{2} = 14.5$$

(14.5 is the average of the two middle numbers)

Mode

Mode should be defined as: the score which occurs **MOST FREQUENTLY**

Example 1. Find the mode: 3 3 3 4 4 5 5 5 5 6 6 6 6 6 6 6 6
Ans. MODE = 6

Note that the mode is NOT how many **times** the score occurs.

Exercise 1 Questions 1–7 could now be attempted.

Which measure?

A discussion should take place on which measure of 'average' to use, highlighting the points given below which provide an indication of when each measure is appropriate.

MEAN

- makes use of all the data
- can be calculated exactly if required
- BUT – it can be misleading if there is an unusually high or low score included.

For example, 2 90 90 98 100 has a mean of 76.

Four out of the five scores are well above the mean. It would therefore not be advisable to use the mean here! (The 'low 2' has affected the mean.)

In this case it would be better to use median or mode.

MEDIAN

- easy to understand
- the low/high scores do not affect it
- BUT – in small groups of numbers which have a rather odd pattern it may not fully represent the group.

For example, 3 3 3 3 3 3 4 4 5 9 has median 3.

The mean 4 might be a better average to use here.

MODE

- easy to understand
- the low/high scores do not affect it
- useful for finding out what most people want
- BUT – as in the example above where the mode is also 3, it may not be a good average to use.

Exercise 1 Questions 8–13 could now be attempted.

The last questions in this exercise involve problems involving the mean. These are intended as extension questions.

Example: A golfer has a mean score of 74 for four rounds.
If he scored 68, 80 and 72 for three of his rounds, what did he score in his fourth ?

$$\begin{aligned}\text{Ans.} \quad \text{Total Score} &= 74 \times 4 = 296 \\ \text{Total for 3 rounds} &= 220 \\ \text{Round 4} &= 296 - 220 = 76\end{aligned}$$

Exercise 1 Questions 14, 15, 16 could now be attempted.

Range, Mean, Median, Mode from a Frequency Table

Note that the RANGE and the MODE are both found in the same way as in Exercise 1.

Example:

Mark	Frequency
2	10
3	12
4	8
5	6
6	4
7	3
8	1

$$\begin{aligned}\text{RANGE} &= \text{Highest mark} - \text{Lowest mark} \\ &= 8 - 2 \\ &= 6\end{aligned}$$

$$\text{MODE} = 3$$

Students can be shown how to find the **MEAN from a Frequency Table**, i.e.

- an extra column is required in the table
- totals must be found.

Example:

Ans.
$$\begin{aligned} \text{MEAN} &= \frac{\text{Total } F \times x}{\text{Total } F} \\ &= \frac{43}{13} \\ &= 3.3 \\ &\text{(correct to 1 dec.pl.)} \end{aligned}$$

Age in years (x)	Frequency (F)	Age \times Freq (F \times x)
1	1	1
2	3	6
3	4	12
4	2	8
5	2	10
6	1	6
	13	43

Students can now be shown how to find the **MEDIAN from a Frequency Table**.

Note that it is still the **MIDDLE NUMBER** which is sought, as before.

Example: Find the median of these scores.

Score	51	52	53	54	55	56
Frequency	4	3	6	7	1	3

Ans. Total Frequency = 24 so Median must lie between 12th and 13th numbers.

51, ..., 51, 52, 52, 52, 53, ..., 53, 53, 54, ...

4 terms + 3 terms + 6 terms = 13

12th number = 53 13th number = 53

MEDIAN = 53

Exercise 2 could now be attempted.

Quartiles and the Semi-Interquartile Range

Students should be reminded that the **median** divides the data set into two distinct halves.

The **quartiles** simply divide the data set into four equal bits.

Define them as:

Q₁ = lower quartile, **Q₂** = middle quartile (or Median), **Q₃** = upper quartile

As a measure of 'spread', we already have the **range**.

Show by the following example that the range is sometimes misleading.

The ages of a group at a Sunday School trip are as follows :

2, 7, 7, 7, 8, 8, 8, 8, 8, 9, 9, 10, 10, 10, 25

(Mrs Dunbar, the Sunday school teacher, brought her son with her!)

Range = 25 – 2 = 23 years — (rather on the high side because of Mrs Dunbar and her son).

Q₂ = 8 (median) **Q₁** = 7 (lower quartile) **Q₃** = 10 (upper quartile)

Interquartile Range = Q₃ – Q₁ = 10 – 7 = 3

Semi-Interquartile Range (SIQR) = $\frac{Q_3 - Q_1}{2} = 1.5$

In this case, SIQR provides a better measure of spread.

Now a few further examples can be shown:

(a) 3, 6, 6, 8, 9, 11, 13

$$Q_2 = 8, Q_1 = 6, Q_3 = 11$$

$$\Rightarrow SIQR = (11 - 6) \div 2 = 2.5$$

(b) 4, 7, 9, | 10, 13, 17

$$Q_2 = 9.5, Q_1 = 7, Q_3 = 13$$

$$\Rightarrow SIQR = (13 - 7) \div 2 = 3$$

(c) 4, 6, | 6, 8, | 10, 10, | 11, 14

$$Q_2 = 9, Q_1 = 6, Q_3 = 10.5$$

$$\Rightarrow SIQR = (10.5 - 6) \div 2 = 2.25$$

Exercise 3(a) can now be attempted.

SIQR from a Frequency Table

The following example can be used to show students how to find SIQR from a frequency table. It can be pointed out that, though not necessary, a cumulative frequency column can help.

No. of people in the house	Freq	Cumulative Freq
2	2	2
3	6	8
4	11	19
5	20	39
6	7	46
7	4	50

this includes from the 9th to the 19th household, including the 13th.
(Q_1 lies in this group and = 4)

this includes from the 20th to the 39th household, including the 25th and 26th.
(Q_2 lies in this group and = 5)

this includes from the 20th to the 39th household, including the 38th.
(Q_3 lies in this group and = 5)

$$\Rightarrow Q_2 \text{ lies between the 25th and 26th household} = 5$$

This leaves 25 in the lower half and 25 in the upper.

$$\Rightarrow Q_1 = 13\text{th household's number of residents} = 4$$

$$\Rightarrow Q_3 = 38\text{th household's number of residents} = 5$$

$$\Rightarrow SIQR = (5 - 4) \div 2 = 0.5$$

This relatively small value shows that the distribution is tightly packed around the median score of 5.

Exercise 3(b) could now be attempted.

The Boxplot

A boxplot is a quick, neat way of showing the highest and lowest scores, the range, median, lower and upper quartiles as well as the median and interquartile range all in the one diagram.

Example:

Find the median and SIQR for the following set of numbers and draw a boxplot to show the results.

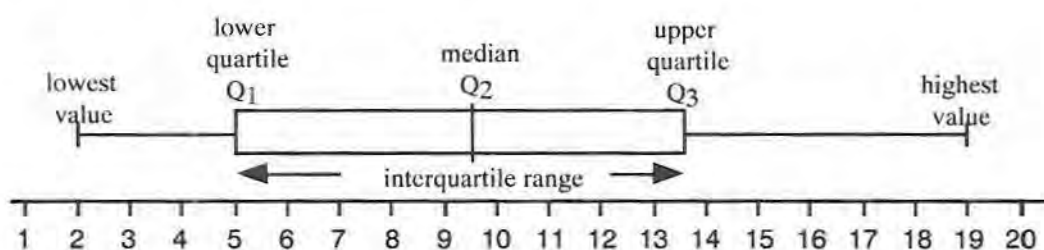
2, 3, 4, 6, 7, 8, 11, 11, 12, 15, 15, 19

It can be seen that $Q_2 = \frac{1}{2}(8 + 11) = 9.5$

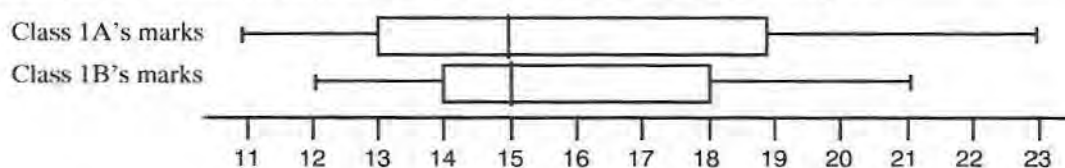
$$Q_1 = \frac{1}{2}(4 + 6) = 5$$

$$Q_3 = \frac{1}{2}(12 + 15) = 13.5$$

Boxplot:



The example below can be used to show how useful boxplots are for the comparison of data. Students should be shown how to analyse the data shown in the boxplot.



Exercise 4 could now be attempted.

The Standard Deviation

Three ways of measuring the 'measure of central tendency' have been considered, i.e. the 'middle' – the **mean**, the **median** and the **mode**.

The **range** and **semi-interquartile range** (SIQR) provide a 'measure of spread', but both these measures of spread have drawbacks.

- The range will always include extreme measures and may not indicate situations where the majority of the measures are closely packed around the middle.
- SIQR completely ignores extreme measures and concentrates solely on the bulk of the numbers in the middle set of scores.

A third and far more accurate 'measure of spread' is the **standard deviation** (s.d.). It takes into account where the bulk of the numbers lie, but it does not neglect the extremities.

For a small data set, and that is all the students will be presented with, (6 to 10 measures), define the **mean** and **standard deviation** as follows:

$$\Rightarrow \text{mean } \bar{x} = \frac{\sum x}{n} \quad (\text{read as 'x bar'})$$

$$\Rightarrow \text{s.d. } s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

Note:

- point out clearly the \bar{x} notation and the n
- define $\sum x$ as the 'sum of all the x 's'.

The definition for the **s.d.** could simply be given, but the teacher/lecturer may wish to go through the 'logical steps' to show where it arises from using this example:

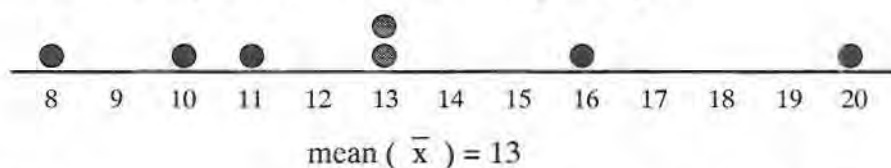
Example. Find the **standard deviation** of the following set of ages:

8, 10, 11, 13, 13, 16, 20

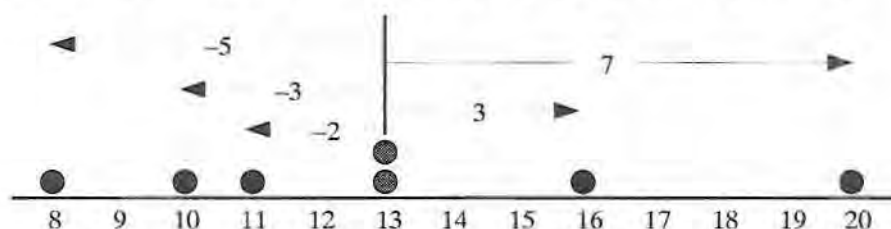
Step 1 Calculate the **mean**

$$\Rightarrow \bar{x} = \frac{\sum x}{n} = \frac{8 + 10 + 11 + 13 + 13 + 16 + 20}{7} = 13$$

Step 2 Look at the spread of the numbers using a **dot plot**.



Step 3 For each measure (x), find how 'far away' it is from the mean, \bar{x} .



Step 4 Introduce the table to simplify this.
(differences)

Score (x)	$(x - \bar{x})$	$(x - \bar{x})^2$
8	$8 - 13 = -5$	$(-5)^2 = 25$
10	$10 - 13 = -3$	$(-3)^2 = 9$
11	$11 - 13 = -2$	$(-2)^2 = 4$
13	$13 - 13 = 0$	$(0)^2 = 0$
13	$13 - 13 = 0$	$(0)^2 = 0$
16	$16 - 13 = 3$	$(3)^2 = 9$
20	$20 - 13 = 7$	$(7)^2 = 49$
		$\sum (x - \bar{x})^2 = 96$

Explain the reason for the 'squaring' is to eliminate the negative signs.
i.e. The sum of the squares of the differences (deviations from the mean) is **always** positive.

Step 5 The 'average' of the square of these 7 differences is now found by dividing by 7.

$$\Rightarrow \frac{\sum (x - \bar{x})^2}{n} = \frac{96}{7} = 13.7$$

Step 6 These differences were squared to eliminate the negative signs.
Therefore to find the **standard deviation** the square root of the answer must be taken.

$$\Rightarrow \text{standard deviation} = \sqrt{\frac{\sum (x - \bar{x})^2}{n}} = \sqrt{13.7} = 3.7$$

This is a more accurate 'measure of spread' since it concentrates on where the large bulk of measures lie but it also takes into account the extremes.

Exercise 5 could now be attempted.

After exercise 5, students can be shown how to use the statistical functions on a scientific calculator and can then check their answers quickly to the questions in exercise 5.

The following notes explain how to do so using a **Casio fx - 82SX** but the steps are similar on most calculators.

CASIO fx - 82SX

Step 1 Select the STATISTICS mode by pressing **MODE** **.**

Step 2 Press **SHIFT** **SAC** to clear all memories.

Step 3 Enter the data as follows (use the example on the previous page)

8 **M+** 10 **M+** 11 **M+** 13 **M+**
13 **M+** 16 **M+** 20 **M+**

Step 4 To display the summary of your data, use the **SHIFT** button as follows:

SHIFT 6 gives **n** (the number of measures) = 7

SHIFT 5 gives $\sum x$ (the sum of the x 's) = 91

SHIFT 7 gives \bar{x} (the mean) = 13

SHIFT 9 gives **s.d.** (the standard deviation) = 3.7

Lines of Regression

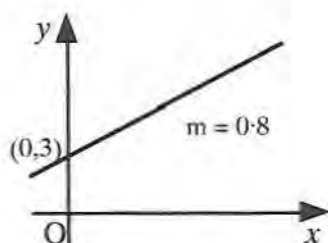
Exercise 6 is used as a revision covering gradients and equations of lines. Revise that (every) line can be written in the form

$$y = mx + c \quad (\text{rather than } y = ax + b)$$

including how to find the gradient. (either by using the gradient formula or simply by counting across and up)

Three examples:

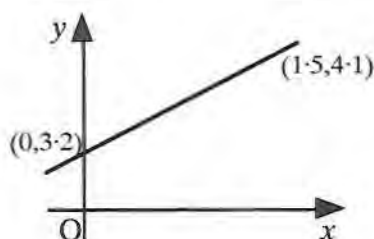
Example 1



$$y = mx + c$$

$$y = 0.8x + 3$$

Example 2

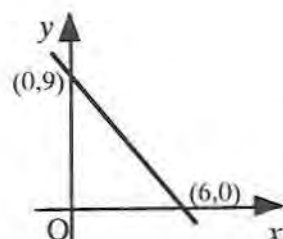


$$m = \frac{\text{vertical}}{\text{horizontal}} = \frac{4.1 - 3.2}{1.5 - 0} = 0.6$$

$$y = mx + c$$

$$y = 0.6x + 3.2$$

Example 3



$$m = \frac{\text{vertical}}{\text{horizontal}} = \frac{0 - 9}{6 - 0} = -1.5$$

$$y = mx + c$$

$$y = -1.5x + 9$$

Exercise 6 could now be attempted.

Line of best fit

Students can now be shown how to draw a **line of best fit** (by eye!) through a series of points when there is an obvious connection (or **correlation**) between the two variables.

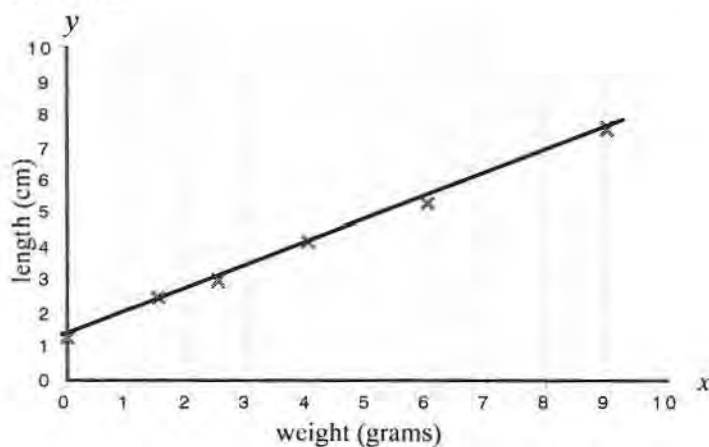
Question 1 (a) and (b) from Exercise 7 can be used as an introduction or the following example can be used.

Weights are placed on the end of a spring and the extension measured. The table shows the results.

Weights (grams) x	0	1.5	2.5	4	6	9
Length of Spring (cm) y	1.3	2.5	3.0	4.2	5.3	7.6

- Plot the points using a scale 1 cm = 1 unit on both axes.
- Draw the best fitting line (the line of regression)
- Use it to estimate the length of the spring when a 5 gram weight is attached.

Solution:



$$\text{gradient} = \frac{7.6 - 1.3}{9 - 0}$$

$$= 0.7 \text{ (approx.)}$$

$$y\text{-intercept} = 1.3 \text{ (approx.)}$$

$$\text{equation} \Rightarrow y = 0.7x + 1.3$$

$$\text{when } x = 5$$

$$\Rightarrow y = 0.7 \times 5 + 1.3$$

$$\Rightarrow y = 4.8 \text{ cm}$$

Exercise 7 may now be attempted.

'Simple' Probability

The following points should be included in a discussion on 'simple' probability.

- A 'cert.' is 1 or 100%
- A 'no chance' is 0
- $$P = \frac{\text{Number of favourable outcomes}}{\text{Number of possible outcomes}}$$
- Answers can be expressed as fractions, decimals or percentages.

Students should be encouraged to leave their answers in simplest form.

A simple introductory example is the rolling of a die, showing a 1, 2, 3, 4, 5 or 6. i.e. there are 6 possible outcomes.

There is a one in six chance of getting a five, i.e. $\frac{1}{6}$. Similarly the probability of getting a two can be found.

Further examples which could be introduced are the probability of - 'a prime number.', 'a square number.', 'a 7', etc.

Example 1.

A fish pond has 30 trout, 20 salmon and 10 eels in it.

What is the probability that a fisherman will catch:

- a) a trout b) a salmon c) an eel d) a herring?

Ans.

- a) 30 poss. out of 60 = $\frac{30}{60} = \frac{1}{2}$ b) 20 poss. out of 60 = $\frac{20}{60} = \frac{1}{3}$
c) 10 poss. out of 60 = $\frac{10}{60} = \frac{1}{6}$ d) No chance ! Prob. = 0

Exercise 8 Questions 1 - 12 could now be attempted.

Data could also be presented in tabular form. The following example is the same kind of dice problem, but in the form of a frequency table:

Example 2.

A boy rolls a dice 50 times and records the numbers in the table below.

From the table what is the probability that

- a) a 3 appears
b) a 2 appears
c) a number greater than 3 appears?

- Ans. (a) $\frac{10}{50} = \frac{1}{5}$
(b) $\frac{20}{50} = \frac{2}{5}$
(c) $\frac{15}{50} = \frac{3}{10}$

Exercise 8 could now be completed.

Students could now try Checkup Exercise 2.

Also included are the Assessment Exam Questions which can be attempted either in class or at home by the students as preparation for a unit assessment or the external assessment.

APPENDIX 1

Introductory Data Collection

Name: Sex: M ☐ F ☐

Month of Birth:

Favourite Colour from the list:	Red	—	<input type="checkbox"/>
	Green	—	<input type="checkbox"/>
	Blue	—	<input type="checkbox"/>
	Yellow	—	<input type="checkbox"/>
	Purple	—	<input type="checkbox"/>

Take out any coin at random from your pocket (purse) and write down the date on it

Without any ruler or measuring device, estimate (in millimetres) the length of this line:



What is your shoe size? What is your height?

Without measuring, place a neat cross at the point you think is exactly in the middle of the following line.



MATHEMATICS 2 (INT 2) – STATISTICS – STUDENT MATERIAL

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GRAPHS, CHARTS AND TABLES

By the end of this set of exercises, you should be able to:

- (a) construct and interpret graphs, charts and tables
- (b) construct a Cumulative Frequency Column for an ungrouped frequency table.

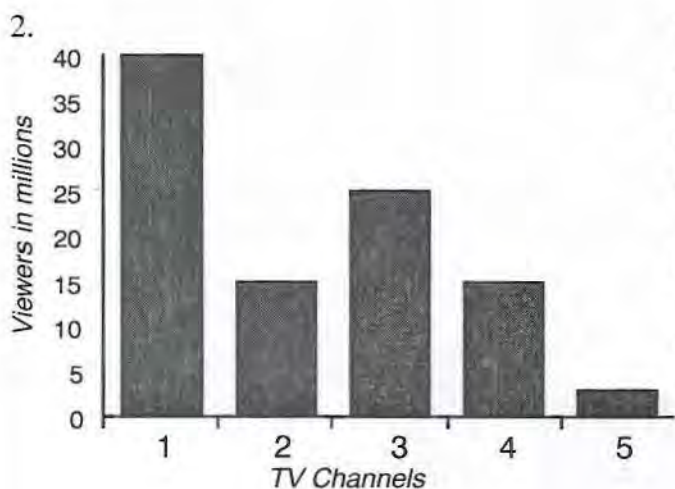
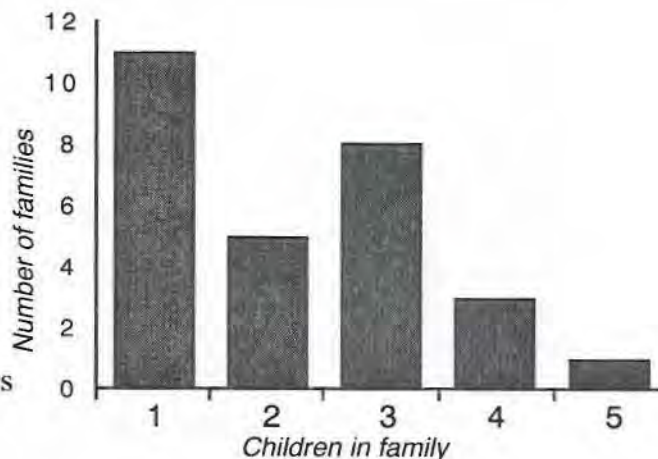
For part (a), you will find that the following points are also covered in Mathematics 2 (Intermediate1):

- (i) extract and interpret data from **bar graphs, line graphs, pie charts and stem-and-leaf diagrams.**
- (ii) construct **bar graphs, line graphs and stem-and-leaf diagrams, (charts)** from given data.
- (iii) construct and interpret a **scatter graph** (scatter diagram) from data.

The Bar Graph (Chart)

Exercise 1

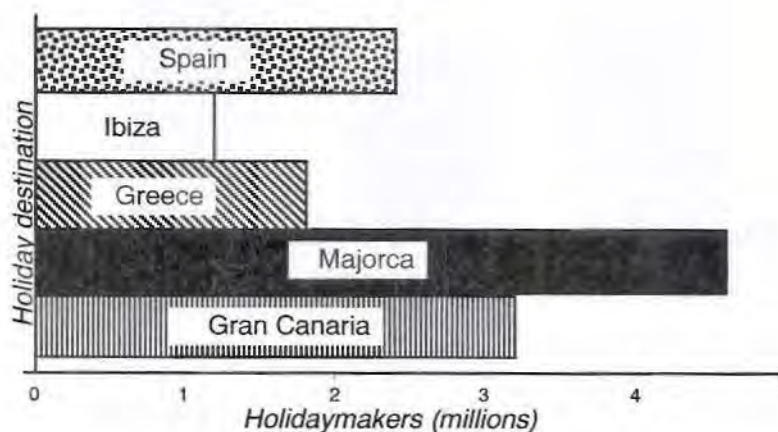
1. This bar graph shows the results of a survey into how many children were in the families of an S1 class.
 - (a) How many pupils had four children in their family?
 - (b) How many pupils had less than two children in their family?
 - (c) How many children were there in the class?
 - (d) How many of the class had no brothers or sisters? Explain.



This bar chart shows how many viewers regularly watch Channels 1 to 5 on television.

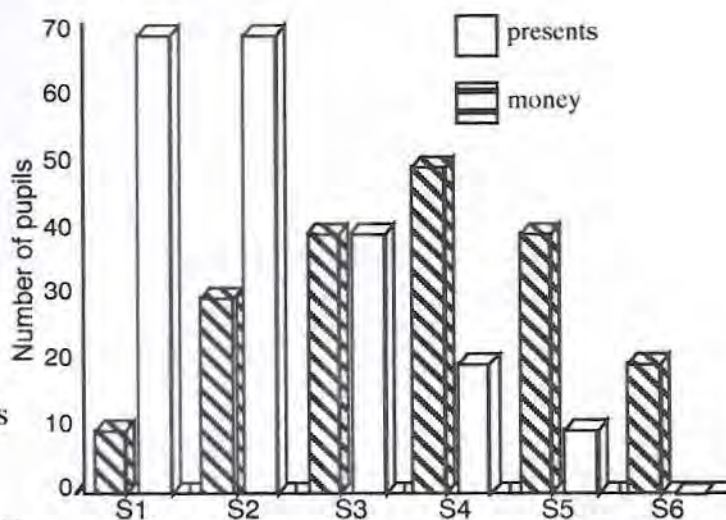
- (a) Which channel is the favourite one?
- (b) Which one is watched by the least number of viewers?
- (c) Which two channels have the same number of viewers?
- (d) How many people in total watch the channels?
- (e) Which station has about one quarter of the viewers?

3. This diagram shows the number of people (in millions) who went abroad on holiday in 1997.

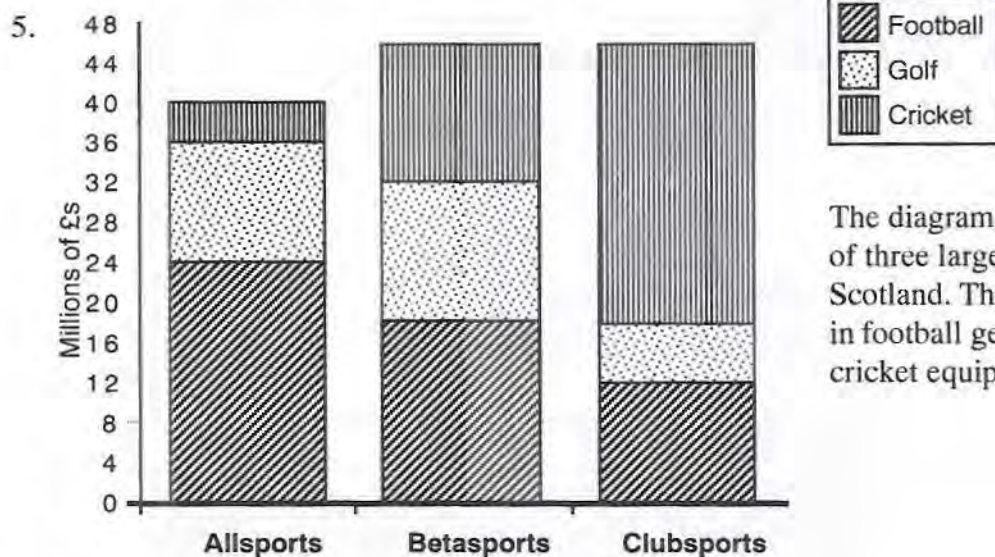


3. (a) Which country was:
 - (i) the most popular
 - (ii) the least popular?
- (b) Why is it difficult to give exact numbers?
- (c) Write down the names of the countries and estimate how many people went to each country.

4. A survey was carried out in a secondary school about the preference of pupils for presents or money for their Christmas gift. All pupils voted and the results are displayed in this compound bar chart.



- (a) Which year group has the greatest difference in the vote?
- (b) In which year groups did less than 30 pupils vote for presents?
- (c) In S4, what was the difference in the vote?
- (d) Which year groups have the same number of pupils voting for presents?
- (e) In which year group is the vote for presents the same as that for money?
- (f) How many pupils are in S1?
- (g) Why is there only one 'bar' for S6?



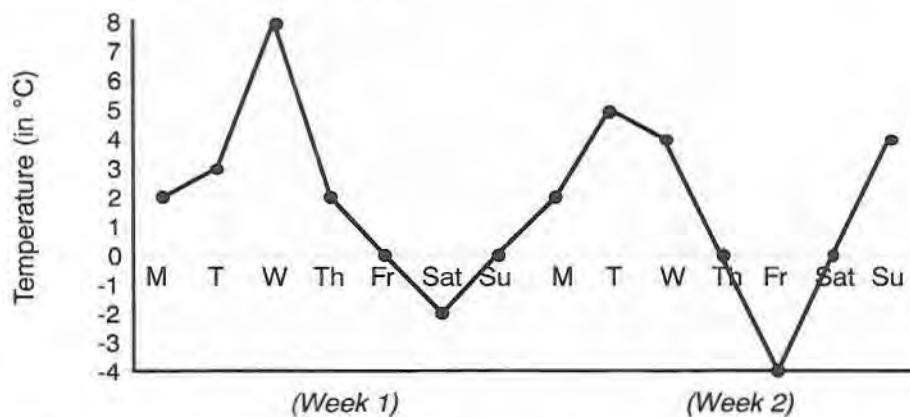
The diagram refers to the sales of three large sports shops in Scotland. Their major sales are in football gear, golf clubs and cricket equipment.

- (a) How much were the golf sales in Allsports?
- (b) What is the total sales for football gear in the three shops?
- (c) What is the difference between the amount of golf sales in Allsports compared with Clubsports?
- (d) What is the total sales of cricket gear in Betasports and Clubsports?

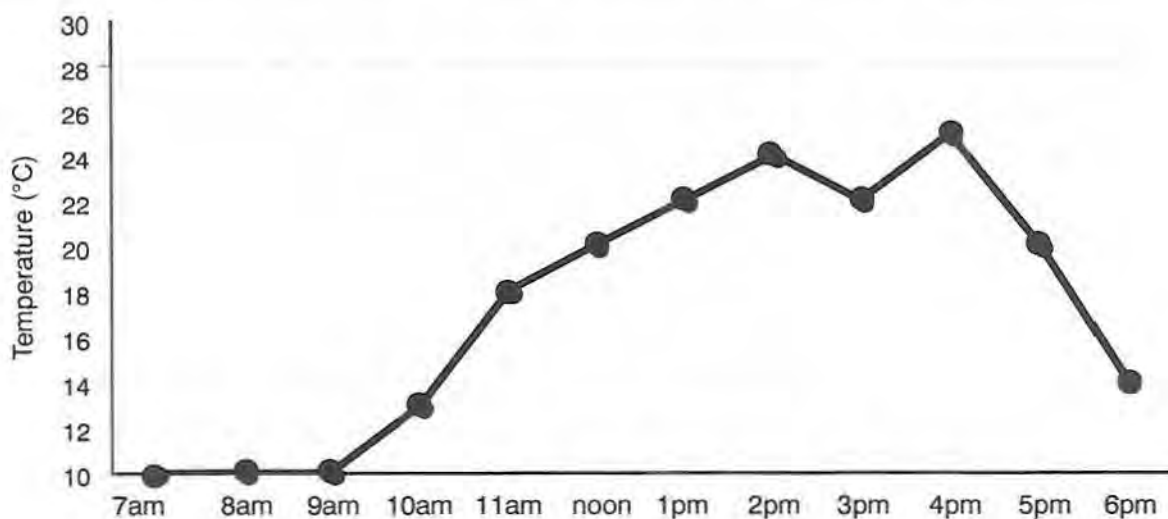
The Line Graph

Exercise 2

1. The temperature on top of a town hall was taken every morning at 1100. This line graph was made up from the recordings.

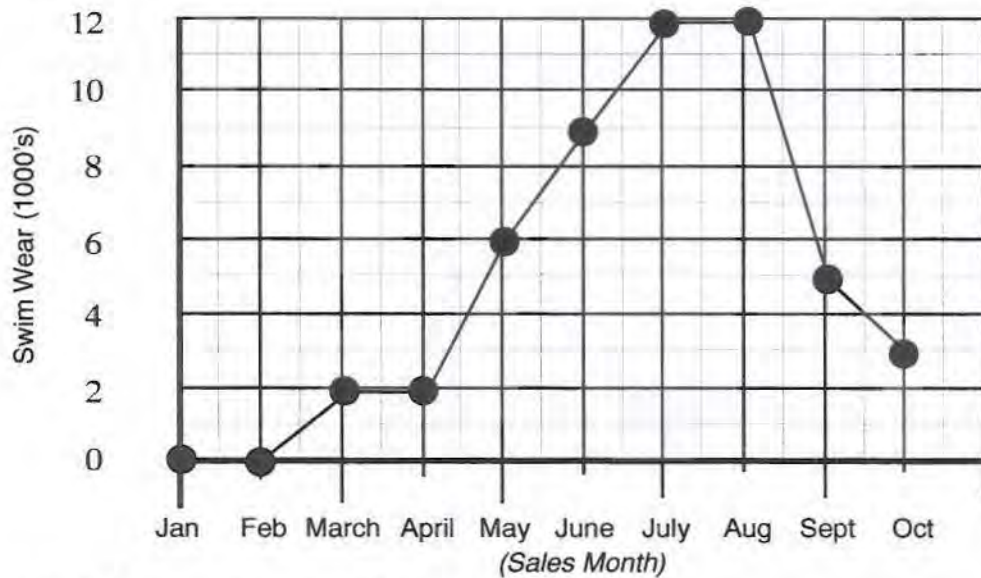


- What was the temperature on:
 - the Wednesday of week 1
 - the Friday of week 2?
- What was the fall in temperature from Tuesday, week 2 – until Friday, week 2?
- Between which two days was there the biggest rise in temperature?
- What was the trend of the graph from Wednesday to Saturday of the first week?



- Someone was also recording the temperature of the rooms inside the town hall every hour from when she arrived at 7 a.m. until 6 p.m..
 - When do you think that the heating was switched on?
 - What was the highest temperature?
 - When was this?
 - Suggest a reason for the sudden dip from 2 p.m. till 3 p.m.
 - Between which times did the temperature rise the most slowly?
 - What was the longest time that the temperature kept rising ?
 - When was the heating officially switched off?

3. The line graph shows the number of swimming trunks, bikinis etc. bought in a superstore during the months of January to October in a normal year.



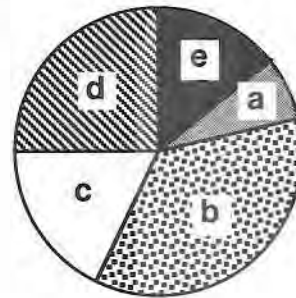
- (a) Why are sales so low during January?
- (b) When do the sales remain the same? (Three answers required.)
- (c) During which month do the sales rise the most?
- (d) When is the most dramatic fall in sales and by how much?
- (e) When are sales at a peak? Why is this?
- (f) Although sales are not great in September – why do you think that swim wear is still being bought?

The Pie Chart

Exercise 3

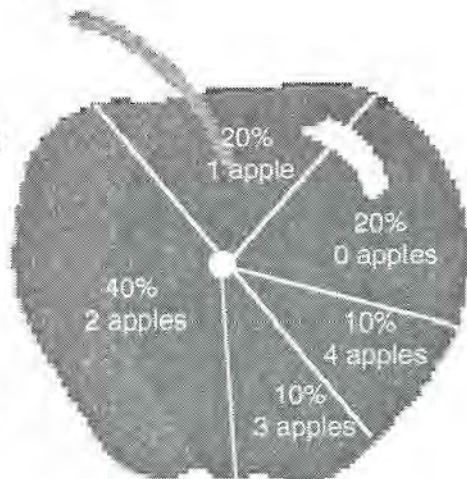
1. Mr. Johnston's Maths class has 28 pupils in it. They were persuaded to vote for their favourite maths topic. The pie chart shows how they voted.

Mr. Johnston's Maths Class

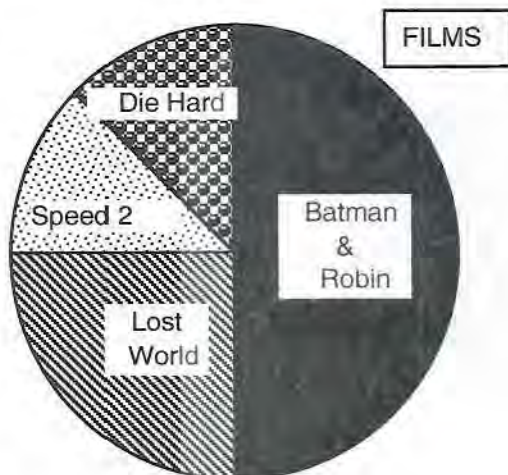


Sums 4
Trigonometry 2
Calculus 10
Statistics 5
Measurement 7

- (a) Which topic is represented by the letter:
(i) a (ii) b in the diagram?
- (b) What percentage of the class is represented by letter d?
- (c) What fraction of the class liked Sums?
2. A college canteen draws up a pie chart showing the number of apples eaten in a week by each of the 200 students who use the canteen.
- (a) Calculate how many of the 200 students eat:
(i) 3 apples in a week.
(ii) 1 apple in a week.
- (b) Use the answer to (i) to find how many apples are actually eaten by these '3-apple' students.
- (c) Calculate the **total** number of apples eaten in a week.



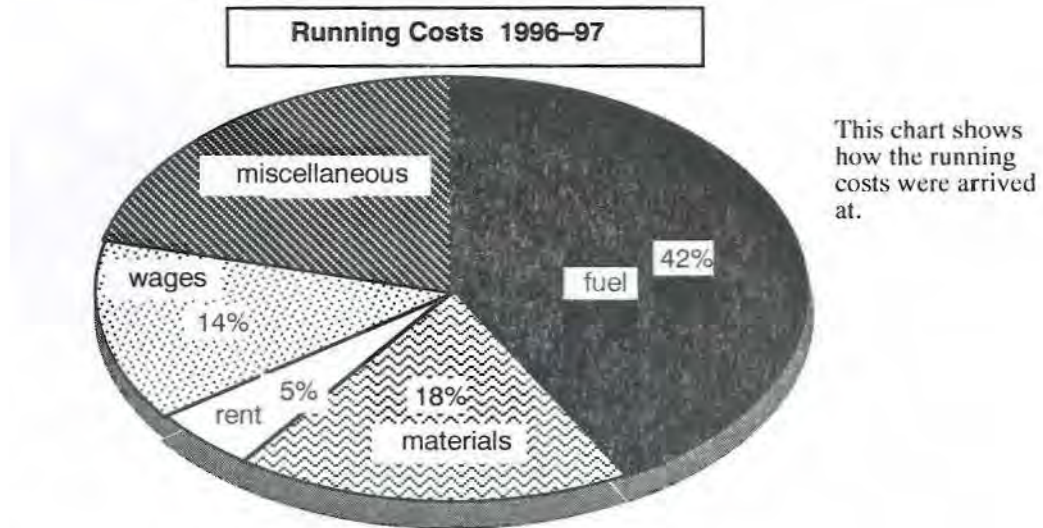
3.



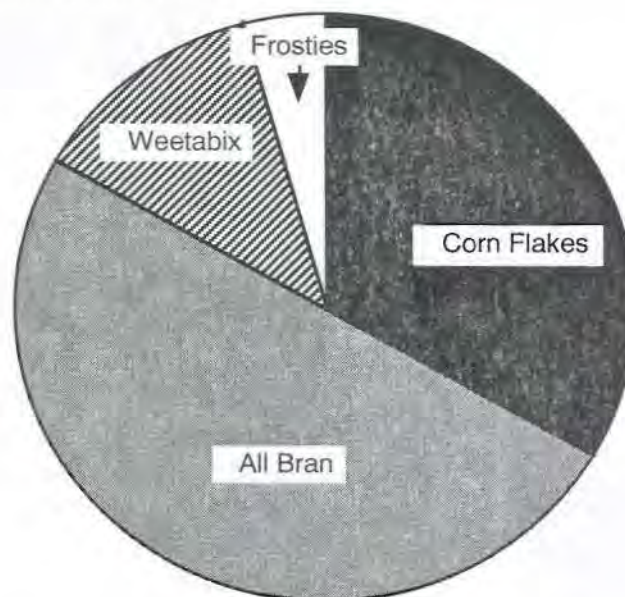
Mrs. Abraham asked her primary six class of 32 pupils to choose their favourite film.

- (a) What fraction of the class chose:
(i) *Batman & Robin* (ii) *Die Hard*?
- (b) How many pupils chose *The Lost World*?

4. For the year 1996–1997, the gross income of a company was £3 700 000.
After taking off the costs of running the company, a profit of £500 000 was declared.



- Calculate how much the running costs must have been.
 - From the pie chart, find what percentage of the running costs was ‘miscellaneous’?
 - What was the actual amount of money spent on wages?
 - Calculate** (do not measure) the size of the angle used to represent ‘rent’ in the pie chart.
5. This pie chart represents the results of a survey of 180 senior citizens as to what their favourite breakfast cereal was.

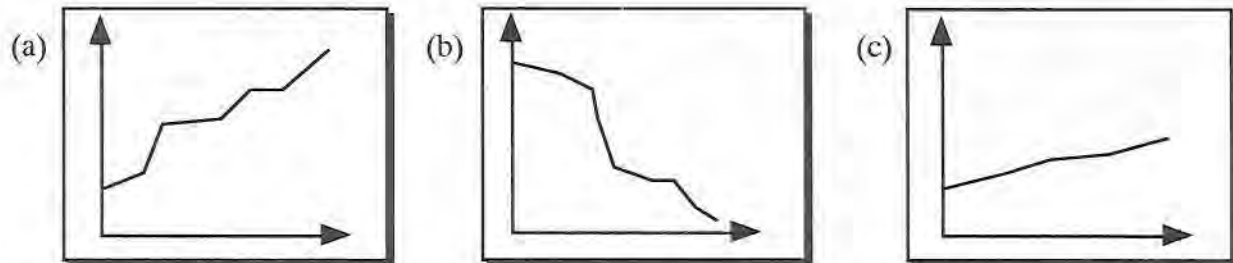


- Use a PROTRACTOR to measure the size of each angle.
- Calculate **how many** senior citizens liked:
 - All Bran
 - Corn Flakes
 - Weetabix
 - Frosties.

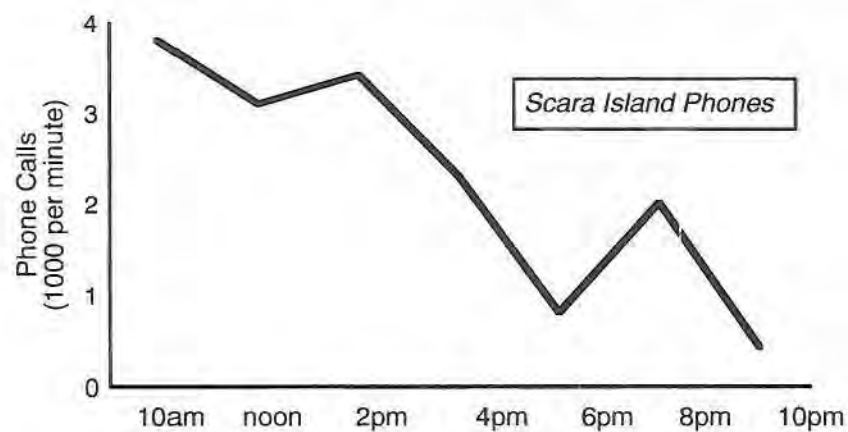
Trends in Graphs

Exercise 4

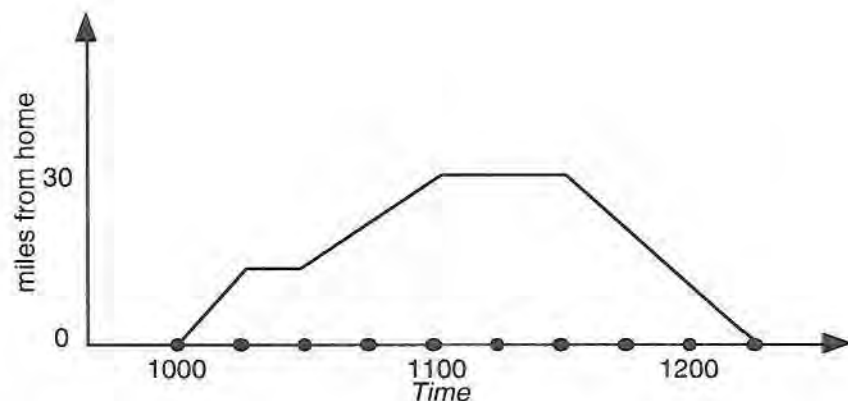
1. Describe the trend in each of these line graphs:



2. This line graph shows the average number of phone calls made from Scara Island over a certain period of time in a normal day.

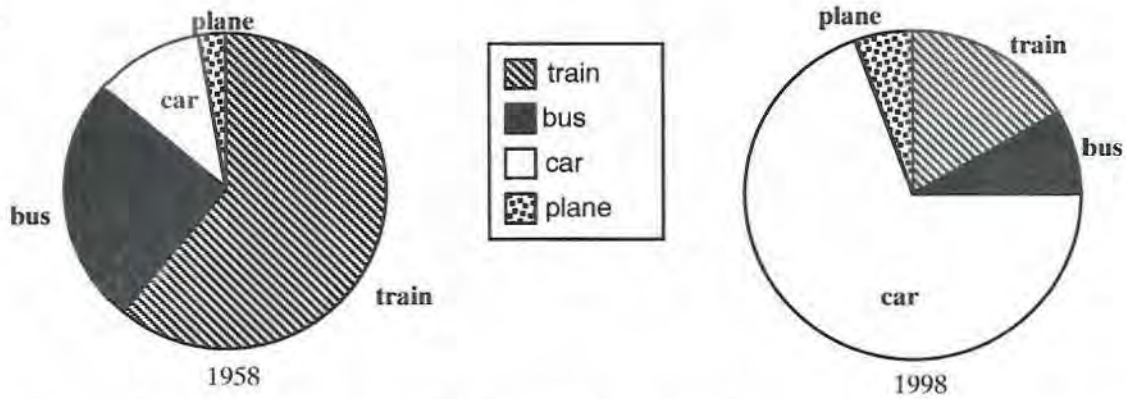


- (a) What is the peak time for calls? (Give a reason.)
 (b) Why is there an increase in the number of calls after 6 p.m.?
 (c) Describe the trend of the graph over the period.
3. Janice visits her gran every Sunday. She goes by car. This graph, shows one such journey.



- (a) When did Janice leave home?
 (b) When did she get home?
 (c) Roughly how far away from Janice does her gran stay?
 (d) Describe what might have happened round about quarter past ten.
 (e) How long did she stay at her gran's?

4.



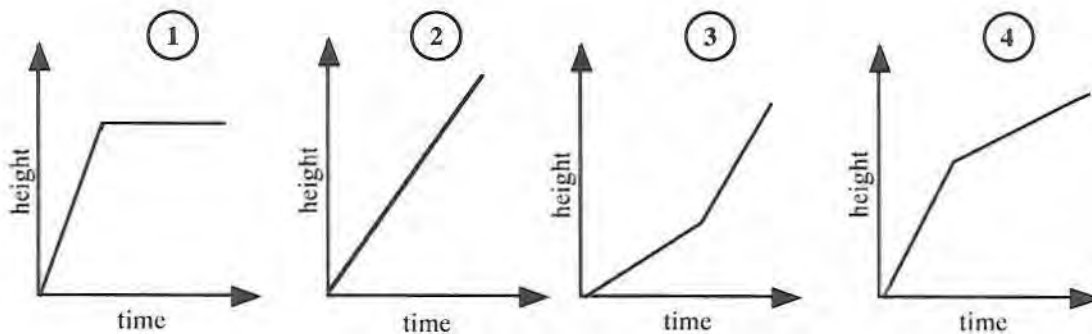
These pie charts give some indication of the changes in methods of transport over the past 40 years.

Describe in detail the major changes, giving reasons for your answers.

5. A modern two-tier fish tank is filled with water from a tap at a steady rate.



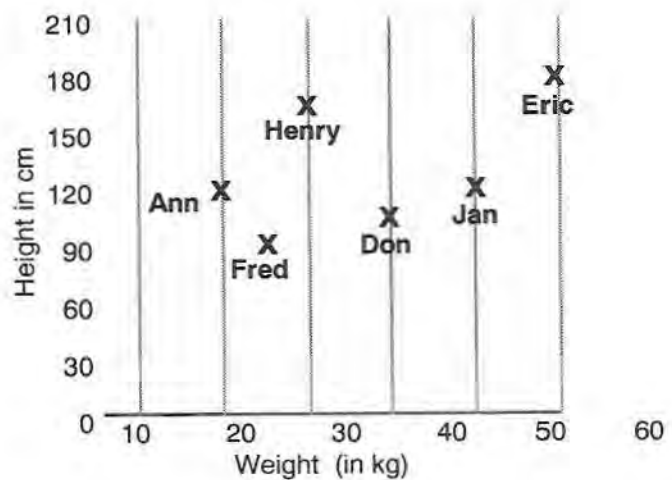
One of the graphs below indicates the change in the height of the water as the tank fills. Which graph is it? and give a reason for your choice.



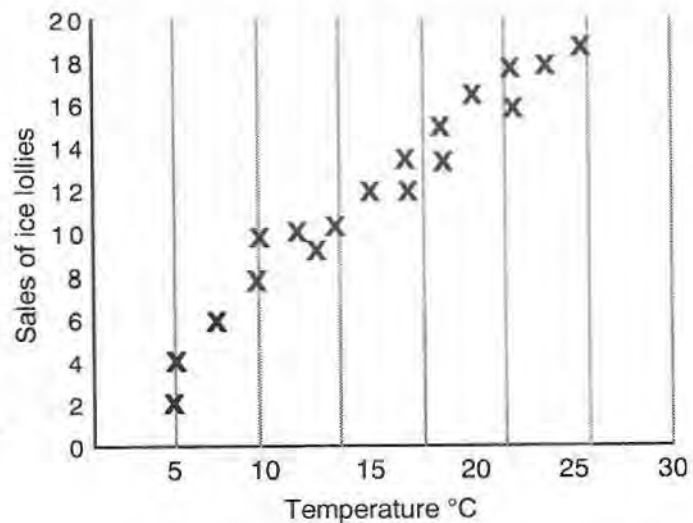
The Scatter Diagram

Exercise 5

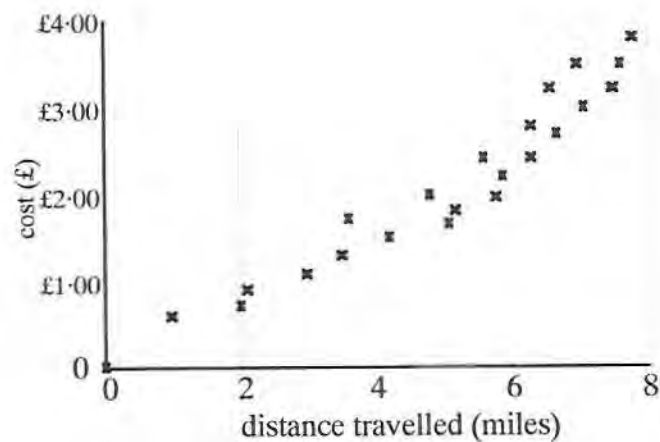
- The scatter diagram shows the height and weight of six children.
 - What height is Fred?
 - What weight is Eric?
 - Which two pupils are the same height?
 - Who is the lightest?
 - Who is the shortest?



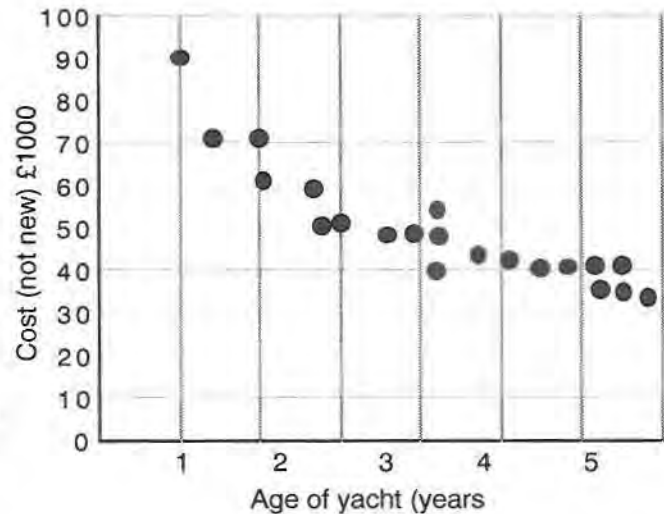
- This chart shows a relation between the temperature during the day and the sales of ice lollies on that day.
 - Suggest a connection between the temperature and the sales of ice lollies.
 - Use the chart to give a reasonable guess at how many ice lollies would be sold when the temperature reaches 35 degrees.
 - Estimate what the temperature was when thirteen ice lollies were sold?



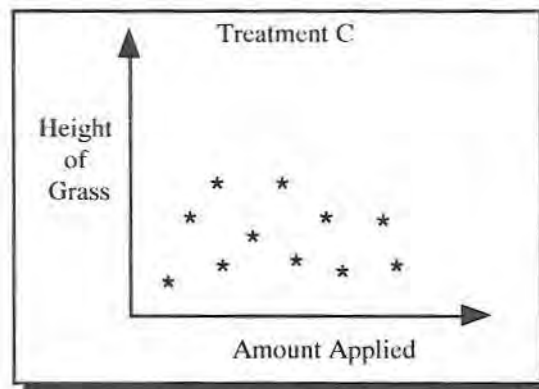
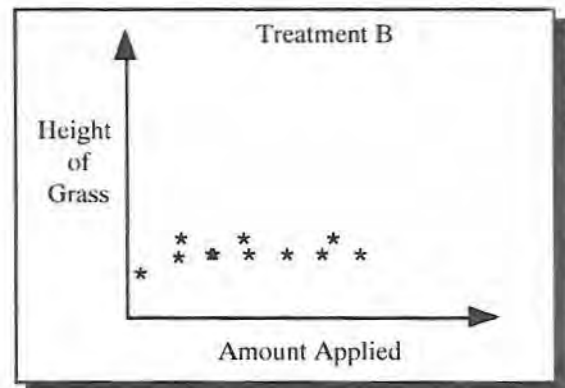
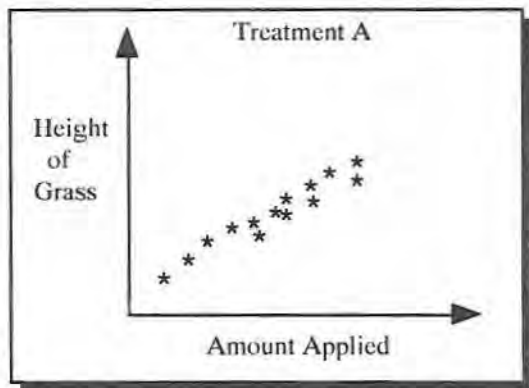
- This scatter graph shows the prices which taxi cabs charge for fairly short distances.
 - Suggest a connection between the fare and the number of miles travelled.
 - Why is there a cross at (0,0)?
 - Use the chart to give a reasonable guess at how far you could go in a taxi for £1.50.
 - How much do you think a 6 mile journey would cost?



4. 'Trylin Yachts' cost £100 000 new. The graph what price second hand yachts are sold for.
- Between which years do yachts fall in value by the largest amount?
 - Suggest a connection between what you would have to pay for a yacht and its age.
 - How old would you expect a yacht to be if you spent £50 000 buying a second-hand one?
 - How much do you think an two year old yacht would cost?



5. A green keeper at Grey Golf Club had terrible trouble trying to get grass to grow in the rough. He was recommended to try three new grass growing treatments, one on each of three holes. He hoped for good, steady growth which would then let him cut the grass to his desired height. The results are shown in the scatter graphs:



- Comment on the effect each treatment (and the amount used) has on the grass.
- If you were the greenkeeper which one would you use? Why?

The Stem-and-leaf Diagram (Chart)

Exercise 6

- The stem-and-leaf diagram shows the number of cases of dog food sold at a supermarket each week over a 6 month period.
Write out the weekly sales, in order, and find how many weeks the sales were more than the target of 35.

stem	leaf
1	4 7
2	9 1 7 3 1
3	7 1 6 4 6 2 8
4	1 0 8 9 2 1
5	3 4 1 4
6	2 1
stem $\times 10$	leaves $\times 1$

2.

*Grant's
Sweet
Shop*

stem	leaf
1	87
2	19 25
3	24 37 69
4	13
5	22 33 55
6	30 58
7	45 73
stem $\times 100$	

This 'two digit' stem-and-leaf diagram shows the daily takings over a fortnight, (in pounds) for Grant's Sweet Shop.

Write out (in order) the fourteen daily takings.

- A machine weighs out coffee and puts it into packets.
The machine is checked over at 11 a.m. and again at 4 p.m. to see if its output is satisfactory.
The results of the inspection on 15/9/98 is shown below in a 'back-to-back' stem-and-leaf chart.
The weights are in grams.
A sample of 20 packets was weighed at both times.

- At which time (11 a.m. or 4 p.m.) did the machine produce:
 - 411 grams?
 - 434 grams?
- Of the 20 packets sampled at 11 a.m., how many weighed between 391 and 406 grams?

11 a.m.		4 p.m.
	38	
2 0 3 7	39	6 4
1 3 5 0 3 4	40	7 0 6 5 4
0 1 7 2 2 6	41	5 2 7 2
2 0 0 2	42	9 8
	43	0 1 4 1
	stem $\times 10$	
	leaves $\times 10$	

The Construction of Graphs

Exercise 7

- The Park Sports Centre began its winter programme with the following number of under 16s enrolling on the opening night.

	<i>Swimming</i>	<i>Fencing</i>	<i>Football</i>	<i>Aerobics</i>	<i>Keep Fit</i>
Girls	120	108	9	62	19
Boys	85	32	105	22	5

Draw a compound BAR CHART to illustrate this information.

- The following table shows the weekly wages of young, part-time workers in Orkam Superstore.

Wage in £'s	10–19	20–29	30–39	40–49	50–59	60–69	70–79
No. Workers	3	7	23	29	38	14	1

Draw a BAR CHART of the distribution.

- The height of a sun flower was measured each week for 8 weeks. Here are the results:

Week Number	1	2	3	4	5	6	7	8
Height (cm)	5	8	20	30	45	59	65	89

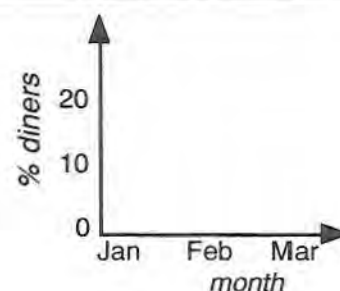
Show this information in a LINE GRAPH.

- A sample of school children was looked at in 1997 for 6 months, regarding their eating habits in school at lunchtime. A comparison was made between those who had school lunches and those who brought their own food.

<i>Month</i>	<i>Jan</i>	<i>Feb</i>	<i>March</i>	<i>April</i>	<i>May</i>	<i>June</i>
<i>% school lunch</i>	75	70	60	60	30	5
<i>% own food</i>	10	10	30	35	40	65

The results are shown in the table:

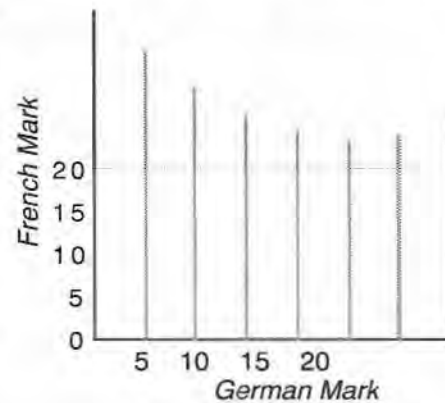
- Use the scale shown to draw LINE GRAPHS of the data on the same diagram.
- Give at least **three** comments on the results of the survey.



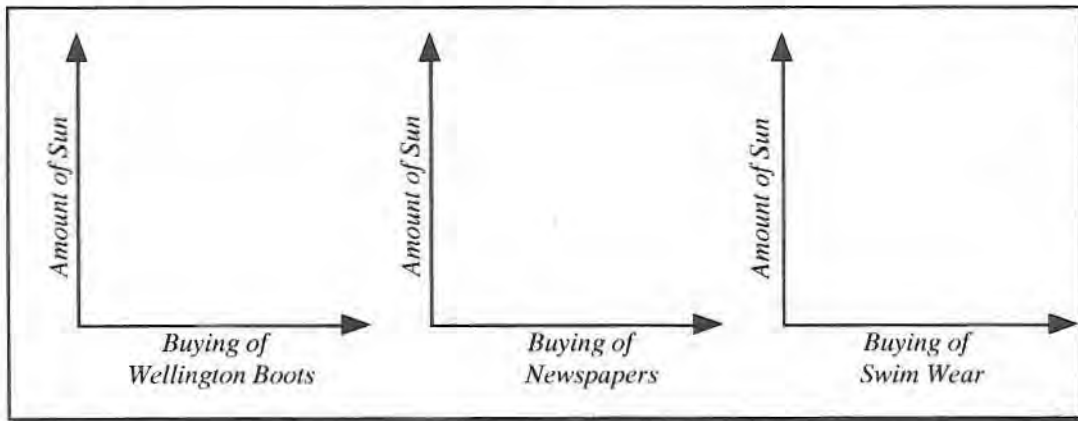
5. Here is a table of exam marks (out of 50) from a modern languages department.

Pupils Name	Ali	Bo	Ed	Dan	Flo	Hal	Nan	Pen	Rab	Sid
French Mark	5	10	10	20	15	30	30	40	40	45
German Mark	5	5	10	15	20	25	30	35	35	45

- Draw a diagram similar to the one shown, using the same scale for each axis.
- Plot the information from the table to make a SCATTER DIAGRAM.
- Describe some connections between the French marks and the German marks.
- Draw a line of best fit through points.
- Use the graph to estimate what the German mark would be if French was 35.
- One person seems to go against the trend. Who is it? . . . and what makes you think that?



6. Copy these axes and draw SCATTER DIAGRAMS which would show the connections between the items shown. (about 10 to 15 crosses would do).



7. Brad and his pals record the number of take-away meals they deliver each evening, and the time it takes them.

Time (mins)	25	22	20	20	15	13	9	15	17	14
No. Meals	40	33	30	32	22	20	13	20	21	19

The average time is 17 minutes and the average number of take-away meals is 25.

- Draw up a set of axes on squared paper, with meals on the horizontal axis and time on the vertical axis. Using suitable scales draw a SCATTER DIAGRAM.
- Draw a line of best fit through the point (25,17). (meals = 25, time = 17)
- Estimate the time it would take Brad & Co. to deliver 28 meals.

8. Construct a simple stem-and-leaf diagram to display the following golf scores, shot by the U.S.A. team in The Ryder Cup, Spain in 1997.

66	79	80	78	69	66	68	80	77
78	93	78	67	62	74	64	81	75
60	66	78	77	84	76	72	69	90
63	62	84	75	75	71	65	64	73

9. A factory has two machines for packing flour into 2 kg packets. 40 packets from each machine were weighed in grams and the results were as follows.

MACHINE 1

2020	2014	2019	2005	2020	2023	2015	2006	2013	2012
2021	2011	2019	2021	2013	2000	2020	2026	2018	2007
2038	2018	2016	2017	2010	2019	2013	2012	2020	2021
2002	2015	2013	2017	2019	2020	2016	2025	2014	2028

MACHINE 2

2005	2016	2019	2017	2029	2018	2020	2023	2014	2022
2020	2018	2020	2000	2020	2033	2010	2013	2030	2005
2013	2019	2021	2016	2012	2017	1999	2021	2014	2009
1998	2002	2004	2005	2007	2011	2016	2020	2001	2003

Make a back-to-back stem-and-leaf diagram for the figures. Compare the two sets.

10. A teacher wanted to compare the marks of her two first year classes in a test. She had the feeling that one class was a good bit better than the other. Here are the results of the test:

CLASS 1X												
5	7	14	17	19	24	24	25	26	26	26	27	27
27	27	28	29	29	31	31	33	36	38	39	43	
CLASS 1Y												
8	10	11	13	15	17	18	18	18	19	20	22	23
23	24	25	25	26	26	48	49	50	50	50	50	

As the mean (average) mark of each class is almost identical the teacher has to find another method to compare the marks.

- (a) Make a back to back stem-and-leaf diagram as shown and complete it.
 (b) If the teacher made the 'pass' mark '25 out of 50'.


Comment on the results with regard to numbers who 'passed' and how many got high marks.

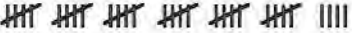
class 1X		class 1Y
	0	
	1	
	2	
	3	
	4	
	5	
(stem $\times 10$ leaves $\times 1$)		

Frequency Tables

Exercise 8

1. What numbers do these tally marks stand for?

(a)  I

(b)  IIII

2. A group of Primary Seven children were asked to vote for their class captain. The ballot papers unfolded as follows:

DAVID	FRED	LOUISE	FRED	LOUISE	FRED
FRED	DAVID	DANIEL	GINA	GINA	DANIEL
GINA	DANIEL	GINA	GINA	DANIEL	FRED
LOUISE	FRED	FRED	DAVID	FRED	GINA
DANIEL	GINA	LOUISE	LOUISE	GINA	GINA
ALICE	FRED	FRED	FRED	LOUISE	DAVID

Construct a frequency table like the one shown and answer the following questions:

- (a) Who won the election?
 (b) Who was the person who voted for him/herself, but that was the only vote he/she got?
 (c) How many more votes did Gina get than Louise?

Name	Tally	Frequency

3. The predicted results for the Scottish Hockey League on the last Saturday in Sept. 2010 are:

Airdrie Thistle	1	Airdrie Athletic	4	Ayr Rovers	8	Ayr Thistle	5
Dundee Thistle	0	Dundee Rovers	0	Jedburgh	4	Peebles	4
Edinburgh Thistle	1	Edinburgh Athletic	2	Kilmarnock Rovers	2	Kilmarnock United	0
Stranraer Thistle	4	Stranraer Rovers	4	Aberdeen Rovers	1	Aberdeen Thistle	1
Elgin Thistle	6	Elgin Rovers	1	Oban Rovers	7	Oban Thistle	7
Stornoway Thistle	9	Stornoway United	3	Brechin Thistle	2	Brechin United	2
Dunfermline Rovers	1	Dunfermline Athletic	1	Troon Thistle	5	Prestwick United	2
Arbroath Rovers	2	Arbroath Thistle	1	Paisley Thistle	1	Johnstone Rovers	3
Bishopton Rovers	0	Clydebank Thistle	1	Perth Flyers	10	Perth Rovers	0

Construct a frequency table to illustrate the number of goals that will be scored!

Construction of a Pie Chart

Earlier in this outcome, (or in Maths 2 (Int 1)), you were shown how to extract and interpret information given in a pie chart.

Now you will see how to draw a pie chart from given data.

Exercise 9

1. A new housing estate is built and the table below shows how many of each type of house was built.

(a) **Copy** and complete the table, filling in the missing numbers.

Type of House	Number	Calculation	Angle (in pie chart)
Semi-detached Villas	80	$80 \times 360^\circ$	120°
Detached Villas	60	$240 \times 360^\circ$	
Terraced Houses	70		
Bungalow	30		
Total Number	240	Total =	

- (b) Now draw a circle of radius (about) 4 centimetres, and construct the pie chart which represents the above information.

(Make sure you label your pie chart, and it helps if you neatly mark in the angles in each sector).

2. This table shows the number of road deaths in Scotland (for a particular year) of boys up to the age of 18.

(a) **Copy** and complete the table.

Fatalities	Number	Calculation	Angle (in pie chart)
Pedestrian	70	$70 \times 360^\circ$	
Pedal Cyclist	45	$\dots \times 360^\circ$	
Driver of motor cycles	40		
Driver of cars	25		
Total Number		Total =	

- (b) Draw and label a pie chart to represent the above figures.

3. A man earns £14400 per year. The table below shows how he uses this money.
Copy and complete the table and draw an appropriately labelled pie chart.

Expenditure	Amount	Calculation	Angle (in pie chart)
Food	£3400		
Clothing	£2000		
Household Bills	£3600		
Car	£1400		
Entertainment	£2800		
Savings	£1200		
Total Number		Total =	

4. A group of young people, in a bar, were asked to name their favourite crisps. The results are shown below.

(a) **Copy** and complete the table. (Calculate each angle to the nearest 1°).

Favourite Crisps	Number	Calculation	Angle (in pie chart)
Plain	15		
Cheese & Onion	47		
Salt & Vinegar	32		
Tomato Sauce	9		
Smoky Bacon	23		
Prawn	19		
Total Number		Total =	

(b) Now draw a pie chart to represent the above data.

5. This table shows the percentages of men, women, boys and girls who attended a school fund raising event.

Group	Number	Calculation	Angle (in pie chart)
Men	17%		
Women	31%		
Boys	26%		
Girls	%		
Total Number		Total =	

Copy and complete the table, and hence draw a pie chart to show the information.

For the rest of this exercise, you are asked to draw and clearly label pie charts to represent the given information.

Before doing so, you are advised to draw up and complete a table, similar to those shown in questions 1 to 5.

6. (a) A group of 90 third year pupils were asked to name their favourite subject. 17 liked P.E., 11 preferred Languages, 22 chose Science, 10 decided on English and the remaining 30 said they liked Maths best.
Draw up a pie chart to show this information.
- (b) A barber noted the hair colour of the first 60 customers one day. 8 had red hair, 17 had black, 10 had blond and 25 were brown haired.
Draw a pie chart which shows this set of statistics.
- (c) After a local council election it was found that the electorate voted as follows:
The Labour candidate polled 50% of the votes, the Conservative 10%, the Liberal Democrat 20%, the SNP 15% and the Greens got 5%.
Show this set of results on a pie chart.

Construction of a Dot Plot

A dot plot is simply another way of representing data.

This dot plot shows the ages of a group of people at a party.



It is a mixture of a bar graph and pictograph, but easier to draw.

Exercise 10

1. Construct a dot plot to represent the following information about shoe sizes of the pupils in a first year class.

Shoe Size	3	3½	4	4½	5	5½	6
Number	2	3	5	9	7	0	1

2. This table shows the marks gained by a group of children in a mental arithmetic test (out of 10). Construct a dot plot to represent the information.

Mark (/10)	1	2	3	4	5	6	7	8	9	10
Frequency	1	0	2	5	8	6	7	2	4	2

3. A traffic warden notes the number of cars with various registration letters in a municipal car park. Construct a dot plot to represent the information.

Reg. Letter	J	K	L	M	N	P	R
No. of cars	2	5	6	2	3	0	4

4. The heights of a group of children were recorded. They are shown below.

Height (cm)	152	153	154	155	156	157	158	159	160	161
Number	10	30	60	70	50	80	20	0	10	20

This time, let • stand for 10 children in your dot plot.

5. A group of First Year pupils were asked how much money, to the nearest £1, they received each week as pocket money.
The results, (in £'s), were:

3	4	5	4	6	4	5	5
5	6	3	5	10	6	7	8
5	10	10	4	6	4	8	5

Show this information as a dot plot.

6. A group of men in a weight watchers club were asked to record how much weight, in kilograms, they had lost over a two week period.

2	5	3	1	6	5	2	0	4	1	2	4
5	1	6	2	0	6	1	4	5	5	4	2
1	2	6	8	7	5	5	2	7	6	6	5

Show this information as a dot plot.

7. As part of a study, a class of primary children were asked how much money they had in their possession one morning.

It ranged from 10p to 25p.

10	12	22	18	10	20	15	18	15	20
22	20	10	14	25	20	23	20	15	10
16	22	25	24	18	22	25	10	15	20

Show this information as a dot plot.

Cumulative Frequency Tables

Exercise 11

1. (a) Copy this frequency table including the last column.

Number of correct responses	Frequency (f)	Cumulative Frequency
4	2	2
5	15	$(2 + 15) = 17$
6	28	$(2+15+28) = 45$
7	36	
8	51	
9	43	
10	17	
11	6	
12	2	200

17 scored 5 or less

45 scored 6 or less

- (b) Complete the 3rd column, showing the cumulative frequency.
- (c) How many people scored 10 or less in the test?
- (d) How many of the 200 people scored more than 10 in the test?
2. The music department, at school, asked the new intake of 150 pupils into first year how many musical instruments they had at home.
The results were:

Number of Instruments	frequency
0	35
1	18
2	9
3	15
4	23
5	29
6	14
7	6
8	1
total	150

- (a) Copy the table.
Add a 3rd column to show the cumulative frequency and complete the table.
- (b) How many pupils had 5 or less instruments?
- (c) How many had less than 3? (careful)!
- (d) How many had more than 4?

3. For each of these tables, copy them, add a cumulative frequency column and complete the table.

(a)

Score in golf competition	Number of golfers
69	1
70	3
71	7
72	11
73	6
74	9
75	4
76	2
77	1

(b)

No. of potatoes in 3 kg. bag	Number of bags
10	3
11	9
12	14
13	18
14	17
15	6
16	1

(c)

No. of dresses in wardrobe	Number of Women
4	5
5	12
6	8
7	2
8	0
9	4
10	5
11	2
12	1

(d)

Time to swim 100m (secs)	Number of competitors
25	1
26	1
27	3
28	15
29	17
30	10
31	2

4. The height of a group of boys was measured at the beginning of their 3rd year and again at the beginning of their 4th year. The increase in the heights is given in the table below.

Increase in height (cm)	1	2	3	4	5	6	7	8
Number of boys	2	3	6	9	12	15	10	3

- (a) Draw up a frequency table to show this information.
 (b) Add on a cumulative frequency column and complete the table.
 (c) How many of the boys had grown by less than 5 centimetres?
5. Shown below are the marks for a group of third year pupils in a small test out of 20 (the lowest score was 11).

13	15	14	13	12	16	14	14	12	13
14	13	11	15	14	13	12	17	15	14
13	14	15	16	13	15	18	14	14	12

- (a) Draw up a frequency table, as in Questions 1 to 4, to show how many scored 11, 12,... in the test.
 (b) Add on and fill in the cumulative frequency column.
 (c) How many scored 15 or less in the test?
 (d) How many scored more than 15?
6. In the 1991 census, 40 houses were checked to determine how many people were living in the houses at the time. The results are shown below.

2	5	1	3	4	6	3	4	2	4
4	2	3	4	1	2	7	3	4	2
4	4	3	2	5	4	1	4	4	5
2	5	6	4	3	4	5	3	4	3

Draw up a frequency table to show the results, including a cumulative frequency column.

7. This cumulative frequency table shows the waist sizes of a group of 50 women after six months at Weight Watchers. Copy out the table and calculate the values of the numbers missing from the middle column.

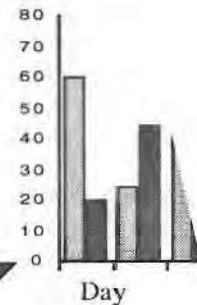
Waist size (in inches)	Number of women	Cumulative frequency
22		3
23		7
24		15
25		28
26		39
27		46
28		50

MATHEMATICS 2 (INTERMEDIATE 2)

Checkup Exercise 1

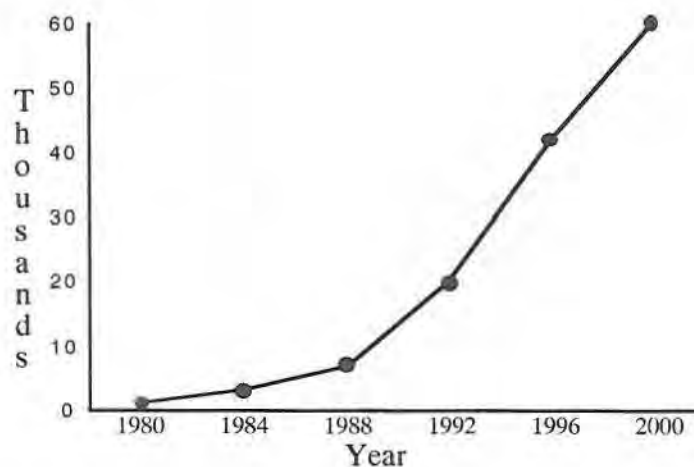
1. A number of children decided to spend their October week's holiday swimming or playing badminton. The table shows those who took part.

Day	Mon.	Tues.	Wed.	Thurs.	Fri.
Swimming	60	25	75	60	10
Badminton	20	45	15	55	70



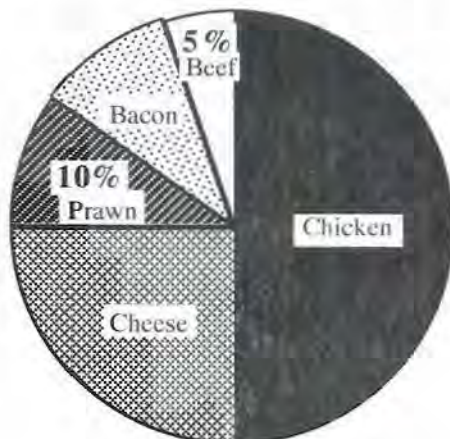
Illustrate this information on a BAR GRAPH. (similar to this one)

2. The number of games consoles being bought by children in Scotland since 1980 is illustrated by a line graph.



- (a) How many children bought a console in (i) 1980 (ii) 1996 ?
- (b) What is the increase from 1996–2000?
- (c) Between which two periods was there the greatest increase?
- (d) Describe the general trend of the graph.

3.



A survey on 'crisps' was carried out among 600 shoppers in a supermarket one Saturday morning. The pie chart shows the results.

- (a) What percentage chose:
(i) Chicken (ii) Cheese (iii) Bacon?
- (b) How many people chose:
(i) Prawn (ii) Beef (iii) Cheese?
- (c) Calculate the **total** number of shoppers who liked prawn, bacon and beef crisps.

4. A plumber decided to monitor the number of call-outs his company had to make in the early hours of one cold winter's morning. His results are shown.

Time (am)	1	1.30	2	2.30	3	3.30	4	4.30	5	5.30
No. call-outs	2	1	3	3	4	5	6	6	8	7

- (a) Draw a SCATTER GRAPH.

Put time along the x -axis and call-outs up the y -axis.

- (b) What is the general trend of the graph?

5. The marks of 36 pupils in a maths test (out of 50) are noted below.

23	12	47	35	27	42	6	44	50	48	44	39
18	25	45	28	36	14	39	50	46	44	22	37
4	29	45	47	38	44	28	47	41	25	3	19

Construct a simple stem-and-leaf diagram to display the marks.

6. A survey was being carried out as people entered DucMonald's Fast Food Store.

As they arrived people were asked 'what are you going to buy today'?

The codes which the researchers used were:

B = Beefburger

C = Cheeseburger

Ch = Chicken burger

CN = Chicken Nuggets

V = Vegetarian Food

H = Hot Dog

U = Ultrabargain

Here are the results:

B	C	B	Ch	B	Ch	Ch	U	Ch	B	CN	C	CN
B	H	U	H	Ch	C	B	Ch	B	Ch	B	C	B
Ch	B	C	Ch	B	H	C	B	Ch	B	CN	B	CN
B	CN	V	B	C	CN	CN	H	B	H	Ch	V	C
CN	CN	Ch	B	Ch	B	CN	B	C	Ch	C	B	H

- (a) Construct a FREQUENCY TABLE to illustrate the results of the survey.
- (b) How many were going to buy a vegetarian meal?
- (c) What kind of food was the most popular?
- (d) How many more chicken burgers were sold than chicken nuggets?
- (e) How many people were asked?

7. A group of 40 children were asked to name their favourite 'Super-hero'.
 15 chose Superman
 13 chose Batman
 8 chose Spiderman
 4 went for Captain Fortune.

Draw up a table, (as in exercise 9) and show the information in a neatly labelled pie chart.

8. Shown are the ages of a group of 60 young people listening to 'Raunchy Rockers' at the 'T in the Park' concert in 1997.

16	12	17	15	17	14	16	15	18	14	16	13
15	16	15	15	12	16	18	16	15	13	17	15
16	14	16	18	16	13	14	17	18	15	14	17
15	15	13	15	18	19	16	14	19	16	18	16
14	17	16	17	15	17	19	17	14	19	16	20

Show the information in a 'dot plot'.

9. A supermarket carried out a survey of its customers from families consisting of four people. Each was asked 'How many cans of food do you open and use during a normal week'?
- The results are shown below.

Number of cans used	6	7	8	9	10	11	12	13	14
Number of families	2	5	12	15	11	7	3	4	1

- (a) Construct a 'vertical' frequency table and add on a 'Cumulative Frequency' column.
 (b) From your table, how many families used no more than ten cans?
 (c) How many of the 60 families used more than ten cans per week?

USE OF SIMPLE STATISTICS

By the end of this set of exercises, you should be able to

- (a) calculate **mean, median, mode** and **range** of a data set.
- (b) calculate **mean, median, mode** and **range** of a set of data presented in an **ungrouped frequency table**.
- (c) calculate the **semi-interquartile range** from a data set and an **ungrouped frequency table**.
- (d) represent information by means of a **boxplot**.
- (e) calculate the **standard deviation** of a data set.
- (f) determine the equation of a **regression line** and use it to estimate the y -value, given the x -value.
- (g) assign **probability** to a set.

Parts (a) and (b) of this outcome are also covered in Mathematics 2 (Intermediate 1).

- (a) calculate **mean, median, mode** and **range** of a data set.
- (b) calculate **mean, median, mode** and **range** of data presented in an **ungrouped frequency table**.

Range, Mean, Median and Mode

Exercise 1

1. For each set of data, find the **range**:
 - (a) 8, 6, 2, 9, 7, 7, 4, 5, 12, 3, 9, 5, 6, 4.
 - (b) 67, 83, 69, 65, 28, 36, 37, 95, 21, 25, 22, 47, 29, 54, 32, 65, 78, 94.
 - (c) 2.1, 3.6, 5.8, 4.7, 2.5, 1.4, 8.9, 4.6, 2.5, 1.4, 2.3, 6.5, 6.8, 2.7, 2.9, 1.3, 4.4, 3.7.
2. Calculate the **mean** in each case:
 - (a) 8, 6, 6, 5, 7, 9, 9, 8, 6, 5, 4, 8, 7, 6, 3, 4, 5, 5, 4, 3.
 - (b) 5.8, 7.2, 8.1, 4.9, 7.3, 7.7, 9, 6, 6.9, 8.1, 5.2, 7.8, 9.3, 6.7, 7, 7, 5.9, 9.1, 8.2, 4.8.
 - (c) £12.20, £12.60, £13.50, £14.20, £16.80, £12.80, £11.40, £15.60, £17.20, £18.
3. Find the **median**:
 - (a) 6, 3, 5, 5, 2, 4, 7, 7, 8, 9, 1, 1, 4, 5, 8, 8, 7, 4, 5, 2, 9.
 - (b) £16, £16, £17, £19, £20, £21, £16, £17, £18, £15.
 - (c) 35 kg, 28 kg, 27 kg, 24 kg, 15 kg, 26 kg, 27 kg, 19 kg, 23 kg, 25 kg, 27 kg, 15 kg, m 15 kg, 35 kg.
4. For the following sets of numbers, find the **mode**.
 - (a) 2, 2, 3, 3, 3, 3, 4, 4, 4, 4, 4, 5, 5, 6, 6, 6, 6, 7, 7, 7, 7, 8, 8, 9.
 - (b) 3, 9, 2, 3, 6, 8, 1, 2, 5, 5, 8.
 - (c) 256, 250, 257, 251, 251, 251, 259, 250, 251, 251, 252, 253, 253, 250, 254, 254, 250, 255, 256, 251, 256, 258, 259.
5. The children of Langbank took part in a fun-run around the village to raise money for charity. These are the number of laps completed by the under 7s.

15	24	13	26	22	17	8	26
16	26	18	26	21	20	14	21

For the number of laps completed, find:

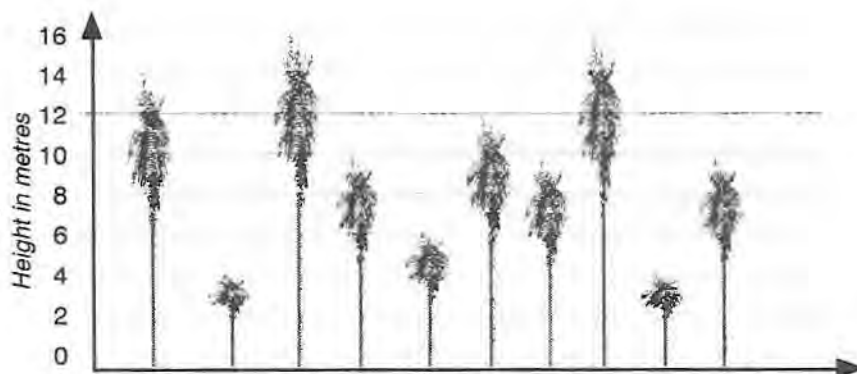
- (a) the range (b) the mean (c) the median (d) the mode.

6. Here are the heights, to the nearest cm, of nine girls:

166 cm 176 cm 162 cm 180 cm 161 cm 176 cm 165 cm 175 cm 172 cm

- Calculate: (a) the range of heights
(b) the median height.
(c) the mean height, (to nearest cm).

7. Every morning of his Caribbean holiday, Gerald would climb a different palm tree. This diagram shows the heights of the trees which he climbed.



Find: (a) the range (b) the mean (c) the median (d) the mode.

8. In the following examples: calculate the range, the mean, the median and the mode. In each case, state which 'average' best illustrates the catalogue of numbers.

- (a) 18 18 19 20 20 20 21 25 163.
 (b) 34 34 34 34 36 36 37 57 85.
 (c) 56 56 57 58 59 60 62 65 67.

9. Brenda and her brother went to Disneyland for Easter. They kept a note as to how long they had to queue to get on the rides. Here are the results (in minutes):

16 30 25 20 10 110 10 22 40 17

- (a) Calculate the mean time waited.
 (b) Find the median and modal times waited.
 (c) Say which 'average' should be chosen to give a fair representation of the data. Give two reasons for your choice.
10. Alf and his pals decided to have a day at an army assault course. They each recorded the number of press-ups they could do in one minute before attempting the assault course and again at the end of the course.
 The results were:

Name	Alf	Bert	Karl	Dino	Ed	Flo	Jim	Ned	Ian	Jan
Before	48	46	48	40	45	51	47	40	50	46
After	36	38	42	35	36	46	32	28	41	38

- (a) Which person seemed to be affected most by the assault course?
 (b) Find the RANGE for
 (i) the 'before' data
 (ii) the 'after' data
 (c) Calculate the MEAN for both sets of data.
 (d) Comment on the results.
 (e) Was Ian above or below average both times?

11. Mary and Beth played eight rounds of golf together during their summer holidays.

Mary scored: 71 78 76 76 79 75 75 74
Beth scored: 76 73 74 77 74 74 75 73

- Calculate the range and mean for Mary.
 - Calculate the range and mean for Beth.
 - Who had: (i) the lowest score (ii) the highest score?
 - Who scored better most of the time?
12. Thirty pupils in Primary Four were given a 30 word spelling test. The teacher was to set a 'pass' mark. Here are the marks out of 30:

18 21 23 19 24 25 17 20 18 18
17 22 20 25 22 19 16 21 22 16
18 23 24 19 15 18 24 23 30 29

- Rewrite the marks in order, starting at the lowest.
 - What is the range of marks?
 - Calculate the mean, mode and median.
 - If you were the teacher, what would your pass mark have been? Give a reason !
13. Mrs. Potts buys Bargain T Bags with an advertised 'average 50 T Bags in every box'. She buys 6 boxes and counts the tea bags in each box! Here is what she finds:
- 49 49 52 50 52 52
- Calculate the mean number of tea bags.
 - What is the mode?
 - Should she take the boxes back to the shop and complain?
 - What gives a clearer picture here, the mean or the mode?
14. East Athletic had a mean score of four goals per game in their first nine games !
- How many goals had they scored?
 - In their next game they scored six, but failed to score in their next four matches. What was their mean score over the 14 games?
15. Five sisters have an average (mean) age of 19. Jean is 14, Joan is 18, Jan is 20 and Josephine is 17. What age is the eldest sister, Mags?

16.

17	9
42	11
18	63
26	18
80	

Here are the number of runs scored by a cricketer, but unfortunately one score is missing. If his **mean** score is 29 over the ten games, calculate what the missing score must have been.

Range, Mean, Median and Mode from a Frequency Table

Exercise 2

1. Jasmine is playing a game of Junior Darts on her children's dart board. The highest she can score is seven. Here are some of her early scores:

4 3 2 2 4 6 7 5 4 7
1 2 1 1 3 5 6 4 1 4

- (a) Draw up the frequency table and complete it.

SCORE	TALLY	FREQUENCY	SCORE x FREQUENCY
1			
2			
3			
..			
..			
..			

- (b) Calculate her mean score.
 (c) What is the range of the distribution?
 (d) What is
 (i) the modal
 (ii) the median score?
2. These frequency tables show the points given to 2 teams in a TV challenge quiz. For each team, calculate:
 (a) the mean
 (b) the median
 (c) the mode.
 (d) which team has the better 'average' if:
 (i) the mean is used
 (ii) the median is used
 (iii) the mode is used.

The Groupies						
Points	0	1	2	3	4	5
Frequency	2	0	3	5	4	2

The Magpies						
Points	0	1	2	3	4	5
Frequency	1	4	3	5	2	6

3. Abid made a survey of the ages of children who appeared on a bouncy castle in a park before 9 a.m. one summer's morning.
 (a) What was the range of the distribution?
 (b) What was the modal age?
 (c) Make up a frequency table and add another column to enable you to calculate the mean age. (correct to 1 decimal place)
 (d) Find the median age.

AGE	2	3	4	5	6	7	8	9	10
Frequency	1	10	11	10	7	5	4	3	2

4. The pupils in Castle High School maths class looked out of their classroom window and noticed that the grass had not been cut for a long time.

Their teacher Mrs. McKenneth, estimated that the grass was about 15 cm high, but the pupils wanted to give their estimates.

A table of results was drawn up.

Height (cm)	Frequency	Height \times Frequency
13	2	
14	4	
15	2	
16	2	
17	10	
18	1	
Total	<u> </u>	<u> </u>

- (a) How many pupils took part?
 (b) What was the range?
 (c) Calculate:
 (i) the mean
 (ii) the median
 (iii) the mode.
 (d) What did the pupil's think of Mrs. McKenneth's estimate?
5. Quix's Chocolate Company claim that there are over 20 mini-quix bars in an economy pack. Some economy packs were purchased and the results of the contents were as follows:

No. Bars	Frequency	Number \times Frequency
18	2	
19	9	
20	8	
21	5	
22	5	
23	5	
Total		

- (a) Copy and complete the table.
 (b) What was the range in the number of bars?
 (c) Calculate:
 (i) the mean
 (ii) the median
 (iii) the mode.
 (d) Which average did the company use to back their claim?

Quartiles and Semi-interquartile Range

Quartiles

Just as the median divides a set of scores into two equal sets, the quartiles divide the numbers into four equal sets.

There are three quartiles:

the **lower quartile**, or Q_1

the **middle quartile**, or Q_2 (the median)

the **upper quartile**, or Q_3 .

Semi-Interquartile Range

The interquartile range is simply $Q_3 - Q_1$ and the semi-interquartile range is:

$$SIQR = \frac{1}{2} (Q_3 - Q_1)$$

Exercise 3(a)

1. Twelve college students were given a psychology test mark, out of 20, for an experiment they carried out. The scores were:

14, 8, 14, 11, 10, 9, 19, 16, 14, 14, 8, 12

Find the three quartiles and the semi-interquartile range.

2. Find the range and semi-interquartile range for each of the following sets of scores:
 - (a) 21, 19, 17, 24, 20, 22
 - (b) 9, 10, 11, 13, 5, 4, 3, 8, 12, 6, 7
 - (c) 118, 118, 120, 111, 120, 121, 114, 114, 115, 117
 - (d) 1004, 1005, 1005, 1001, 1001, 1002, 1008, 1008, 1009, 1009, 1008, 1007, 1002.
3. Each of a group of people measured the lengths of his/her index finger. The lengths, in centimetres, were:

7.0, 6.9, 7.5, 7.9, 7.8, 8.7, 8.7, 8.1, 6.9, 8.1, 8.5, 7.0, 7.8, 7.1

Find the median and semi-interquartile range.

The Semi-interquartile Range from a frequency table

Exercise 3(b)

- Students in a class were asked to count how many books they had with them in their bags one Monday morning.

<i>Number of books</i>	<i>Frequency</i>	<i>Cumulative Frequency</i>
0	0	0
1	1	1
2	2	3
3	3	6
4	4	...
5	6	...
6	4	...
7	6	...
8	4	...

- Copy and complete the frequency table.
 - Find the median number of books.
 - Find Q_1 , Q_3 and the semi-interquartile range.
- The ages of a group of workmen on a building site were recorded.

<i>Ages (in years)</i>	24	25	26	27	28	29	30	31
<i>Frequency</i>	2	2	3	5	6	4	2	1

- Draw up a frequency table for the above and add on a cumulative frequency column.
 - Find the median and semi-interquartile range.
- The number of driving lessons received by a group of young people who had passed their driving tests before they were 18 years old are shown below.

<i>No. of lessons</i>	10	11	12	13	14	15	16	17	18
<i>Frequency</i>	2	6	7	11	8	6	5	4	1

Find the median and calculate the semi-interquartile range.

4. The East Neuk Amateur Golf tournament was held over a week-end and the first round scores were noted.

<i>Score</i>	69	70	71	72	73	74	75	76	77
<i>No. of Golfers</i>	1	3	4	12	14	18	14	11	12

- (a) Was there a definite leader at the end of the first round?
 (b) Find the median and calculate the semi-interquartile range.
5. The local Education Authority made a list of the number of teachers who took retiral between the ages of 55 and 65.

<i>Retiral Age</i>	55	56	57	58	59	60	61	62	63	64	65
<i>No. of Men</i>	2	0	3	13	27	35	29	11	6	0	1
<i>No. of Women</i>	8	12	25	31	17	19	6	0	0	1	0

Find the median and calculate the semi-interquartile range for both men and women.

6. The label on a RED BELL matchbox reads: '**Average contents – 42 matches**'
 A sample of 50 boxes was analysed and the following figures obtained.
- (a) Find the **mean** number of matches per box for the sample.

<i>No. of matches in box</i>	37	38	39	40	41	42	43
<i>Frequency</i>	3	4	7	15	16	4	1

- (b) Find the median and calculate the semi-interquartile range.
 (c) Comment on the statement on the boxes of matches.

The Boxplot

Introductory Question

Copy and complete the working for this question:

Find the median and SIQR for the following set of numbers and draw a box plot to show the results.

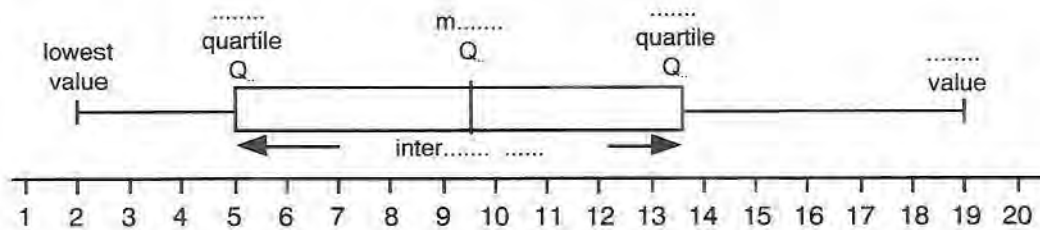
2, 3, 4, | 6, 7, 8, | 11, 11, 12, | 15, 15, 19

The Median (Q_2) is given by $Q_2 = \frac{1}{2}(8 + \dots) = \dots$

The Lower Quartile (Q_1) is $Q_1 = \frac{1}{2}(4 + \dots) = \dots$

The Upper Quartile (Q_3) is $Q_3 = \frac{1}{2}(\dots + \dots) = \dots$

The Boxplot



(Make a copy of this and fill in the blanks).

Exercise 4

1. A father timed how long his daughter was on the phone during 10 phone calls over a two night period. Here are the times in minutes.
2, 5, 6, 8, 10, 10, 10, 12, 17, 22
 - (a) Find the median and upper and lower quartiles.
 - (b) Show the information as a boxplot.
2. The daily rainfall (in millimetres) was measured on the roof of the meteorological offices from March 10th to March 23rd.
0, 3, 5, 6, 9, 15, 12, 5, 2, 0, 8, 12, 5, 8
 - (a) Rearrange the measurements in order and find the medians and quartiles.
 - (b) Show the results as a boxplot.
3. A man timed himself over a three week period on how long it took him to drive to work in the morning. The times, in minutes, were:
15, 17, 20, 23, 29, 32, 30, 29, 25, 23, 18, 29, 15, 17, 23, 20.
 - (a) Find the median and quartiles.
 - (b) Show your results as a boxplot.

4. A factory manager noted the number of absences, due to 'illness', both the men and women had during 1996.

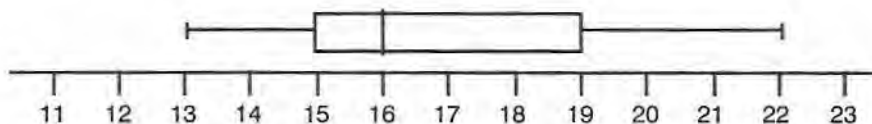
men 2, 2, 2, 3, 3, 3, 5, 5, 5, 6, 7, 7, 7, 7, 7, 8, 8, 8, 10, 11, 11, 12, 12, 13, 17
 women 0, 0, 0, 0, 1, 1, 1, 2, 2, 2, 2, 3, 4, 4, 4, 6, 6, 7, 8, 8, 8, 8, 8, 9, 9

- (a) Find the median and quartiles for each set of data.
 (b) On the same diagram, draw the two boxplots to represent the two sets of data.
 (c) Make two or three observations about your results.
5. A group of women were asked about the number of paperbacks they had read over the previous 12 months.

No. of books	0	1	2	3	4	5	6	7
No. of women	4	1	6	2	5	8	4	1

- (a) Draw up a frequency table, adding a cumulative frequency column.
 (b) Find the median number of books and calculate the semi-interquartile range.
 (c) Show your results as a boxplot.
6. A group of senior citizens were asked when they first noticed they had grey hairs. The results are shown as a back-to-back stem and leaf diagram.
- (a) Find Q_1 , Q_2 and Q_3 for each sex.
 (b) On a single diagram, show the two boxplots representing this information.
 (c) Make one or two comments about the results.

men		women
8 5 5 2 1 1	3	8 8 9
8 8 7 5 5 4 2 2 0	4	0 2 4 4 5 7 8
5 2 1 1	5	0 1 1 5 6
7 5 1 0	6	0 2 3 8
	7	1
7. A group of **seven** young people turned up at the opening of a new youth club. Their ages were noted and the boxplot shown below was drawn up.



Though all the ages cannot be predicted exactly, try to make up a list of possible ages which would fit the above graph.

Standard Deviation

mean $\bar{x} = \frac{\sum x}{n}$

standard deviation $s = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$ where n = the number of scores

Exercise 5

1. Follow through this example carefully to find the standard deviation of this set of scores.

5, 7, 8, 10, 10, 13, 17

- (a) Find the mean \bar{x} of the set of seven numbers.
 (b) Copy and complete the table and find the total of the $(x - \bar{x})^2$ column. (i.e. find $\sum (x - \bar{x})^2$)
 (c) Now calculate the standard deviation, s , of the seven numbers.

Score x	$x - \bar{x}$	$(x - \bar{x})^2$
5	$5 - 10 = -5$	$(-5)^2 = 25$
7	$7 - 10 = -3$	$(-3)^2 = 9$
8		

2. At Halloween, a group of children each counted out the number of apples they received.

13, 20, 16, 24, 19, 16

- (a) Calculate the mean number of apples.
 (b) Draw up a table and find the standard deviation.

3. During one week in January 1997 a man recorded the wind speed, in knots, at noon each day in his back garden.

11, 2, 0, 2, 18, 16, 7

- (a) Find the mean and range.
 (b) Rearrange the above recordings and find the median and semi-interquartile range.
 (c) Calculate the standard deviation.

4. Three groups of Primary 6 children sat the same test.

Blue Group: 12, 13, 14, 14, 14, 14, 15, 16

Red Group: 11, 11, 12, 14, 18, 18

Yellow Group: 8, 8, 9, 9, 14, 19, 19, 20, 20.

- (a) Check that the mean for each of the three groups is exactly the same.
 (b) Use a separate table each time to calculate the standard deviation for each group.
 (c) Comment on the differences in the standard deviations of the groups.

5. A golfer takes a note of his golf scores for each game he plays throughout the golf season.

94, 112, 88, 92, 100, 87, 90, 91, 88, 96, 94, 102, 83, 85, 86

- (a) Calculate the golfer's mean score.
(b) Draw up a table and hence calculate the standard deviation.
6. Bob grows brussel sprouts in his garden. He is hoping to win a prize in the next Campsie Show. He has been advised that if he uses Make-it-grow fertiliser then his sprouts will be bigger than normal.

He weighs each sprout carefully. The weights are in grams.

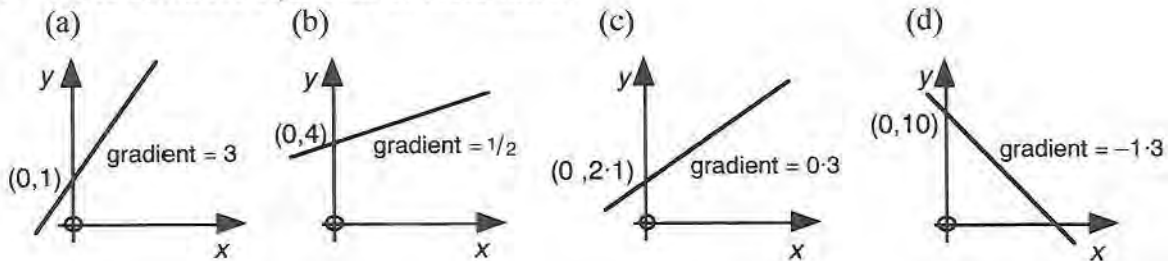
49, 50, 55, 47, 62, 35, 28, 59, 53, 54, 43, 58, 47, 69, 75, 34

- (a) Calculate the mean weight of the sprouts.
(b) Draw up a table and hence calculate the standard deviation.

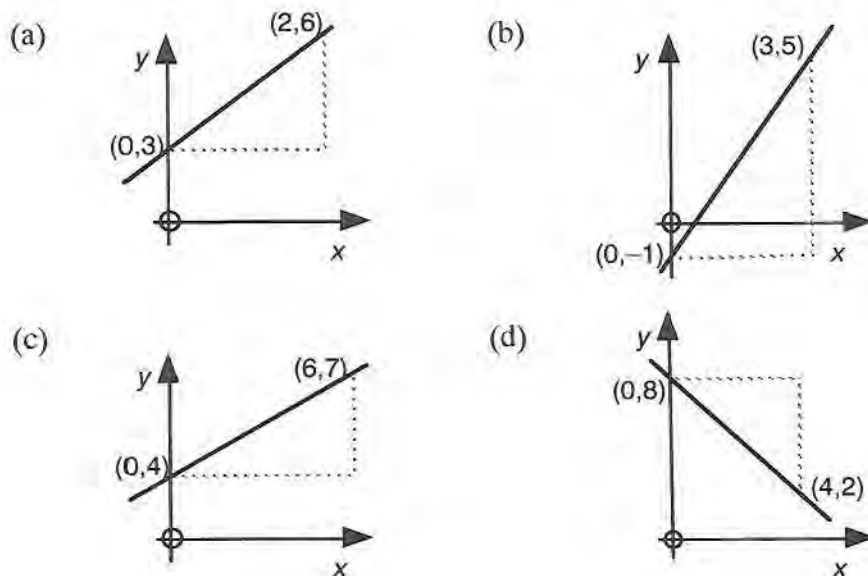
Regression Lines

Exercise 6

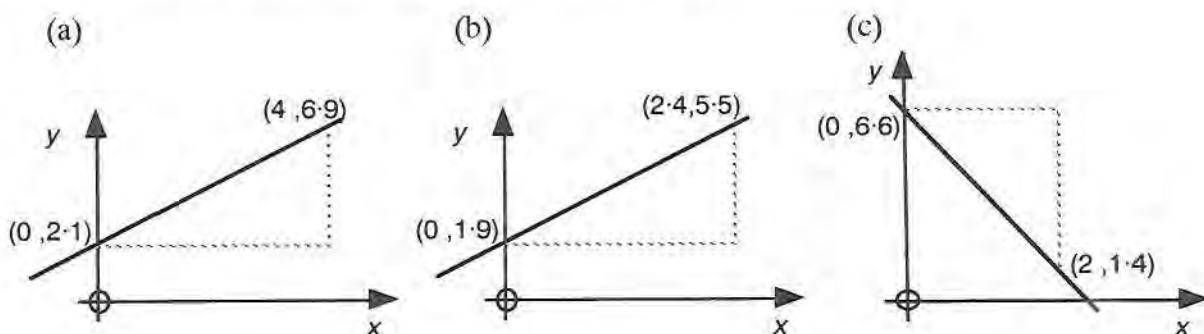
1. Write down the equations of these lines:



2. For each of the following lines,
 (i) find its gradient
 (ii) then find its equation.



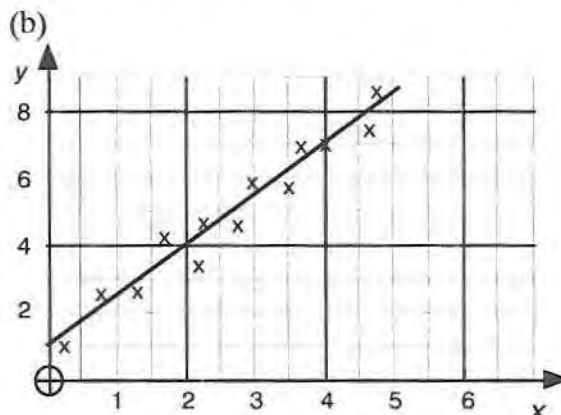
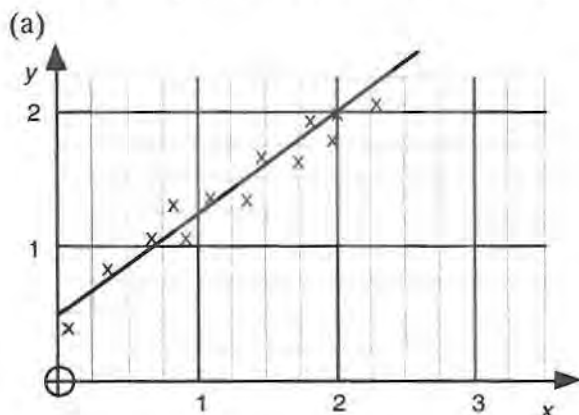
3. These lines all have decimal gradients. Find the equations of these lines:



Regression lines (lines of best fit)

Exercise 7

- For both of the following sets of points, the regression lines have been drawn for you. Choose two points on each line, find the gradient of it and write down its equation.



- Use $\frac{1}{2}$ centimetre squared paper to plot the following sets of points.
 - Decide if there is a strong enough correlation (or connection) between the pairs of points to draw a regression line.
 - Where yes, draw, by eye, the best fitting line of regression.
 - Find the equation of the line of regression.

(a)

x	0.5	1.0	1.5	2.0	2.5	3.0	3.5
y	0	1.1	1.5	3.0	4.2	4.6	6.0

Scales

x axis 1cm = 1 unit
 y axis 1cm = 1 unit

(b)

x	0	0.5	1.0	1.5	2.0	3.0	4.0
y	1.25	1.5	1.8	2.2	2.25	2.9	3.2

x axis 2cm = 1 unit
 y axis 2cm = 1 unit

(c)

x	0	5	10	15	20	25	30
y	10	13	18	20	27	28	35

x axis 1cm = 5 units
 y axis 1cm = 5 units

(d)

x	0	0.5	0.75	1.0	1.5	1.75	2.25
y	4.5	3.7	2.8	2.6	1.25	1.0	0

x axis 2cm = 1 unit
 y axis 2cm = 1 unit

Use 2 mm graph paper for the next four questions.

3. The English and the German judges at an ice skating competition gave the following marks for the eight finalists in an International competition.

<i>English (x)</i>	1.5	2.7	5.6	4.9	3.8	4.2	3.8	2.1
<i>German (y)</i>	2.6	3.6	6.4	5.5	4.6	5.0	4.5	3.1

- Plot the eight pairs of scores and draw the line of regression.
(Use a scale of 2 cm = 1 mark on both axes)
 - Find the equation of the line of regression in the form $y = mx + c$.
 - Use it to decide the most probable mark given by the German judge to a competitor who was given a mark of 1.9 by the English judge.
4. A group of eight pupils compared their French and English marks in two recent tests.

	Ted	Bill	Flo	Lucy	Ian	Eric	Stu	Millie
<i>French (x)</i>	10	35	60	24	56	17	42	49
<i>English (y)</i>	23	57	88	40	85	33	62	?

Millie had not had her English mark back by the time the table was made up.

- Plot the seven pairs of known points. (Scale 1 cm = 5 marks)
 - Draw the line of regression through the points.
 - Find the equation of the line of regression.
 - From it, estimate what Millie's English mark might have been.
5. At different times during his life, David had both his height and the circumference of his head measured. The table shows both of these (in centimetres).

David's Height	(x)	40	60	75	90	120	150	180
Circumference of David's head	(y)	29	30	36	37	45	48	56

- Plot the above pairs of measurements on 2mm graph paper (1cm = 10 cm).
- Draw the line of regression through the points if you feel there is one.
- Find the equation of this line of regression.
- When David was fourteen years old, his height was 165 centimetres. Estimate what the circumference of his head was at that time.

6. A leak develops in the bottom of a water storage tank on a farm. Using a dipstick, the farmer measures the depth of the water (in metres), in the tank over a period of 9 days.

<i>Day Number</i> (x)	1	3	4	6	8	9
<i>Depth (in m)</i> (y)	2.25	1.75	1.63	1.17	0.84	0.59

- (a) Plot the above pairs of measures. (x scale \rightarrow 2 cm \equiv 1 day)
(y scale \rightarrow 5 cm \equiv 1 metre)
- (b) Draw and find the line of regression.
- (c) Use the line to estimate the depth of water after 5 days.
- (d) After how many days do you think the tank will finally be empty?

Probability

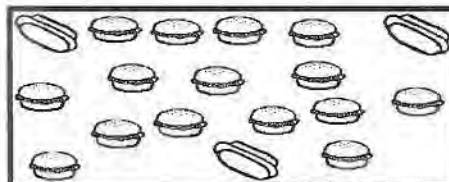
$$\text{Probability of an outcome} = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$$

Exercise 8

1. Blind-folded, Jason pointed to an advert for fast-food.

What is the probability that he pointed to:

- (a) a hot dog
- (b) a hamburger?

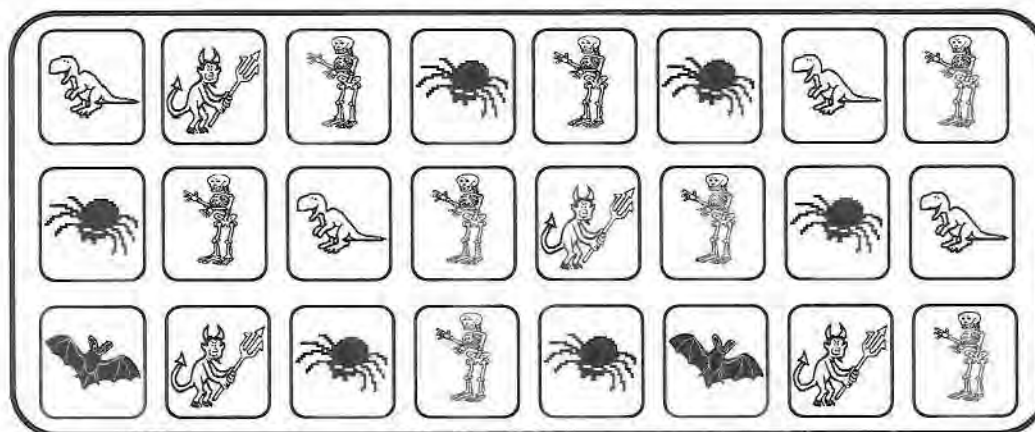


2. On a normal six-sided die (numbered 1 to 6), what is the probability of rolling:

- (a) a four
- (b) an odd number
- (c) a number less than 3
- (d) a prime number?



3. The 'ghostly' dart board is shown below. You are allowed 1 throw only with a dart.



What is the probability that, if you hit a picture, you will land on a card containing:

- (a) a skeleton
 - (b) a devil
 - (c) a bat
 - (d) a spider
 - (e) a dinosaur?
4. There are 49 numbers which can be drawn in the National Lottery. What is the probability that the first number out will be:
- (a) 44
 - (b) even
 - (c) a square number
 - (d) a multiple of 7?

5. Arnold reckons that his chances of holing a putt is 70% (or 7 out of 10). What is the probability that he won't hole it?

6. A pack of 52 playing cards are laid out, face down on a table. You have to pick a card. What is the probability that it will be:

- (a) a three
- (b) the three of spades
- (c) a face card
- (d) a black card
- (e) a heart?



7. Henrietta watches five TV channels:

BBC1 – BBC2 – STV – Channel 4 – Channel 5.

What is the probability that that she will select at random:

- (a) STV
- (b) a channel with no breaks for adverts?

8. **Win a Goldfish or a Hamster !**

All you have to do is throw a ping-pong ball into a narrow-neck bowl.

G for Goldfish. **H** for Hamster. **L** for Lose.

If your ball lands in a bowl, what is the probability of:

- (a) winning a goldfish
- (b) winning a hamster
- (c) winning
- (d) losing?



9. Malchester Rovers get most of their young players from 4 junior clubs. The diagram below indicates the number which they called up last season.



- (a) How many new young players were called up?
- (b) What was the probability that the player came from Tweed Juniors?
- (c) What was the probability that the player came from Tay Juniors?
- (d) What was the probability that the player did **not** come from Forth Juniors?

10. A letter is chosen at random from the name **THE ROLLING STONES**.

Calculate:

- (a) the probability it is an L
- (b) the probability it is a vowel
- (c) the probability it is not a vowel.

11. At the town fair, **700** red, **800** blue and **1000** yellow balloons were let off.

Each of them had a prize-winning ticket attached. If you were to catch a balloon, what is the probability that it would be:

- (a) red
- (b) yellow
- (c) red or yellow
- (d) not blue
- (e) green?



12. At Flo's cafe, Flo carried out a survey on what people had to drink after church on a Sunday. The results are shown in the table:

Tea # # # # # # # # # #

Coffee # # # # # # # #

Milk # # # # # # #

Fresh Juice # # #

Coke # # # # # # # # # # # # # #

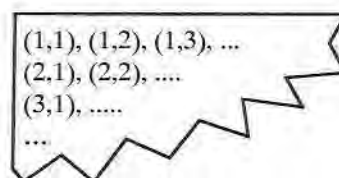
Others # # # #

What is the probability that if one person was chosen at random, he/she would be drinking:

- (a) tea
- (b) coke
- (c) others?

13. When 2 dice are rolled, one possibility is a 6 and a 2. This can be represented by **(6,2)**.

- (a) Make a list of all the possibilities.
- (b) How many different possibilities are there?
(Note: (1,2) is different from (2,1))
- (c) What is the probability of getting a
 - (i) double 6
 - (ii) double
 - (iii) total score of 7
 - (iv) total score of 5 or less?



14. A washing machine manufacturer surveyed several people about the powder they used.

Zad	Momo	Pesril	Radia	Fairo	Rainbo	Brand X
80	240	160	4000	360	400	320

- (a) How many people were asked?
 (b) If one person was picked at random, what is the probability that he/she uses:
 (i) Zad
 (ii) Rainbo
 (iii) Radia? (to 3 decimal places)
 (c) Make a comparison between the probabilities of Rainbo and Radia.
15. In Farmer Giles' orchard there are many different varieties of trees. They are illustrated in a table.

The fruit on the trees begin to go bad around the same time.

What is the probability that the first of his trees to go bad will be:

tree	frequency
apple	500
pear	180
plum	20
banana	110
orange	70
peach	120

- (a) an apple tree
 (b) a peach tree
 (c) an orange tree
 (d) a coconut tree
 (e) a pear or a plum tree??

16. The scores in the final round in the Open Golf Championship at Royal Troon in 1997 are shown in the table.

Score	64	65	66	67	68	69	70	71	72	73	74
Golfers	1	4	7	3	8	7	15	18	22	6	14
Score	75	76	77	78	79	80	81	82	83	84	85
Golfers	8	7	6	8	5	3	1	2	3	1	1

- (a) How many players completed the final round?
 (b) If you asked one player at random what his score was.....
 What is the probability that he scored:
 (i) 64 (ii) 70 (iii) 79 (iv) 90 (v) over 79?

MATHEMATICS 2 (INTERMEDIATE 2)

Checkup Exercise 2

1. Find the **range**, the **mean**, the **mode** and the **median** in the following:

- (a) 1, 3, 5, 7, 9, 11, 14, 14
- (b) £11, £15, £3, £6, £2, £14, £7, £13, £11, £10, £7.
- (c) 5cm, 2cm, 2cm, 1cm, 3cm, 3cm, 3cm, 4cm,
4cm, 3cm, 3cm, 4cm, 2cm, 3cm, 2cm, 4cm.

2. In a maths exam, everyone who sat it got between 51% and 56%.

Here is a frequency table displaying the results.

Mark	Frequency
51	3
52	4
53	7
54	6
55	3
56	1

- (a) What is the **range** of marks?
- (b) What is the **modal** mark?
- (c) Find the **median** mark.
- (d) Calculate the **mean** mark, giving your answer correct to 1 decimal place.

3. A paper boy was informed by his new employer that previous paper boys had been paid:

£6.56 £9.81 £4.81 £5.96 £8.46 £5.56 per week.

He was now being offered the **median** of these amounts, but being a true statistician, he said that he would prefer the **mean**!

Was he correct? Explain fully!

4. A Sunday school teacher was asked about the ages of children in her group. She replied: 4, 5, 5, 6, 6, 7, 7, 7, 7 and 19!

- (a) Calculate the **mean** age.
- (b) How many of the group were below the mean age?
- (c) Was the mean a good choice for 'average'?
- (d) What 'average' (**mean**, **mode** or **median**) should have been used here?

5. The owner of a shoe shop is ordering from the manufacturer. In order to find out which size of shoe to order most of, he looks carefully at the size of shoes which women buy in his shop.

Here is one common sample of shoe size he found:

3 3 3 3 4 4 5 5 6 6 6 6 6 6 6 7

- (a) Calculate the mean, mode and median.
- (b) For **his** own purpose, which one should the shop owner make the most use of?

6. Richard gets the following marks (out of 10) for his spelling tests.

9 5 5 4 8 9 7 3 4 4 6

- (a) Find: (i) the mean (correct to the nearest whole number)
(ii) the mode
(iii) the median.
- (b) Richard's 'average' mark will be used by the teacher in his report. Which 'average' – mean, mode or median, would Richard prefer?

7. This table shows the results of a survey in a factory on the average annual pay of the workers, rounded to the nearest £1000.

Pay (£1000's)	13	14	15	16	17	18	19	20	21	22
Number	1	3	5	3	6	9	2	7	3	1

- (a) How many people took part in the survey?
 (b) What was the range in their pays?
 (c) What was the modal pay?
 (d) What was the median pay?
 (e) Draw up a frequency table and add on a last column to enable you to calculate the mean pay.
8. Find the medians, quartiles and semi-interquartile ranges of the following:
 (a) 17, 17, 19, 20, 23, 23, 25, 27, 27, 27, 30, 31, 33.
 (b) 2.9, 4.6, 3.8, 4.8, 5.0, 4.2, 2.4, 3.1, 4.9, 4.6.

9. A small secondary school noted the number of standard grade maths passes of its fourth year, along with their grades.

Grade	Number
1	3
2	8
3	10
4	13
5	7
6	4
7	2

- (a) Find the median grade.
 (b) Find the lower and upper quartiles and then state the semi-interquartile range.
10. A security guard, overseeing a car park, made a note of the ages of the cars one evening. The ages, in years, were:
 5, 1, 3, 7, 6, 5, 10, 2, 1
 (a) Find the median and upper and lower quartiles.
 (b) Show all of this information as a box plot.

11. Show the details from question 9 as a **box plot**.

12. A girl threw 8 plastic darts at her toy dart-board. Her scores were: 11, 17, 10, 6, 4, 9, 8, 15.

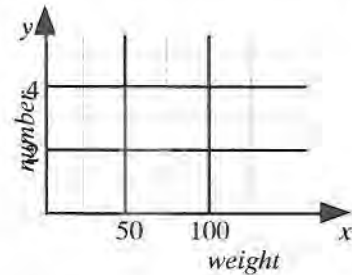
- (a) Calculate the mean \bar{x} .
 (b) Draw up and complete this table.
 (c) Calculate the standard deviation of the set of scores.

Score (x)	$x - \bar{x}$	$(x - \bar{x})^2$
11		
17		
10		
6		
4		
9		
8		
15		

13. An ornithologist believes that the more bread he leaves out for the birds in the morning, the greater the number of different species he'll attract to his garden. Over a nine day period, he weighs out the bread and notes the number of species which land in his garden.

Weight (grams)	50	125	175	225	300	375	500	575	650
No. of Species	3	4	6	6	8	9	13	13	15

- (a) Use $\frac{1}{2}$ centimetre squared paper to plot the results.
 (b) Draw the best fitting line through the set of points.
 (c) Find the equation of this line of the form $y = mx + c$.
 (d) Use your line to estimate how many species might be expected to land in the garden when 400 grams of bread is left out.



14. (a) Plot the following points on 2 mm graph paper.

x	0.0	2.0	3.5	4.0	6.5	7.5	8.0
y	5.9	8.2	12.4	13.3	20.1	22.4	23.9

Scales: x – axis (2 cm \equiv 1 unit); y – axis (1 cm \equiv 2 units)

- (b) Draw the line of best fit through the points.
 (c) Find the equation of this line of regression.
 (d) What would you expect the value of y to be when x is 5?

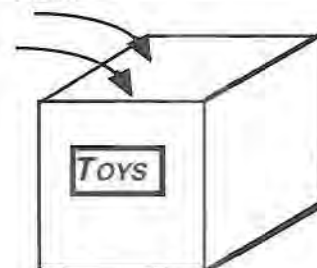
15. A five-sided spinner has a number (1–5) on each of its sides. When it is spun,

- (a) what is the probability that it stops at:
 (i) a 2
 (ii) an even number
 (iii) an odd number?
 (b) what is the probability that:
 (i) it won't stop
 (ii) it will stop at one of the numbers 1–5?

16. Mrs. Young put her two son's toys into **one** box in the dark attic. Albert's toys were – **3** planes, **4** cars, **2** jigsaws and **1** construction set. Andrew's toys were – **5** books, **4** cars and **1** football.

Albert, sneaks into the attic looking for a football. In the darkness, he plunges his hand into the box! What is the probability that he will first touch:

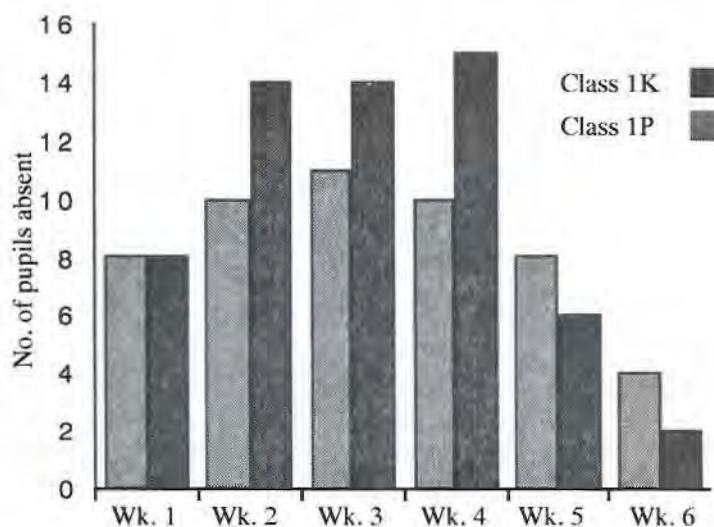
- (a) a book
 (b) a plane
 (c) a car
 (d) the football
 (e) one of his own toys
 (f) one of Andrew's toys?



MATHEMATICS 2 (INTERMEDIATE 2)

Specimen Assessment Questions for Graphs, Charts and Tables

1. The graph shows class absences which were recorded during a chicken-pox epidemic over 6 weeks in 1996.



- (a) Which class was more affected first by the epidemic?
(b) On how many weeks were there more than 10 pupils absent in class 1K?
(c) What was the largest number of pupils absent on any day in either class?
(d) How many pupils, in total, were absent over the period.
2. On Sat. 11th. Oct. 1997 Scotland defeated Latvia 2–0 to qualify for the World Cup finals in France in 1998. To assess Scotland's chances, a survey was carried out, asking people in the street which team would win the World Cup. The replies from **500** people are shown in the pie-chart.



- (a) How many said
(i) Brazil
(ii) Germany
(iii) France?
(b) The remaining section of the chart shows the people who said 'Scotland'. **How many** was that?

3. The marks of eight pupils from tests in History and Geography are shown below.

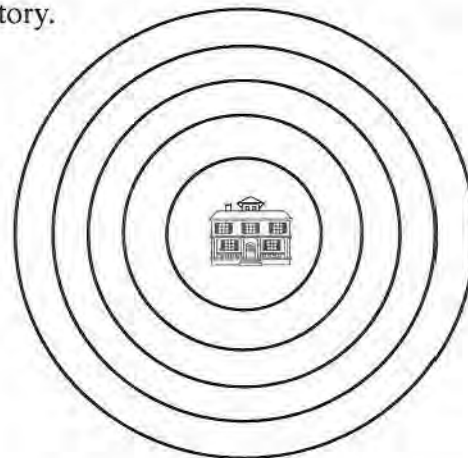
Pupil's Name	Alice	Dawn	Gerry	Colin	Freda	Sally	Harry	Will
History	5	6	10	11	13	15	18	22
Geography	8	10	13	14	16	17	20	25

- Draw a SCATTER DIAGRAM using the History marks for the *horizontal* axis and the Geography marks for the *vertical* axis.
 - Describe the general trend of the graph.
 - Draw in a line of best fit.
 - Find the equation of this line in the form $y = mx + c$
 - Use your equation to estimate what the Geography mark would be if the History mark was 20.
4. The following marks are those scored by pupils in a Primary 4 science test.

9	3	3	4	6	7	5	4	2	5	5	7	1
3	6	5	7	4	8	7	5	4	5	8	6	2
7	5	3	6	4	8	6	4	4	5	6	5	7
6	9	7	8	6								

- Draw a FREQUENCY TABLE to represent the data and add on an extra column to indicate the **cumulative frequency**.
 - From your table, say how many scored 5 or less.
 - How many scored more than 5?
5. A survey was taken of the 240 workers at a Glasgow factory as to how far away each lived from the factory.

<i>distance</i>	<i>number</i>
under 1 mile	12
from 1 up to 2 miles	40
from 2 up to 3 miles	80
from 3 up to 5 miles	54
from 5 up to 10 miles	30
10 miles or over	24



Set up a table and use it to help you draw a neat, carefully labelled pie-chart to display this data.

6. A group of men in an office was discussing the number of ties they possessed. The numbers are shown below:

4	2	5	9	7	6	5	3
1	2	3	5	5	2	5	4
9	6	4	4	6	2	4	5

Show this information as a **dotplot**.

MATHEMATICS 2 (INTERMEDIATE 2)

Specimen Assessment Questions for Use of Simple Statistics

1. After using a special feed, a farmer weighs a sample of his chickens. Their weights, in kilograms, are:
2.2, 2.7, 2.9, 2.5, 3.5, 3.1, 3.6, 3.1, 2.7, 2.3, 3.6, 3.1, 2.7
Find the **median** weight, the **upper** and **lower quartiles** and the **semi-interquartile range**.

2. The farmer also records how much milk (to the nearest litre) each of his cows produced one day.
This is shown in the table opposite.
(a) Find the **median** number of litres.
(b) Find Q_1 and Q_2 , the **upper** and **lower quartiles**.
(c) Calculate the **semi-interquartile range**.

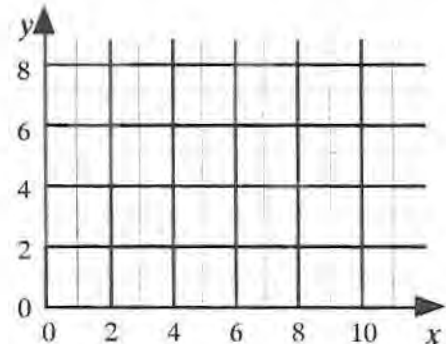
Volume of milk (in litres)	Number of cows
3	2
4	0
5	3
6	5
7	10
8	14
9	7
10	2
11	3
12	1

3. A golfer sent in his medal golf scores for one round, over 6 weeks.
69, 75, 74, 78, 70, 72.
(a) Calculate his **mean** score, \bar{x} .
(b) Calculate the **standard deviation**, showing all of your working.

4. (a) Use $\frac{1}{2}$ centimetre squared paper to plot the following pairs of values.

x-value	1	3	5	8	12	15	16
y-value	4	6.1	6.3	9.2	12.5	14.1	15

- (b) Draw, by eye, the best fitting straight line through the set of points.
(c) Determine the equation of the line in the form $y = mx + c$.
(d) Use your equation to calculate the y-value given the x-value is 10.



5. (a) In class 1C₁ at Cardew High School, there are 8 girls and 12 boys. What is the probability that the first person from 1C₁ to enter a classroom is a girl?
(b) An octagonal die has 8 faces. Each face is marked in turn with the first 8 letters of the alphabet, a, b, c, What is the probability that when the die is rolled, a 'vowel' will appear showing on top?



ANSWERS TO GRAPHS, CHARTS AND TABLES

Exercise 1

- (a) 3 (b) 16 (c) 28 (d) 11 (only child) - no brother/sister
- (a) Ch 1 (b) Ch 5 (c) Ch 2 Ch 4 (d) 97.5 million (e) Ch 3
- (a)i) Majorca ii) Ibiza (b) Scale too large to read
(c) Sp 2.4 million; Ibiza 1.3 m; Greece 1.8m; Maj 4.7m; Gran C 3.2m
- (a) S1 (b) S4/5/6 (c) 30 (d) S1 & S2
(e) S3 (f) 80 (g) All S6 prefer money
- (a) £12 million (b) £54 million (c) £6 million (d) £42 million

Exercise 2

- (a)i) 8 °C ii) -4 °C (b) 9 °C (c) Tues–Wed Wk 1
(d) Falling Temp.
- (a) 9 a.m. (b) 25 °C (c) 4 p.m. (d) Heating off / open window?
(e) 11 a.m. – 2p.m. (f) 3 hours (g) 4 p.m.
- (a) Cold weather (b) Jan-Feb, March-Apr, July-Aug
(c) April (d) Aug-Sept by 7000
(e) July-Aug – summer holidays (f) Go on winter holiday to sun.

Exercise 3

- (a)i) Trigonometry ii) Calculus (b) 25% (c) $\frac{1}{7}$
- (a)i) 40 ii) 20 (b) 60 apples (c) 340 apples
- (a)i) $\frac{1}{2}$ ii) $\frac{1}{8}$ (b) 8
- (a) £3 200 000 (b) 21% (c) £448 000 (d) 18°
- (a) All Bran = 180° Corn Fl. = 120° Frost. = 15° Weet. = 45°
(b)i) 120 ii) 80 iii) 30 iv) 10

Exercise 4

- (a) Rising (b) Falling (c) General trend is upwards, but slowly.
- (a) 10a.m. (b) Cheaper rate
(c) Before 10 – high, then fall to noon, slight rise at lunch, the fall away till 6 p.m. – quite a rise till 8 p.m. then as day ends, trend falls.
- (a) 10.00 (b) 12.15 (c) 30 miles (d) Flat tyre??
(e) 30 mins. approx.
- Decrease in use of train – bus about same – increase in car & plane
More people have cars and more confidence in air travel.
- Graph 4. Fills steadily, but quickly – then fills steadily, but slower.

Exercise 5

- (a) 90 cm (b) 60 kg (c) Ann & Jan (d) Ann (e) Fred
- (a) As temp rises – sales rise (b) 20 (c) Around 18–20 °C
- (a) More miles travelled – dearer the fare (b) no travel – no cost
(c) Around 4 miles (d) about £2.40 – £2.50
- (a) 1 & 2 (b) the older the yacht - the smaller its value (c) 3–3.5 years
(d) about £60000?
- (a) A – the more you apply, the better the growth B – apply more, but growth static
C – apply more, but height varies
(b) Use A, – for better, more reliable, controlled growth.

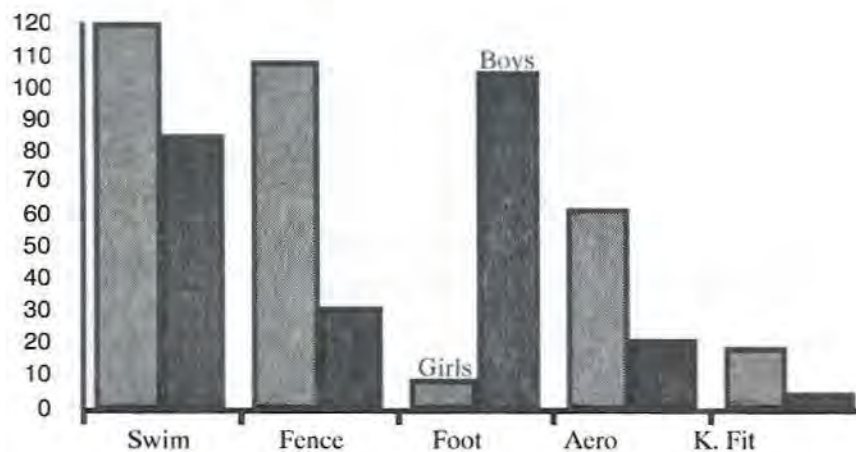
Exercise 6

- 14 17 21 21 23 27 29 31 32 34 36 36 37
38 40 41 41 42 48 49 51 53 54 54 61 62
16 weeks

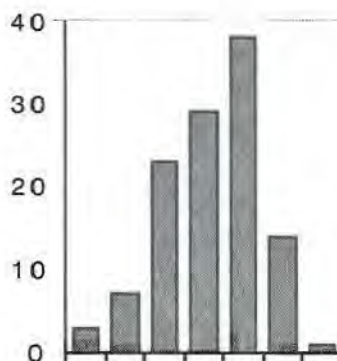
- £187 £219 £225 £324 £337
£369 £413 £522 £533 £555
£630 £658 £745 £773
- (a) i) 11 a.m. ii) 4 p.m. (b) 9

Exercise 7

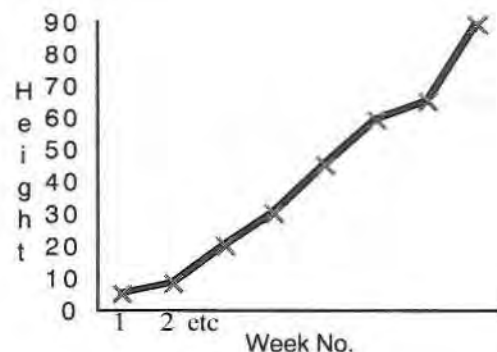
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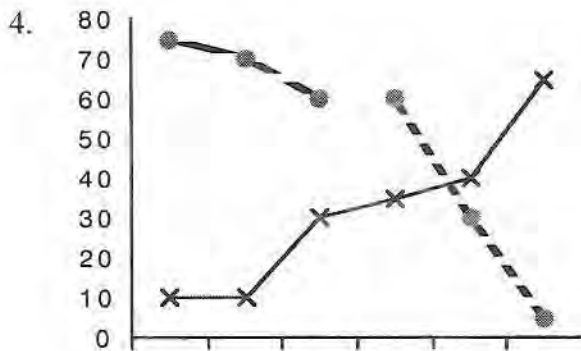


2. Shaped like this (but with labels!):



3.

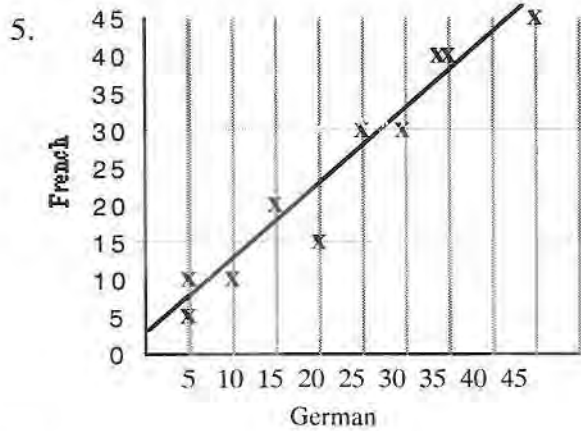




In Jan. due to bad weather, more go for hot school lunch.

As year goes on, number of school lunches fall while own food increases.

By June, many more bring own – not many in school

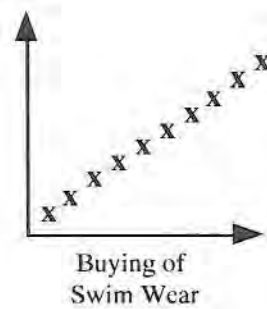
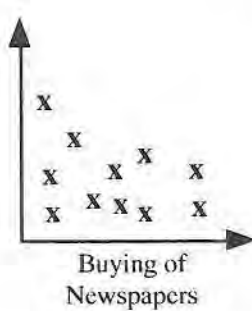
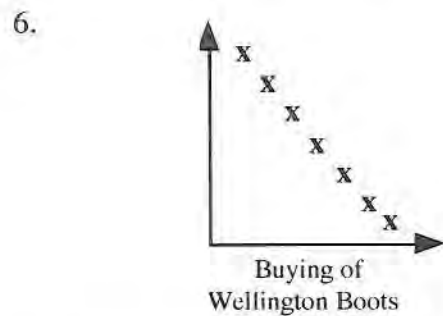


(c) French marks are higher (not by much); Pen & Rab got same in both; French marks rose so did German

(d) By eye

(e) Estimate 35

(f) Flo's German marks are higher.



7. Draw Scatter Graph with correct axes and labels

(c) Estimate 20 mins.

8.

Stem	Leaf
6	6 0 3 6 2 7 9 2 6 8 4 5 9 4
7	8 9 8 8 8 7 5 5 4 6 1 2 7 5 3
8	0 4 4 0 1
9	3 0

9.

Machine 1	Machine 2
	199 8 9
2 5 0 6 7	200 5 2 4 0 5 7 1 5 9 3
4 1 8 5 9 9 6 3 7 7 3 0 9 9 5 3 6 2 3 8 4 2	201 3 6 8 9 9 7 6 2 8 7 1 0 6 3 4 4
0 1 1 0 3 0 0 6 5 0 1 8	202 0 0 1 9 0 0 3 1 0 2
8	203 3 0
stem \times 10, leaf \times 1	

Machine 1 more bunched, gives more 201's. Machine 2 gives more of the lesser 200's but gives more 203's (not many!).

10.

Class 1X	Class 1Y
7 5 0	8
9 7 4	1 0 1 3 5 7 8 8 8 9
9 9 8 7 7 7 7 6 6 6 5 4 4	2 0 2 3 3 4 5 5 6 6
9 8 6 3 1 1	3
3	4 8 9
5	0 0 0 0

(b) More passed in 1X, but 1Y had the cleverest pupils in it.

Exercise 8

- (a) 16 (b) 34
- Table with frequencies 4, 11, 9, 6, 5, 1 = 36
(a) Fred (b) Alice (c) 3.
- Table with:

Goals	0	1	2	3	4	5	6	7	8	9	10
Teams	5	10	6	2	5	2	1	2	1	1	1

Exercise 9

- Pie chart with angles 120° , 90° , 105° , 45° .
- Pie chart with angles 140° , 90° , 80° , 50° .
- Pie chart with angles 85° , 50° , 90° , 35° , 70° , 30° .
- Pie chart with angles 37° , 117° , 79° , 22° , 57° , 47° .
- Pie chart with angles 61.2° , 111.6° , 93.6° , 93.6° .
- (a) Pie chart with angles 68° , 44° , 88° , 40° , 120° .
(b) Pie chart with angles 48° , 102° , 60° , 150° .
(c) Pie chart with angles 180° , 36° , 72° , 54° , 18° .

Exercise 10

1–4 appropriate dot-plots

5. Dot plot for frequency table:

Pocket Money	3	4	5	6	7	8	9	10
Frequency	2	5	7	4	1	2	0	3

6. Dot plot for frequency table:

Weight	0	1	2	3	4	5	6	7	8
Number	2	5	7	1	4	8	6	2	1

7. Dot plot for frequency table:

Money	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Frequency	5	0	1	0	1	4	1	0	3	0	6	0	4	1	1	3

Exercise 111. (a) & (b) third column 2, 17, 45, 81, 132, 175, 192, 198, 200
(c) 192 (d) 82. (a) 3rd column 35, 53, 62, 77, 100, 129, 143, 149, 150.
(b) 129 (c) 62 (d) 50.3. (a) 3rd column 1, 4, 11, 22, 28, 37, 41, 43, 44.
(b) 3rd column 3, 12, 26, 42, 59, 65, 66.
(c) 5, 17, 25, 27, 27, 31, 36, 38, 39.
(d) 1, 2, 5, 20, 37, 47, 49.

4. (a) & (b) 3rd column 2, 5, 11, 20, 37, 47, 49. (c) 20

5. (a) and (b)

Score	11	12	13	14	15	16	17	18
frequ	1	4	7	9	5	2	1	1
cum freq	1	5	12	21	26	28	29	30

(c) 26 (d) 4

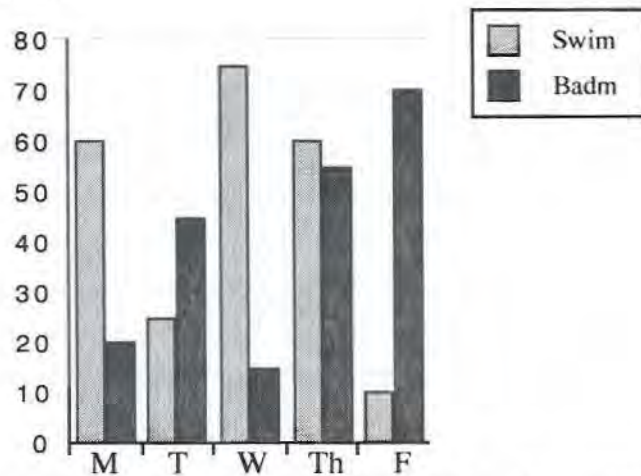
6.

number	1	2	3	4	5	6	7
freq	3	7	8	14	5	2	1
cum freq	3	10	18	32	37	39	40

7. Middle column 3, 4, 8, 13, 11, 7, 4.

Checkup Exercise 1

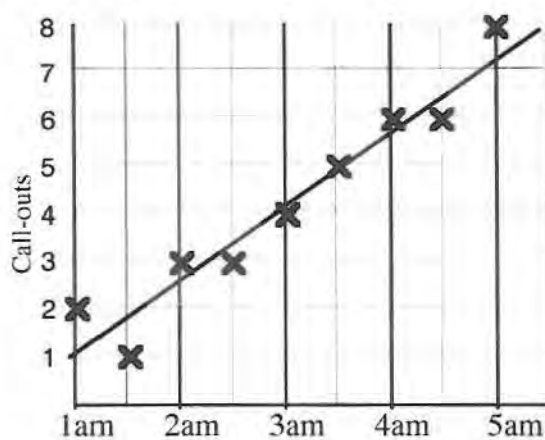
1.



2. (a) i) 0–1000 ii) 41/42 thousand (b) 18000 approx. (c) 1992–1996
(d) Rising slowly, then fast!

3. (a) i) 50% ii) 25% iii) 10%
(b) i) 60 ii) 30 iii) 150 (c) 150

4.



(b) Rising – the later it gets – the more call-outs

5.

Stem	Leaf
0	4 6 3
1	8 2 4 9
2	3 5 9 8 7 8 5 2
3	5 6 8 9 9 7
4	7 5 5 7 2 4 4 7 6 1 8 4 4
5	0 0

6. (a) Table with: B = 21, C = 10, Ch = 14, CN = 10, V = 2, H = 6, U = 2

(b) 2 (c) Beefburger (d) 4 (e) 65

7. Pie chart showing 135° , 117° , 72° , 36° .

8. Dot-plot showing frequencies 2, 4, 8, 12, 14, 9, 6, 4, 1.

9. (a) Cumulative frequency column – 2, 7, 19, 34, 45, 52, 55, 59, 60.

(b) 45 (c) 15

Answers to Use of Simple Statistics

Exercise 1

1. (a) 10 (b) 74 (c) 7.6
2. (a) 5.9 (b) 7.1 (c) £14.43
3. (a) 5 (b) £17 (c) 25.5kg
4. (a) 4 (b) 5 (c) 251
5. (a) 18 (b) 19.6 (c) 20.5 (d) 26
6. (a) 19 cm (b) 170 cm (c) 172 cm
7. (a) 12 m (b) 10.2 m (c) 10 m (d) 10 m
8.

	Range	Mean	Mode	Median	Best
(a)	145	36	20	20	Med/Mode
(b)	51	43	34	36	Mode
(c)	11	60	56	59	Mean
9. (a) 30 mins (b) Med = 21 mins Mode = 10 mins
(c) Median; Mean is put out by 110 mins. Mode...only 2 at 10 mins..not enough to justify
10. (a) Jim 15 less (b) i) 11 ii) 18 (c) Before = 46.1 After = 37.2
(d) At end...wider range and mean lower. (e) Above both times.
11. (a) R 8, M 75.5 (b) R 4, M 74.5 (c) i) Mary ii) Mary (d) Beth
12. (a) List Marks in order (b) 15
(c) Mean = 20.9 Mode = 18 Median = 20.5
(d) 20 or 21 Mean & median close to each other and small range
13. (a) 50.7 (b) 52 (c) No! (d) Mode
14. (a) 36 (b) 3
15. 49
16. 6

Exercise 2

1. (a) Complete table (b) 3.6 (c) 6 (d) i) 4 ii) 4
2. (a) B = 3.4 D = 3 (b) B = 3 D = 3 (c) B = 3 D = 5
(d) i) Groupies ii) neither iii) Magpies.
3. (a) 8 years (b) 4 (c) 5.3 (d) 5
4. (a) 21 (b) 5 cm (c) i) 15.8 cm ii) 17 cm iii) 17 cm
(d) Not great! too low.
5. (a) Check table (b) 5 (c) i) 20.5 ii) 20 iii) 19
(d) Median

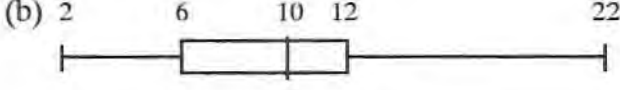
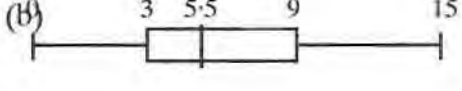
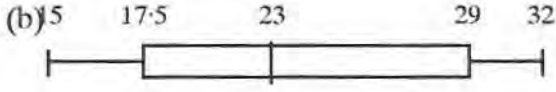
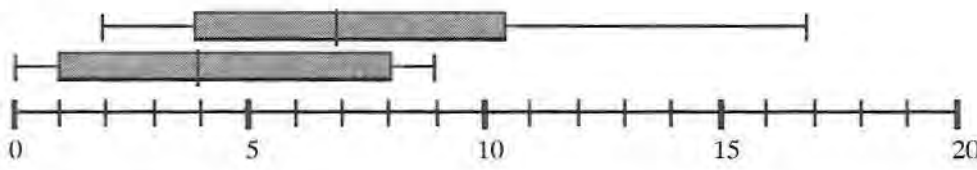
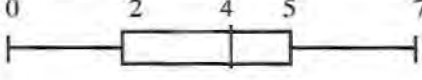
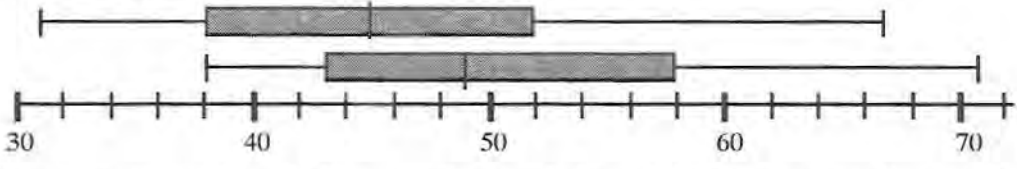
Exercise 3(a)

1. lower quartile = 9.5, median = 13, upper quartile = 14, SIQR = 2.25
2. (a) Range = 7 SIQR = 1.5 (b) Range = 10 SIQR = 3
(c) Range = 10 SIQR = 3 (d) Range = 8 SIQR = 3
3. median = 7.8 SIQR = 0.55

Exercise 3(b)

- (a) Cumulative frequencies 0, 1, 3, 6, 10, 16, 20, 26, 30.
(b) median = 5 (c) lower quartile = 4, upper quartile = 7 SIQR = 1.5
- (a) Cumulative frequencies 2, 4, 7, 12, 18, 22, 24, 25.
(b) median = 28 (c) SIQR = 1.5
- median = 13 SIQR = 1.5
- (a) Yes – score = 69 (b) median = 74, SIQR = 1.5
- MEN – median = 60, SIQR = 1 WOMEN – median = 58, SIQR = 1
- (a) mean = 40.1 (b) median = 40, SIQR = 1
(c) median and mean indicate that ‘average’ contents are only 40, not 42!

Exercise 4

- (a) median = 10
lower quartile = 6
upper quartile = 12
(b) 
- (a) median = 5.5
lower quartile = 3
upper quartile = 9
(b) 
- (a) median = 23
lower quartile = 17.5
upper quartile = 29
(b) 
- (a) median = MEN – 7 WOMEN – 4
lower quartile = MEN – 4 WOMEN – 1
upper quartile = MEN – 10.5 WOMEN – 8
(b) 
(c) Range of women's absences smaller, median lower, => generally fewer absences than men.
- (a) Cumulative frequencies: 4, 5, 11, 13, 18, 26, 30, 31.
(b) median = 4, SIQR = 1.5 (c) 
- (a) MEN $Q_1 = 38$, $Q_2 = 45$, $Q_3 = 52$.
(b) WOMEN $Q_1 = 43$, $Q_2 = 49$, $Q_3 = 58$.

(c) Women go greyer later in life, median age is later in life (or women lie more!)
- Possibly: 13, 15, 15, 16, 17, 19, 22.

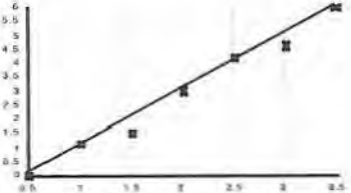
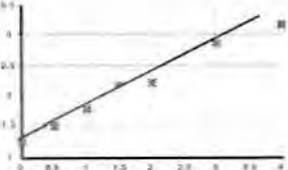
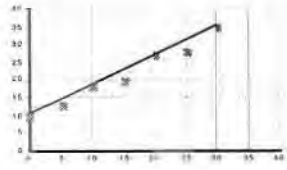
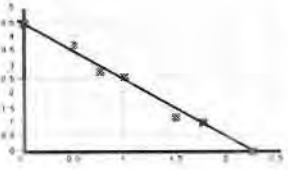
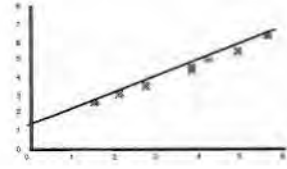
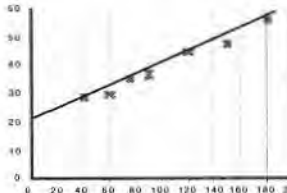
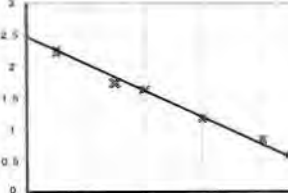
Exercise 5

- (a) mean = 10 (b) total = 96 (c) standard deviation = 3.7
- (a) mean = 18 (b) standard deviation = 3.51
- (a) mean = 8, range = 18 (b) median = 7, SIQR = 7
(c) standard deviation = 6.66
- (a) mean = 14 (b) blue s.d. = 1.12, red s.d. = 3.00, yellow s.d. = 5.21
(c) comments.
- (a) mean = 92.5 (b) standard deviation = 7.36
- (a) mean = 51.125, standard deviation = 12.09

Exercise 6

- (a) $y = 3x + 1$ (b) $y = \frac{1}{2}x + 4$ (c) $y = 0.3x + 2.1$ (d) $y = -1.3x + 10$
- (a) $m = 1.5$ ii) $y = 1.5x + 3$ (b) $m = 2$ ii) $y = 2x - 1$
(c) $m = 0.5$ ii) $y = 0.5x + 4$ (d) $m = -1.5$ ii) $y = -1.5x + 8$
- (a) $y = 1.2x + 2.1$ (b) $y = 1.5x + 1.9$ (c) $y = -2.6x + 6.6$

Exercise 7

- (a) $y = 0.75x + 0.5$ (b) $y = 1.5x + 1$
- (a)  $y = 2x - 1$ (b)  $y = 0.5x + 1.25$
- (c)  $y = 0.8x + 10$ (d)  $y = -2x + 4.5$
- (a)  (b) $y = 0.9x + 1.1$ (approx)
(c) 2.8
- (a)  (c) $y = 0.2x + 20$ (d) 53
- (a)  (b) $y = -0.2x + 2.4$ (c) 1.4 (d) 12 days

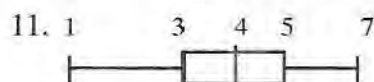
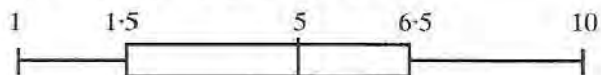
Exercise 8

1. (a) $\frac{3}{18} = \frac{1}{6}$ (b) $\frac{5}{6}$
2. (a) $\frac{1}{6}$ (b) $\frac{1}{2}$ (c) $\frac{1}{3}$ (d) $\frac{1}{2}$
3. (a) $\frac{8}{24}$ (b) $\frac{4}{24}$ (c) $\frac{2}{24}$ (d) $\frac{6}{24}$ (e) $\frac{4}{24}$
4. (a) $\frac{1}{49}$ (b) $\frac{24}{49}$ (c) $\frac{1}{7}$ (d) $\frac{1}{7}$
5. 30% (or 3 out of 10)
6. (a) $\frac{1}{13}$ (b) $\frac{1}{52}$ (c) $\frac{3}{13}$ (d) $\frac{1}{2}$ (e) $\frac{1}{4}$
7. (a) $\frac{1}{5}$ (b) $\frac{2}{5}$
8. (a) $\frac{7}{20}$ (b) $\frac{1}{20}$ (c) $\frac{8}{20} = \frac{2}{5}$ (d) $\frac{3}{5}$
9. (a) 120 (b) $\frac{1}{6}$ (c) $\frac{5}{12}$ (d) $\frac{3}{4}$
10. (a) $\frac{1}{8}$ (b) $\frac{5}{16}$ (c) $\frac{11}{16}$
11. (a) $\frac{7}{25}$ (b) $\frac{2}{5}$ (c) $\frac{17}{25}$ (d) $\frac{17}{25}$ (e) 0
12. (a) $\frac{27}{124}$ (b) $\frac{39}{124}$ (c) $\frac{9}{124}$
13. (a) (1,1)(1,2)(1,3)(1,4)(1,5)(1,6)
(2,1)(2,2)(2,3)(2,4)(2,5)(2,6)
(3,1)(3,2)(3,3)(3,4)(3,5)(3,6)
(4,1)(4,2)(4,3)(4,4)(4,5)(4,6)
(5,1)(5,2)(5,3)(5,4)(5,5)(5,6)
(6,1)(6,2)(6,3)(6,4)(6,5)(6,6)
(b) 36
(c) i) $\frac{1}{36}$ ii) $\frac{1}{6}$
(iii) $\frac{1}{6}$ iv) $\frac{5}{18}$
14. (a) 5560 (b) i) 0.014 ii) 0.0719 iii) 0.719
(c) There were 10 times as many using Radia as Rainbo.
This showed up when the probability was 10 times that of Rainbo.
15. (a) 0.5 (b) 0.12 (c) 0.07 (d) 0 (e) 0.2
16. (a) 150
(b) i) 0.007 ii) 0.1 iii) 0.03 iv) 0 v) 0.073

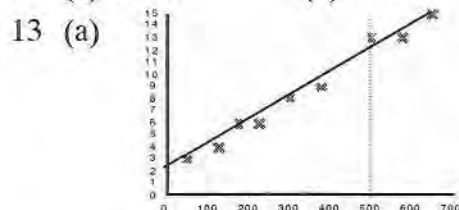
Checkup Exercise 2

1. Range Mean Mode Median
(a) 13 8 14 8
(b) £13 £9 none £10
(c) 4 cm 3 cm 3 cm 3 cm
2. (a) 5 (b) 53 (c) 53 (d) 53.2
3. Median = £6.26, Mean = £6.86. Yes. He was correct!
4. (a) 7.3 (b) 9 out of 10!
(c) No, the teacher included herself, knocking the mean out
(d) Median
5. (a) Mean 4.9, Mode 6, Median 5
(b) Mode will tell him which size he sells most.
6. (a) i) 6 ii) 4 iii) 5 (b) Mean gives better mark.

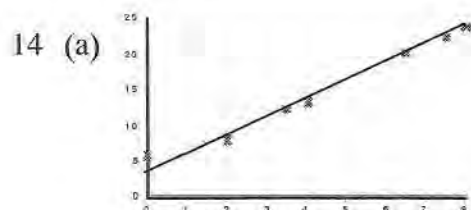
7. (a) 40 (b) 9 (c) £18000 (d) £18000 (e) £17625
8. (a) median = 25, $Q_1 = 19.5$, $Q_3 = 28.5$, SIQR = 4.5
 (b) median = 4.4, $Q_1 = 3.1$, $Q_3 = 4.8$, SIQR = 0.85
9. (a) median = 4, $Q_1 = 3$, $Q_3 = 5$, SIQR = 1
10. (a) median = 5, $Q_1 = 1.5$, $Q_3 = 6.5$



12. (a) $\bar{x} = 10$ (b) table (c) standard deviation = 3.63



- (c) $y = 0.02x + 2$
 (d) 10 species



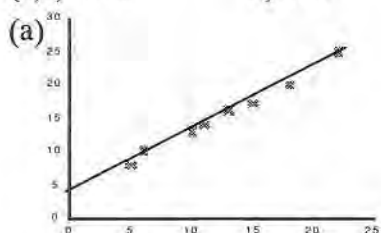
- (c) $y = 2.5x + 3$
 (d) 15.5

15. (a) i) $1/5$ ii) $2/5$ iii) $3/5$ (b) (i) 0 ii) 1
16. (a) $1/4$ (b) $3/20$ (c) $1/5$ (d) $1/20$ (e) $1/2$
 (f) $1/2$

Specimen Questions for Graphs, Charts and Tables

1. (a) 1K (b) 3 (c) 15 (d) 110 (e) Wk. 4
 (f) Wk. 5

2. (a) i) 250 ii) 125 iii) 50 (b) 25
 (b) As History marks rise, so do Geog.
 (c) By eye
 (d) $y = x + 3$
 (e) about 23



4. (a)

Score	1	2	3	4	5	6	7	8	9	10
Frequ	1	2	4	8	9	10	9	4	2	1
Cum Fre	1	3	7	15	24	34	43	47	49	50

(b) 24 (c) 26

5. Pie chart showing $18^\circ, 60^\circ, 120^\circ, 81^\circ, 45^\circ, 36^\circ$.

6. Dot plot showing

ties	1	2	3	4	5	6	7	8	9
frequ	1	4	2	5	6	3	1	0	2

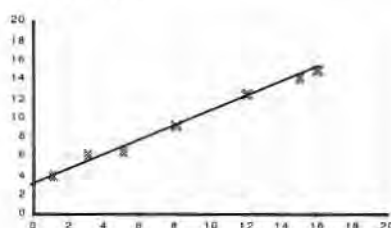
Specimen Assessment Questions for Use of Simple Statistics

1. median = 2.9, $Q_1 = 2.6$, $Q_3 = 3.3$, SIQR = 0.35

2. (a) median = 8 (b) $Q_1 = 7$, $Q_3 = 9$, (c) SIQR = 1

3. (a) 73 (b) 3.05

4. (a) & (b)



(c) $y = 0.75x + 3$

(d) 10.5

5. (a) $\frac{2}{5}$ (b) $\frac{1}{4}$