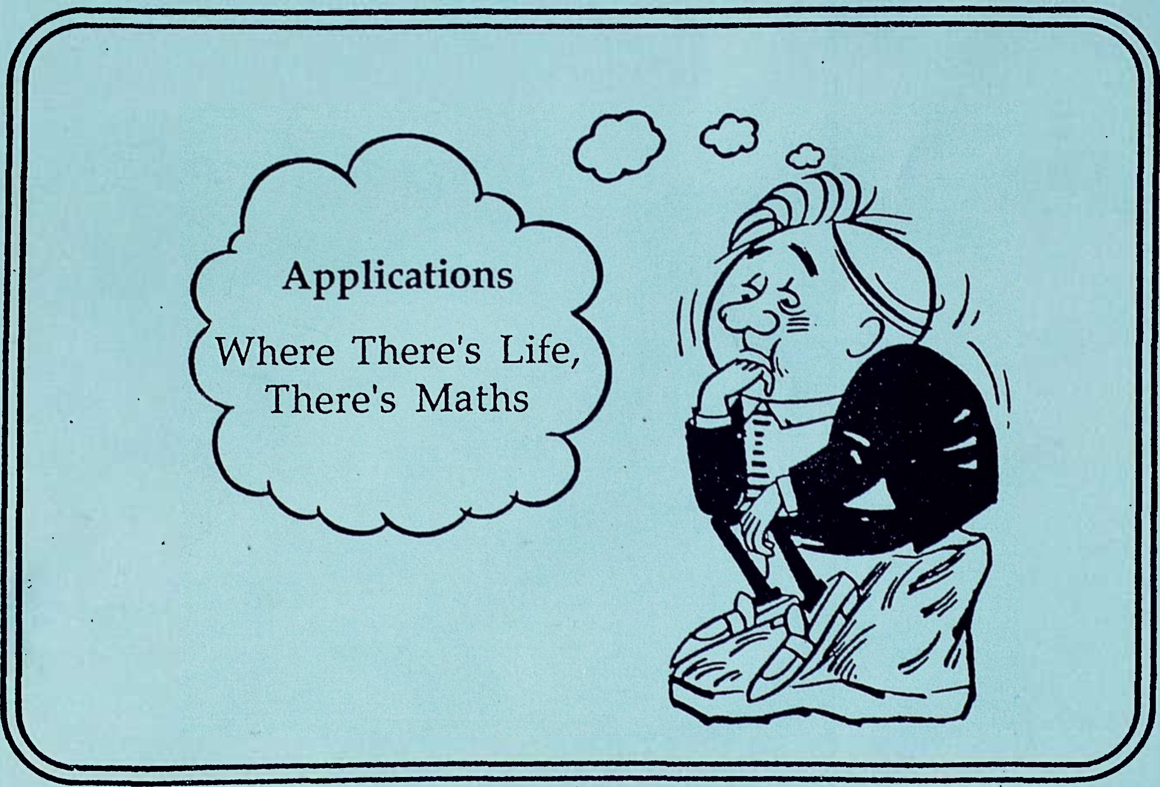
EXTENDED TASKS FOR GCSE MATHEMATICS

A series of modules to support school-based assessment



MIDLAND EXAMINING GROUP

SHELL CENTRE FOR MATHEMATICAL EDUCATION

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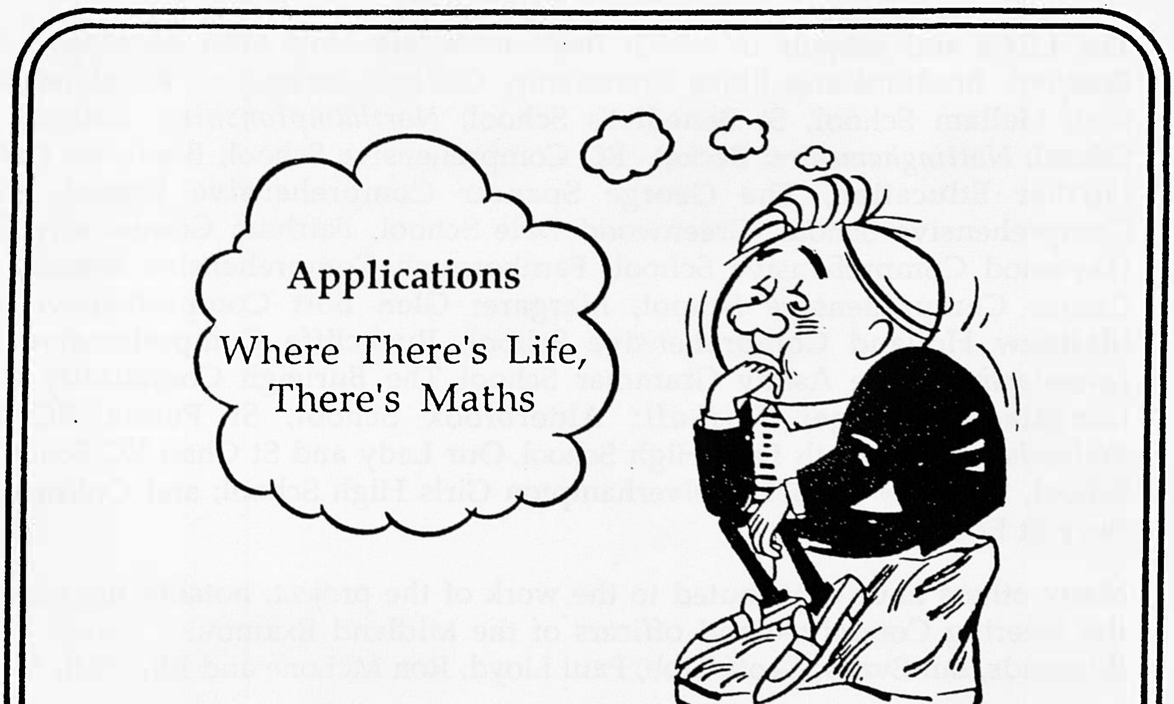

MIDLAND EXAMINING GROUP

SHELL CENTRE FOR MATHEMATICAL EDUCATION

Authors

This book is one of a series forming a support package for GCSE coursework in mathematics. It has been developed as part of a joint project by the Shell Centre for Mathematical Education and the Midland Examining Group.

The books were written by

Steve Maddern and Rita Crust

working with the Shell Centre team, including Alan Bell, Barbara Binns, Hugh Burkhardt, Rosemary Fraser, John Gillespie, Richard Phillips, Malcolm Swan and Diana Wharmby.

The project was directed by Hugh Burkhardt.

A large number of teachers and their students have contributed to this work through a continuing process of trialling and observation in their classrooms. We are grateful to them all for their help and for their comments. Among the teachers to whom we are particularly indebted for their contributions at various stages of the project are Paul Davison, Ray Downes, John Edwards, Harry Gordon, Peter Jones, Sue Marshall, Glenda Taylor, Shirley Thompson and Trevor Williamson.

The LEAs and schools in which these materials have been developed include *Bradford:* Bradford and Ilkley Community College; *Derbyshire:* Friesland School, Kirk Hallam School, St Benedict's School; *Northamptonshire:* Raunds Manor School; *Nottinghamshire:* Becket RC Comprehensive School, Broxtowe College of Further Education, The George Spencer Comprehensive School, Chilwell Comprehensive School, Greenwood Dale School, Fairham Community College, Haywood Comprehensive School, Farnborough Comprehensive School, Kirkby Centre Comprehensive School, Margaret Glen Bott Comprehensive School, Matthew Holland Comprehensive School, Rushcliffe Comprehensive School; *Leicestershire:* The Ashby Grammar School, The Burleigh Community College, Longslade College; *Solihull:* Alderbrook School, St Peters RC School; *Wolverhampton:* Heath Park High School, Our Lady and St Chad RC School, Regis School, Smestow School, Wolverhampton Girls High School; and Culford School, Bury St Edmonds.

Many others have contributed to the work of the project, notably the members of the Steering Committee and officers of the Midland Examining Group - Barbara Edmonds, Ian Evans, Geoff Gibb, Paul Lloyd, Ron McLone and Elizabeth Mills.

Jenny Payne has typed the manuscript in its development stages with help from Judith Rowlands and Mark Stocks. The final version has been prepared by Susan Hatfield.

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1 *Introduction*

WHERE THERE'S LIFE, THERE'S MATHS is one of eight such 'cluster books', each offering a lead task which is fully supported by detailed teacher's notes, a student's introduction to the problem, a case study, examples of students' work which demonstrate achievement at a variety of levels, together with six alternative tasks of a similar nature. The alternative tasks simply comprise the student's introduction to the problem and some brief teacher's notes. It is intended that these alternative tasks should be used in a similar manner to the lead task and hence only the lead task, has been fully supported with more detailed teacher's notes and examples of students' work.

The eight cluster books fall into four pairs, one for each of the general categories: Pure Investigations, Statistics and Probability, Practical Geometry and Applications. This series of cluster books is further supported by an overall teacher's guide and a departmental development programme, IMPACT, to enable teacher, student and departmental experience to be gained with this type of work.

The material is available in two parts

Part One		The Teacher's Guide
		IMPACT
	Pure Investigations	I1 - Looking Deeper
		I2 - Making The Most Of It
	Statistics and Probability	S1 - Take a Chance
		S2 - Finding Out
Part Two	Practical Geometry	G1 - Pack It In
		G2 - Construct It Right
	Applications	A1 - Plan It
		A2 - Where There's Life, There's Maths

This particular 'cluster book', WHERE THERE'S LIFE, THERE'S MATHS, offers a range of materials designed to support students as they pursue applications tasks within any GCSE mathematics scheme. The material has been designed and tested, as extended tasks, in a range of classrooms. A total of about twelve to fifteen hours study time, usually over a period of two to three weeks, was spent on each task. Many of the ideas have been used to stimulate work for a longer period of time than this, but any period which is significantly shorter has proved to be rather unsatisfactory. These applications tasks are intended to stimulate students' interest in, and understanding of, the world in which they live. As they pursue these tasks students will be involved in selecting materials and mathematics to use for their chosen task, checking they have sufficient information, working methodically and reviewing their progress, interpreting mathematical information presented in oral, written or diagrammatic form, as well as in making and testing hypotheses.

It is important that students should experience a variety of different types of extended task work in mathematics if they are to fully understand the depth, breadth and value of the subject. The tasks within this cluster concern real life situations, and they are intended to be tackled practically. However, it is important that this practical approach should be followed up using reasoning, calculation and proof, according to the individual need and ability of each student. The common element amongst all the items within this cluster is the idea that the students should be involved in making conjectures, which they aim to prove or disprove on the basis of evidence they have collected and analysed.

Clearly, there are many styles of classroom operation for GCSE extended task work and it is intended that this pack will support most, if not all, approaches. All the tasks outlined within the cluster books may be used with students of all abilities within the GCSE range. The lead task of *Do You Need A Water Meter?* may be used with a whole class of students, each naturally developing their own lines of enquiry. It is intended that all the tasks within the cluster may be used in this manner. However, an alternative classroom approach may be to use a selection, or even all, of the ideas within the cluster at one time, thus allowing students to choose their preferred context for their applications task. There is, however, a further more general classroom approach which may be adopted. This is one that does not even restrict the task to that of an applications nature. In this case some, or all, of the items within this cluster may be used in conjunction with those from one or more of the other cluster books, or indeed any other resource. The idea is that this support material should allow individual teacher and class style to determine the mode of operation, and should not be restrictive in any way.

Teachers who are new to this type of activity are strongly advised to use the lead tasks.

These introductory notes should be read in conjunction with the general teacher's guide for the whole pack of support material. Many of the issues implied or hinted at within the cluster books are discussed in greater detail in The Teacher's Guide.

2 *Do You Need A Water Meter?*

The lead task in this book is called *Do You Need A Water Meter?*. It is based on a real life situation and provides a rich and tractable environment for applications type coursework tasks at GCSE level.

The task is set out on pages 7-11 in a form that is suitable for photocopying for students.

The Teacher's Notes begin on page 12. These pages contain space for comments based on the school's own experiences.

DO YOU NEED A WATER METER?

MEGTOWN ADVERTISER

GCSE STUDENT SAVES PARENTS £57 AND GETS REWARD!!

Kay Rowlands recently investigated a real problem in her Mathematics GCSE Coursework class. She discovered that her parents would save about £57 per year if they had a water meter fitted in their house. Kay explained, "A water meter lets you pay for the amount of water you use, instead of a fixed amount each year. Using the details provided by the water board, I did a rough check and I thought that we could save a bit. I was really surprised when I looked further into the problem. From the data I collected at home over a two week period I reckoned that Mum and Dad would save £57. They got a water meter fitted the following week. It cost £32 to fit, and they gave me the other £25 towards my bike. This means that they won't save anything in the first year, but after that they will save all the time."

Kay Rowlands - successful problem solver

Kay's teacher, Susan White, said that GCSE mathematics encouraged real problem solving and that she was delighted with Kay's achievement during this work.

Editor's Note

Mathematics has clearly changed since my own days at school, and obviously for the better.

DO YOU NEED A WATER METER?

The previous article has recently appeared in a local newspaper.

Every household has to pay water rates. The amount paid usually depends upon the rateable value of the property. You may like to find out more about this type of payment which all householders have to make. As you work on this task, it will certainly help you if you can find out the rateable value of the property in which you live, and how much the water rates are.

There is now another way of paying your water rates. This depends on how much water you actually use. This new way involves having a water meter fitted in your home, as mentioned in the newspaper cutting.

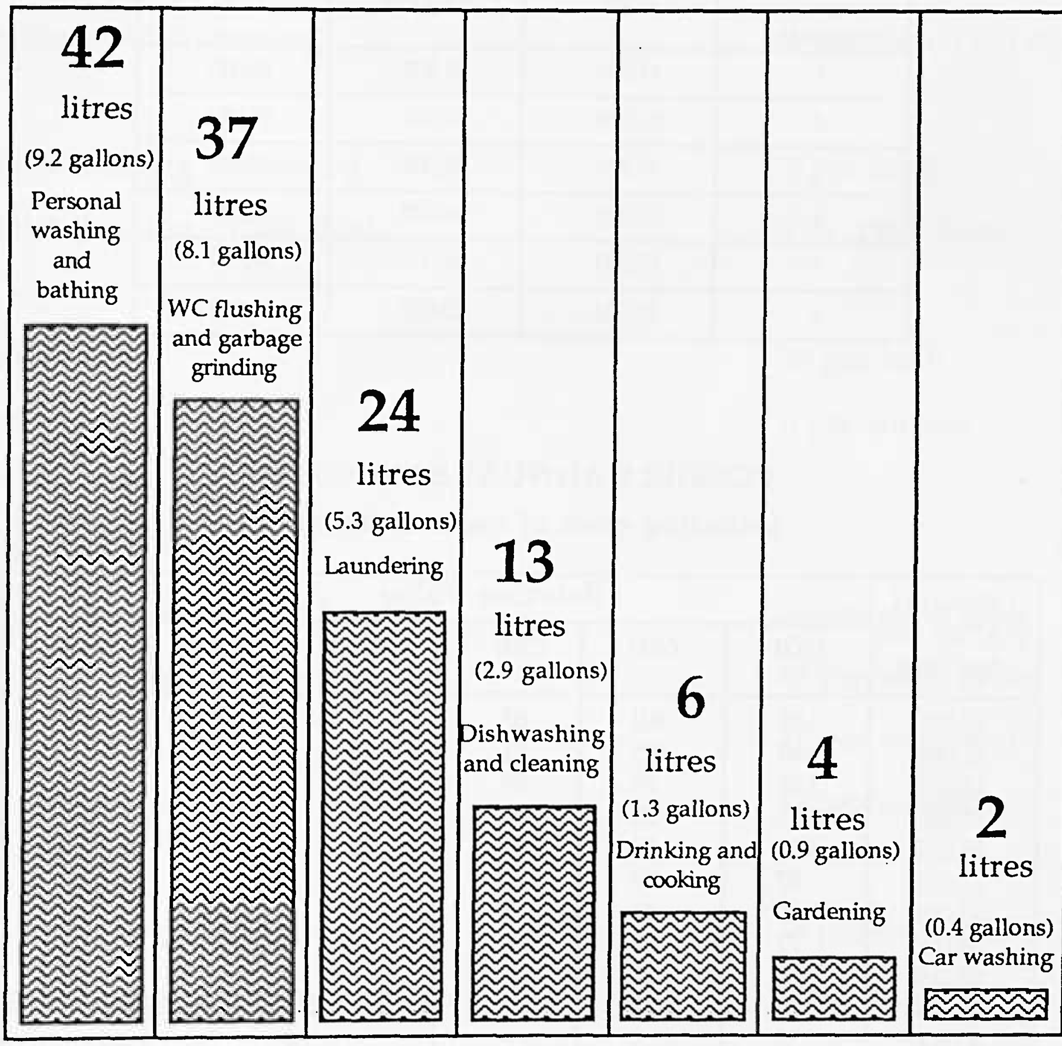
For this task you will be supplied with some information, based upon facts produced by one, or more, water authority. Read it carefully and see what you think. You may tackle any problem that interests you about this work or any similar idea.

One problem you may like to consider is the one which Kay Rowlands looked at, 'Does our household need a water meter?' There are, however, many other ideas which you may like to study. Perhaps you and a small group of friends could have a discussion about all the things you could investigate, before you each begin to explore your own ideas.

As you go along, you should keep notes about all your ideas, so that you can write a detailed report describing how you tackled your problem, and what conclusions you came to.

DO YOU NEED A WATER METER? : continued

EVERY DAY EACH PERSON USES 128 LITRES (28 GALLONS) OF WATER



Based on information supplied by one Water Authority

DO YOU NEED A WATER METER? : continued

AMOUNT OF WATER USED IN GALLONS

CATEGORY

Number of people in household	High	Average	Low
1	14,000	12,000	10,000
2	33,000	23,000	18,000
3	43,000	33,000	27,000
4	50,000	36,000	33,000
5	60,000	40,000	36,000
6	65,000	43,000	36,000

POSSIBLE ANNUAL SAVINGS (£)

(exluding costs of meter installation)

ANNUAL WATER USE (gallons)	Rateable Value					
	£500	£400	£300	£250	£200	£150
10,000	142	103	65	45	26	7
12,000	140	101	62	43	23	4
14,000	134	95	56	37	18	-
18,000	123	84	45	26	6	-
23,000	108	70	31	12	-	-
27,000	97	58	20	-	-	-
33,000	80	41	3	-	-	-
36,000	72	33	-	-	-	-
40,000	60	21	-	-	-	-
43,000	52	13	-	-	-	-
50,000	32	-	-	-	-	-
60,000	4	-	-	-	-	-
65,000	-	-	-	-	-	-

DO YOU NEED A WATER METER? : continued

HOW MUCH WATER DO YOU USE?

	Gallons
Average cooking, drinking, washing up, etc. and personal hygiene excluding bathing and showering	9 per person per day
Toilet flushing - Standard	2 per flush
Toilet flushing - Dual flush	1 or 2 per flush
Bath	20 per bath
Shower	6 per shower
Washing Machine	
- Automatic Top Loader	30 per wash cycle
- Automatic Front Loader	22 per wash cycle
- Twin Tub	25 per washload
- Single Tub	17 per washload
Dishwashing Machine	13 per washload
Use of Hosepipe/Lawn Sprinkler	2 per minute
Other uses	

Note that meters do not record in gallons but in cubic metres.

1 cubic metre = 220 gallons.

Do You Need A Water Meter - Teacher's Notes

Water metering is a relatively new idea. It is similar to the metering of gas, electricity or telephone. Traditionally, households have paid their water rates to their local water authority, and the amount paid has been entirely dependent upon the rateable value of the property.

For some considerable time, a major discussion has been taking place concerning the present rating system in England. The water authorities have responded to the criticism that the present water rating system is unfair, by providing an alternative. They now offer each household the choice of being metered, instead of continuing to pay a price determined by the rateable value of the property.

Different water authorities charge different amounts for metered water. They also calculate the total amount payable in different ways. However, if you use a meter, your bills will probably take account of

* a standing charge for fresh water
* a charge for fresh water, based on how much you use
* a standing charge for sewage disposal
* a charge for sewage disposal, based on how much fresh water you use
* a charge for environmental services.

Deciding whether you need a water meter is a very real everyday problem which offers a useful starting point for a GCSE coursework extended task. Since different water authorities calculate their costs in different ways, it is essential that teachers should obtain up-to-date local information on this issue.

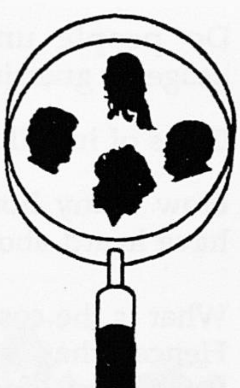
Although, at first sight, this topic seems to be an 'Applications of Mathematics', it also lends itself very strongly to a 'Statistics and Probability' task, involving surveys and survey reports. It could, therefore, be submitted under either classification.

The chosen classification will probably depend upon which other tasks have been completed, and how this task is developed. It would not be appropriate to submit this task in the 'Applications of Mathematics' category if a survey had already been submitted in the 'Statistics and Probability' category. The range of coursework tasks submitted by each student should aim to cover process and content categories.

Understanding and Exploring the Problem

Students could simply be handed the resource sheets provided on pages 7 and 8. They should be encouraged to work in small groups, and to discuss the problem as it relates to their own household situation. Currently, there is much advertising and publicity about our water supply, and students should find it easy to get into a discussion about why they use water. Without much teacher input, students may well realise that when deciding whether they need a water meter, they should consider the following factors

* How many people are in their household
* For what purposes they use water
* How frequently they use water for each purpose.



In order to obtain a rough estimate of how much water their own household uses, students will also need to estimate how much water is used for purposes such as using a washing machine, flushing a toilet, having a shower, etc. Such discussions can produce wide-ranging estimates. Each small group could try to reach a concensus about how much water an 'average' family uses.

The resource sheets provided on pages 9-11 could then be introduced, so that students can compare their own estimates with the figures provided by one of the water authorities. Students may then choose to consider the following questions

* Is their own household a *high, average* or *low* user
* Are the figures provided accurate?

Devising and Planning Individual Studies

There are many ways in which this task could be developed, including amongst others

* Are the stated figures in the table on page 9 correct?
* Are the costs of different water authorities comparable?
* Graphical representation of the data
* Is $1m^3$ really the same as 220 gallons, or is it a misprint?
* Conversion charts
* How much variation is there in the volume of water required for a bath, shower etc.
* What are rateable values?
* Breakdown of rates - what are they used for?
* The rates league table.
* Estimation of water usage in their own homes - guess
  - more accurate figures
  - survey of home use.
* Do people under or over-estimate their usage by guessing?
* Costs of installation, a survey
* How many households have water meters, have heard about, or considered them?
* What is the cost of $1m^3$ of water ?
  Hence what is the cost of a bath/shower - using a washing machine/dishwasher etc.
* White meters and Economy 7. Is it worth it?
* Rating systems - Are they fair?
  - Alternatives?
  - Who benefits?
* The Poll Tax or Community Charge.

This second stage may well involve students in considering how they might survey the actual usage of water in their own household over a short period of time, say two weeks.

Students need to discuss

* How they will measure how much water is used on each occasion

* How they will record the frequency of use

* The accuracy of their measurements.

The data which is collected can then be used, together with that supplied in the resource material, and a personal conclusion may them be drawn. It is quite a natural thing for students to look at the whole idea on a personal basis, and to find out whether or not water metering is going to save money for their own household. However, this is by no means the only valid area of personal investigation within this problem, and many other ideas have already been listed.

Small scale school, or class based, surveys may be carried out to look at some related problems. There is a series of such problems which students could set themselves within this work, and many have already been covered in the list of possible ways for developing the topic. However, two further claims could be investigated

* Only 1% of the water supplied to each home is used for drinking purposes

* During the financial year 1987-88, the average cost of water supply and sewage disposal per household was less than 40p per day.

Implementing Plans and Pursuing Ideas

Before embarking on this third stage, students should have set themselves specific problems and questions to be answered. They can then direct their attention to the production of a report showing how they tackled their problem and what conclusions they came to. This style of approach makes student survey work much more realistic and personally relevant to them. It provides a well defined focus for their work. There is, then, a real need to collect, organise, analyse and present the data in order to reach some conclusions about their problem. This task illustrates the fact that when surveys are used to help solve real problems, they can be a very powerful tool. This is why this particular piece of work is included in the Applications Cluster, rather than in the Statistics and Probability Cluster within this series. It is a valuable application of statistical methods. There are many such similar problems within a broad range of contexts, but the idea of saving money really does appeal to students in general.

With any genuine survey work of this type, where data has to be collected over a period of time, it is sometimes useful to plan the coursework time-tabled sessions in two parts. The first phase allows for consideration of the problem. This involves students in deciding how to tackle their own problem, including what data they need to collect, how to collect it, when to collect it, and for how long a period. Students then need a period of time in which to do their data collection. This can provide a normal break in the class work. However, some of this time can be used in writing up the first phase of the work, or in carrying out further related enquiry. The second phase of the work involves analysing, organising and interpreting the real data that the students have collected. Only then can decisions be taken and recommendations be made. These recommendations may need to take account of the time of year when the data was collected. Students could attempt to forecast whether there are periods of high and low water usage, as they generalise from the data collected.

Reviewing and Communicating Findings

The students' resource sheets for this piece of work offer a structured introduction to the context of the problem. After students have worked in small groups using these resource materials, it is useful to hold a whole class discussion so that students can communicate their initial findings and increase their awareness about the range of problems that could be looked at within this task. Even if it turns out that every student carries out a similar piece of work, in deciding whether or not their own household needs a water meter, the data collection has to take place in each student's own home. Consequently, factors particular to each student's home need to be taken into account, and hence the problem belongs to the individual.

After the introductory stage has been completed, it is likely that the teacher will be acting as a resource and counsellor rather than adopting the more traditional roles. The teacher's task is to try to ensure that all students achieve their full potential in extending themselves within their own selected investigation. Tasks such as this benefit from discussion, reviewing progress, communicating findings, as the investigation progresses. Students need to be encouraged to look at their findings from a variety of perspectives, as the task develops. They need to collect data systematically, to organise it and analyse it, as they move forward.

When completing tasks such as this, students are often reluctant to describe *how* they collect their data. They appear to believe that this is not mathematics. However, it is essential that students should describe how they collect their data, in order that they, and others, can attempt to estimate the degree of accuracy of measurements taken, as well as their effects on the final recommendations.

It is important that students should realise that if they spend too much time in gathering information, they will not have sufficient time to organise and analyse it. A limited well planned survey, which is carefully organised and analysed, can lead to fruitful recommendations. It can also suggest possible future areas for research.

Although students will be assessed on the basis of final reports, these should be based upon their ongoing notes and accurate records of what they did, why they did it, how they organised their findings, and what types of representations proved useful. Moreover, students' oral contributions as they work on the task will be extremely important. Short oral presentations to the whole class or a small group at the end of their work can be stimulating for many students.

3 Case Study

Fourth Year

Intermediate/Higher GCSE Group

Pupils in this class had been following a Higher Level GCSE course. They had already completed three GCSE projects - all assessed at Higher Level. On most other occasions a choice of projects had been offered, but for this piece of work, all pupils were asked to base their coursework on 'Do You Need A Water Meter?' Most pupils in the class had been involved in investigative mathematics during their first three years at school. They were generally well disposed towards coursework, keen to try new things and reasonably practised at writing reports.

My overall impression of the project is that it worked well, in the sense that a good standard of work was produced by most pupils. Several projects earned the highest grade. On the other hand, a large number of pupils made the comment that they found the subject matter less interesting than in previous projects. As far as I was concerned, I had hoped that more pupils might find the work of greater interest, but I was pleased with the end result and with the fact that many important mathematical ideas had been brought out by the project (some of which are rarely raised elsewhere). For example

* different methods of estimation - many brighter pupils initially favoured the estimation of capacity by approximating sinks, baths etc to hemispheres or cuboids, and calculating volume, rather than using 'jug and bucket' methods

* the relative significance of particular pieces of data - the number of baths per week was often crudely estimated, whilst at the same time painstaking calculations of a pet's drinking water were made!

* sources of error - including the difficulty of estimating the volume of water used by an appliance and its frequency of use.

* measures of accuracy - could the total usage be estimated to within 100 bathfuls, 10%, three significant figures, ten thousand gallons?

* theoretical considerations and modelling - the project was completed during the summer, but how much more or less is used in the winter months?

I initially planned to give pupils a week's notice of the coursework idea, and then allow them the use of nine or ten consecutive lessons. A week before the project was due to begin, I gave each pupil a Severn Trent leaflet 'Should You Have A Water Meter In Your Home?'. Everyone was asked to read it and 'think up an idea for a three week project'. I talked to pupils individually the next day about their ideas. These included variations on the following themes

* Surveying the water usage of a whole street or community
* Surveying particular institutions, buildings etc (pubs, stables etc)
* Isolating which factors make a household a high or low water user
* Comparing the various metering systems of different water boards (not as easy as it sounds - each has its own combination of survey fees, installation charges rental and usage charges
* Analysing the leaflet itself to discover if a formula (linear?) had been used to calculate 'savings' figures from rateable value and water usage (and so attempt to fill in the 'losses' figures omitted from the leaflet)

Most pupils chose to investigate whether their own household would benefit from having a meter - led no doubt by the title of the leaflet.

Pupils were then given one week to begin collecting data, and generally prepare for the beginning of the project. In addition they were asked to construct a week-by-week outline plan of action.

The following week saw pupils in various stages of readiness. Some had visited libraries, started surveys, made measurements and/or written for information. Others had done little else than write rudimentary lists.

It was clear, even at this early stage, that whilst most pupils were actively getting on with the coursework, a handful of others found the whole project idea to be dry(!) and were dragging their feet. Some of these never became interested, and offering a choice might have helped these pupils.

The project made steady headway over the next week or so. My role was largely concerned with talking to individuals about their ideas, and challenging their assumptions. Some interesting ideas were beginning to emerge and a whole variety of methods (some exotic) were being employed. One common problem was emerging. Many in the class were spending the bulk of their time fine tuning one or two of the most accessible and easily quantifiable water usages (however insignificant), whilst putting to one side the estimates of those water usages most difficult to quantify (however significant). I attempted to focus attention on this in the next lesson. Pupils were asked to list, in rank order, what they believed to be the six largest usages of water in their home. I asked them to estimate how much more the first in their list would use, in a year, than the last. The intention was to promote a feel for the relative importance of particular usages. Pupils were asked to form groups and reach a consensus before we discussed it as a class. The lists were very similar. The exercise generated a lot of discussion and seemed to work well. Unfortunately, spurred on by this, I followed up the next lesson with another exercise designed to focus attention on the difference between estimating *how many* times an appliance was used, as opposed to *how much* water it used on each occasion. I asked pupils to list the main usages of water and say whether they thought the difficulty lay in estimating the former, or the latter, or both. The discussion was forced and unnecessary and I wish I hadn't bothered with it.

By now I was beginning to feel that a large proportion of the class time had become redundant and that lessons were beginning to feel 'slack' (was this why I was trying to fill up class time with discussion?). Instead of using every consecutive mathematics lesson, we switched to using only one lesson per week on the project. This helped. Pupils were now able to gather more data between sessions. I think I could have spaced the coursework lessons out even more. When I run the project again I shall spread the class time over a whole term.

As the project neared the end of the allocated time, pupils' progress seemed to depend on which task they had set themselves. Those pupils working on estimating their own household need for a meter seemed mostly to be heading for completion on target. Some of the survey groups were getting behind. I tried to push them a little, but in the end I had to allow them more time. The pupils engaged in comparing different water boards were sinking under the complications of the task. They eventually gave up and concentrated on other strands of their work. This was disappointing. A more organised or persistent pupil (or group) could, I think, have really made something of this.

Half term intervened. This gave pupils more time to finish collecting data etc. I asked for the projects to be handed in when they returned.

Throughout the project, I asked to see all coursework files at least once per week. I tried to make sure that I was able to collect them in one day, and give them back the next. This was hard work but it did, as always, pay dividends. It was particularly helpful for picking up the pupils who were falling behind or in need of extra support. I have followed this system for several pieces of coursework, and whilst I managed to catch more and more in this safety net, still a few slipped through, unmonitored again.

I also tried to encourage pupils to keep referring to their week by week plan and update it where necessary. I had given them a form on which to do this. This helped pupils, I hope, but it also helped me. The plans formed a useful basis for discussing projects with individuals.

4 *Alternative Tasks*

Breaking The Record

Life Or Death

Jam Tomorrow?

Seal Your Fate

Who's Won?

Price It Right


PRICE IT RIGHT
A student consumer group recorded the following prices in three supermarkets during May 1989.
SAFEBURY £
SAINSWAY £
OPCO £
Coffee (100g) 1.79 1.79 1.94
JAM TOMORROW?
BREAKING THE RECORD
Athletes today run faster than they did in 1913. Using the data provided
• Can you estimate when a runner will take less than 3 mins 45 secs?
• What about the three minute mile?
LIFE OR DEATH
The only certainty in life is death
• But how long do people live?
• Why do people die?
WHO'S WON?
END OF SEASON MIXED HOCKEY LEAGUE TAB
Played Won Lost Drawn Points
Asdown 10 6 1 3 15
Brigtown 10 7 2 1 15
Cheltree 10 2 4 4
Donkley 10 4 6 0
Exham 10 2 5 3
Fulflow 10 3 6 1
During a season, each team plays every oth
Points are obtained in the following way
two for a win
one for a draw
In order to improve play, it is suggeste
changed to
three for
one fo
• Do you think this will make
• What type of scoring syste
Investigate
© Shell Centre for Mathematical Education/Midland Examining Group
SEAL YOUR FATE
MEGTOWN GAZETTE
VIRUS INFECTION STRIKES SEALS
A virus infection spreads through the seal population. It causes the population to decrease at a rate of 50% per annum for five years.
Biologists develop a vaccine, and some seals become immune to the virus. The population then begins to increase at a rate of 50% per annum.
• How long will it take for the seal population to reach its original size?
• What would happen if the rates of decay and growth were different?
Investigate The Problem
© Shell Centre for Mathematical Education/Midland Examining Group

Alternative Tasks

General Notes

The six alternative tasks are all intended to be used in the same way as the lead task, *Do You Need A Water Meter?* The teacher's notes for each task are brief and should be read and considered in conjunction with those for *Do You Need A Water Meter?* The student's notes are in the same form as those for the lead task. The student's notes offered for the six alternative tasks in this cluster book are all written in a similar style. They outline the context of study to the student and offer one or two problems to be considered. This provides the student with an opportunity to consider the problem and gain some understanding of it. Students are then encouraged to investigate the problem in any way they wish. Some further suggestions are offered which may be used if the teacher feels this is appropriate for any individual student, group or class. These suggestions provide further ideas for investigation without prescribing exactly what should happen.

BREAKING THE RECORD

Athletes today run faster than they did in 1913. Using the data provided

* Can you estimate when a runner will take less than 3 mins 45 secs?
* What about the three minute mile?
* What do you think will be the world record in the year 3000?

WORLD RECORDS FOR ONE MILE FROM 1913 - 1985

4:14.4	John Paul Jones	USA	1913
4:12.6	Norman Taber	USA	1915
4:10.4	Paavo Nurmi	FIN	1923
4:09.2	Jules Ladoumegue	FRA	1931
4:07.6	Jack Lovelock	NZL	1933
4:06.8	Glen Cunningham	USA	1934
4:06.4	Sydney Wooderson	GBR	1937
4:06.2	Gunder Haag	SWE	1942
4:04.6	Arne Anderson	SWE	1942
4:04.6	Gunder Haag	SWE	1942
4:02.6	Arne Anderson	SWE	1943
4:01.6	Arne Anderson	SWE	1944
4:01.4	Gunder Haag	SWE	1945
3:59.4	Roger Bannister	GBR	1954
3:58.0	John Landy	AUS	1954
3:57.2	Derek Ibbotson	GBR	1957
3:54.5	Herb Elliot	AUS	1958
3:54.4	Peter Snell	NZL	1962
3:54.1	Peter Snell	NZL	1964
3:53.6	Michel Jazy	FRA	1965
3:51.3	Jim Ryun	USA	1966
3:51.1	Jim Ryun	USA	1967
3:51.0	Filbert Bayi	TAN	1975
3:49.4	John Walker	NZL	1975
3:49.0	Sebastian Coe	GBR	1979
3:48.8	Steve Ovett	GBR	1980
3:47.3	Sebastian Coe	GBR	1981
3:46.3	Steve Cram	GBR	1985

BREAKING THE RECORD : continued

You may like to investigate other sports records

* The Olympic Records
* The Long Jump
* The High Jump.

You may like to investigate the trends for women as well as men.

You could investigate trends in other areas

* Population
* Financial
* Sales

BREAKING THE RECORD : continued

OLYMPIC RECORDS

MEN 100 METRES

DATE	NAME	COUNTRY	TIME
1896	Thomas Burke	USA	12.0
1900	Francis Jarvis	USA	11.0
1904	Archie Hahn	USA	11.0
1906	Archie Hahn	USA	11.2
1908	Reginald Walker	SAf	10.8
1912	Ralph Craig	USA	10.8
1920	Charles Paddock	USA	10.8
1924	Harold Abrahams	UK	10.6
1928	Percy Williams	CAN	10.8
1932	Eddie Tolan	USA	10.38
1936	Jessie Owens	USA	10.3
1948	Harrison Dillard	USA	10.3
1952	Lindy Remigino	USA	10.79
1956	Bobby Morrow	USA	10.62
1960	Armin Hary	FRG	10.32
1964	Robert Hayes	USA	10.06
1968	James Hines	USA	9.95 OR
1972	Valeriy Borzoz	USSR	10.14
1976	Hasely Crawford	Tri	10.06
1980	Allan Wells	UK	10.25
1984	Carl Lewis	USA	9.99

MEN 200 METRES

DATE	NAME	COUNTRY	TIME
1900	Walter Tewksbury	USA	22.2
1904	Archie Hahn	USA	21.6
1908	Robert Kerr	CAN	22.6
1912	Ralph Craig	USA	21.7
1920	Allen Woodring	USA	22.0
1924	Jackson Scholz	USA	21.6
1928	Percy Williams	CAN	21.8
1932	Eddie Tolan	USA	21.12
1936	Jesse Owens	USA	20.7
1948	Melvin Patton	USA	21.1
1952	Andrew Stanfield	USA	20.81
1956	Bobby Morrow	USA	20.75
1960	Livio Berrutti	ITA	20.62
1964	Henry Carr	USA	20.36
1968	Tommie Smith	USA	19.83
1972	Valeriy Borzov	USSR	20.00
1976	Donald Quarrie	JAM	20.22
1980	Pietro Mennea	ITA	20.19
1984	Carl Lewis	USA	19.80 OR

BREAKING THE RECORD : continued

OLYMPIC RECORDS

MEN 400 METRES

DATE	NAME	COUNTRY	TIME
1896	Thomas Burke	USA	54.2
1900	Maxie Long	USA	49.4
1904	Harry Hillman	USA	49.2
1906	Paul Pilgrim	USA	53.2
1908	Wyndham Halswelle	UK	50.0
1912	Charles Reidpath	USA	48.2
1920	Bevil Rudd	SAf	49.6
1924	Eric Liddell	UK	47.6
1928	Ray Barbuti	USA	47.8
1932	Bill Carr	USA	46.28
1936	Archie Williams	USA	46.66
1948	Arthur Wint	JAM	46.2
1952	George Rhoden	JAM	46.09
1956	Charles Jenkins	USA	46.86
1960	Otis Davis	USA	45.07
1964	Michael Larrabee	USA	45.15
1968	Lee Evans	USA	43.86 OR
1972	Vincent Matthews	USA	44.66
1976	Alberto Juantorena	CUB	44.26
1980	Viktor Markin	USSR	44.60
1984	Alonzo Babers	USA	44.27

MEN 800 METRES

DATE	NAME	COUNTRY	TIME
1896	Edwin Flack	AUS	2:11.0
1900	Alfred Tysoe	UK	2:01.2
1904	James Lightbody	USA	1:56.0
1906	Paul Pilgrim	USA	2:01.5
1908	Mel Sheppard	USA	1:52.8
1912	James Meredith	USA	1:51.9
1920	Albert Hill	UK	1:53.4
1924	Douglas Lowe	UK	1:52.4
1928	Douglas Lowe	UK	1:51.8
1932	Tom Hampson	UK	1:47.70
1936	John Woodruff	USA	1:52.9
1948	Malvin Whitfield	USA	1:49.2
1952	Malvin Whitfield	USA	1:49.34
1956	Thomas Courtney	USA	1:47.75
1960	Peter Snell	NZL	1:46.48
1964	Peter Snell	NZL	1:45.1
1968	Ralph Doubell	AUS	1:44.40
1972	David Wottle	USA	1:45.86
1976	Alberto Juantorena	CUB	1:43.50
1980	Steve Ovett	UK	1:45.40
1984	Joaquim Cruz	BRA	1:43.00 OR

BREAKING THE RECORD : continued

OLYMPIC RECORDS

MEN 1500 METRES

DATE	NAME	COUNTRY	TIME
1896	Edwin Flack	AUS	4:33.2
1900	Charles Bennett	UK	4:06.2
1904	James Lightbody	USA	4:05.4
1906	James Lightbody	USA	4:12.0
1908	Mel Sheppard	USA	4:03.4
1912	Arnold Jackson	UK	3:56.8
1920	Albert Hill	UK	4:01.8
1924	Paavo Nurmi	FIN	3:53.6
1928	Harri Larva	FIN	3:53.2
1932	Luigi Beccali	ITA	3:51.20
1936	Jack Lovelock	NZ	3:47.8
1948	Henry Eriksson	SWE	3:49.8
1952	Josef Barthel	LUX	3:45.28
1956	Ron Delany	IRE	3:41.49
1960	Herbert Elliott	AUS	3:35.6
1964	Peter Snell	NZ	3:38.1
1968	Kipchoge Keino	KEN	3:34.91
1972	Pekka Vasala	FIN	3:36.33
1976	John Walker	NZ	3:39.17
1980	Sebastian Coe	UK	3:38.40
1984	Sebastian Coe	UK	3:32.53 OR

MEN 5000 METRES

DATE	NAME	COUNTRY	TIME
1912	Hannes Kolehmainen	FIN	14:36.6
1920	Joseppth Guillemot	FRA	14:55.6
1924	Paavo Nurmi	FIN	14:31.2
1928	Ville Ritola	FIN	14:38.0
1932	Lauri Lehtinen	FIN	14:29.91
1936	Gunnar Hockert	FIN	14:22.2
1948	Gaston Reiff	BEL	14:17.6
1952	Emil Zatopek	CS	14:06.72
1956	Vladimir Kuts	USSR	13:39.86
1960	Murray Halberg	NZ	13:43.4
1964	Robert Schul	USA	13:48.8
1968	Mohamed Gammoudi	TUN	14:05.0
1972	Lasse Viren	FIN	13:26.42
1976	Lasse Viren	FIN	13:24.76
1980	Miruts Yifter	ETH	13:20.91
1984	Said Aouita	MOR	13:05.59 OR

BREAKING THE RECORD : continued

OLYMPIC RECORDS

MEN 10000 METRES

DATE	NAME	COUNTRY	TIME
1912	Hannes Kolehmainen	FIN	31:20.8
1920	Paavo Nurmi	FIN	31:45.8
1924	Ville Ritola	FIN	30:23.2
1928	Paavo Nurmi	FIN	30:18.8
1932	Janusz Kushocinski	POL	30:11.42
1936	Ilmari Salminen	FIN	30:15.4
1948	Emil Zatopek	CS	29:59.6
1952	Emil Zatopek	CS	29:17.0
1956	Vladimir Kuts	USSR	28:46.60
1960	Pyotr Bolotnikov	USSR	28:32.18
1964	William Mills	USA	28:24.4
1968	Naftali Temu	KEN	29:27.4
1972	Lasse Viren	FIN	27:38.35
1976	Lasse Viren	FIN	27:40.38
1980	Miruts Yifter	ETH	27:42.69
1984	Alberto Cova	ITA	27:47.54

WOMEN 100 METRES

DATE	NAME	COUNTRY	TIME
1928	Elizabeth Robinson	USA	12.2
1932	Stanislawa Walasiewicz	POL	11.9
1936	Helen Stephens	USA	11.5
1948	Fanny Blankers-Koen	HOL	11.9
1952	Marjorie Jackson	AUS	11.65
1956	Betty Cuthbert	AUS	11.82
1960	Wilma Rudolph	USA	11.08
1964	Wyomia Tyus	USA	11.49
1968	Wyomia Tyus	USA	11.08
1972	Renate Stecher	GDR	11.07
1976	Annegret Richter	FRG	11.08
1980	Lyudmila Kondratyeva	USSR	11.06
1984	Evelyn Ashford	USA	10.97 OR

BREAKING THE RECORD : continued

OLYMPIC RECORDS

WOMEN 200 METRES

DATE	NAME	COUNTRY	TIME
1948	Fanny Blankers-Koen	HOL	24.4
1952	Marjorie Jackson	AUS	23.89
1956	Betty Cuthbert	AUS	23.55
1960	Wilma Rudolph	USA	24.03
1964	Edith Maguire	USA	23.05
1968	Irena Szewinska	POL	22.58
1972	Renate Stecher	GDR	22.40
1976	Barbel Eckert	GDR	22.37
1980	Barbel Wockel (nee Eckert)	GDR	22.03
1984	Valerie Brisco-Hooks	USA	21.81 OR

WOMEN 400 METRES

DATE	NAME	COUNTRY	TIME
1964	Betty Cuthbert	AUS	52.01
1968	Colette Besson	FRA	52.03
1972	Monika Zehrt	GDR	51.08
1976	Irena Szewinska	POL	49.29
1980	Marita Koch	GDR	48.88
1984	Valerie Brisco-Hooks	USA	48.83 OR

WOMEN 800 METRES

DATE	NAME	COUNTRY	TIME
1928	Lina Radke	GER	2:16.8
1960	Lyudmila Shevtsova	USSR	2:04.50
1964	Ann Packer	UK	2:01.1
1968	Madeline Manniang	USA	2:00.92
1972	Hildegard Falck	FRG	1:58.55
1976	Tatyana Kazankina	USSR	1:54.94
1980	Nadezhda Olizarenko	USSR	1:53.43 OR
1984	Doina Melinte	ROM	1:57:60

WOMEN 1500 METRES

DATE	NAME	COUNTRY	TIME
1972	Lyudmila Bragina	USSR	4:01.38
1976	Tatyana Kazankina	USSR	4:05.48
1980	Tatyana Kazankina	USSR	3:56.56 OR
1984	Gabriella Doria	ITA	4:03.25

WOMEN 3000 METRES

DATE	NAME	COUNTRY	TIME
1984	Maricica Puica	ROM	8:35.96 OR

Breaking The Record - Teacher's Notes

This task is intended to provide students with a starting point which motivates them to look into trends across periods of time. The selection of sport as the topic for our starter produced a high level of interest and activity in our trial classrooms.

Working in groups, using the data provided on the first resource sheet, students can discuss what they think the information shows, from merely looking at the way the numbers appear to increase and decrease. Before beginning to graph the data, students will find it useful to discuss things such as appropriate ranges of values and scales on each axis. Unless they restrict the range of values, they will not be able to perceive such trends as may exist. When their graphs have been drawn, students will need to discuss whether the expected trends have emerged; or are there others? They should consider whether they can expect things to continue in the same way, and for how long, as they attempt to answer the questions posed.

In order to get into the task quickly students are provided with information which has already been collected and organised. They are simply required to discuss the situation and display the information graphically in order to analyse it, as they come to terms with the nature of the task.

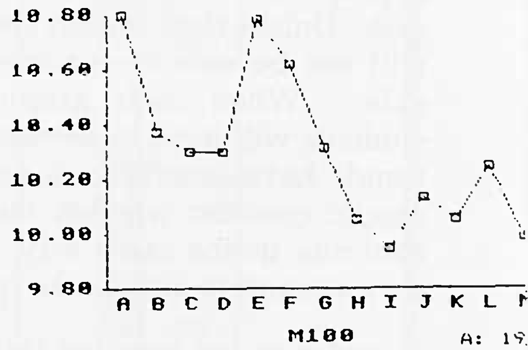
The main task, however, is broader. Students must move on to collecting and organising their own data, as well as asking their own questions, or making their own conjectures and hypotheses. It is not intended that students should merely become submerged in number-crunching and graphing the data provided. The main purpose of this task is to answer questions and to perceive trends.

For the convenience of those teachers who wish to continue to use sport as a theme, tables containing Olympic Record Results are provided on further resource sheets. The tables are based on data from *The Guinness Encyclopaedia of Sports Records and Results*.

Tasks such as this can make powerful use of modern technology. Using calculators and computers with data handling packages, a wide range of possibilities become available. Even simple databases such as *Grass*, and straightforward spreadsheets such as *Grasshopper*, can make the task much more interesting and stimulating.

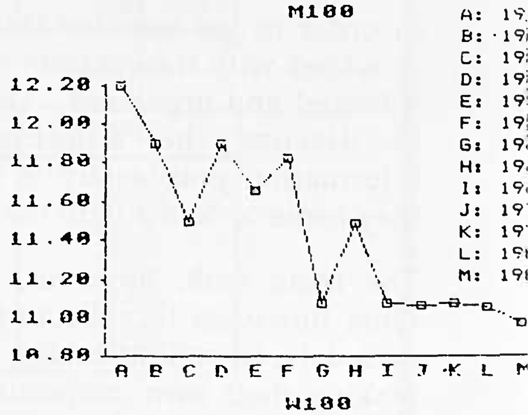
:	A	B	C	D
00:	YEAR	W100	M100	W-M
01:	1928	12.2	10.8	1.4
02:	1932	11.9	10.38	1.52
03:	1936	11.5	10.3	1.2
04:	1948	11.9	10.3	1.6
05:	1952	11.65	10.79	0.86
06:	1956	11.82	10.62	1.2
07:	1960	11.08	10.32	0.76
08:	1964	11.49	10.06	1.43
09:	1968	11.08	9.95	1.13
10:	1972	11.07	10.14	0.93
11:	1976	11.08	10.06	1.02
12:	1980	11.06	10.25	0.81
13:	1984	10.97	9.99	0.98
14:	28-84	1.23	0.81	

Students can take the information provided, relating to Olympic records, and build on it. They can look up further details about the Olympic winners such as age, weight, height etc. They can organise their data carefully and categorise it, before entering it accurately on to their database. Databases can be merged to produce larger databases. They can look for relationships between variables. Students can then produce graphs of their data, and test hypotheses such as

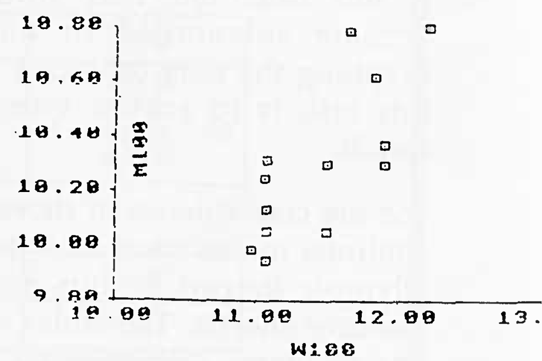


* The average height of runners is greater than javelin throwers
* The average weight of jumpers is less than discus throwers
* There is a relationship between the men's and the women's speed.

The use of a spreadsheet opens up a different range of possibilities, as students attempt to analyse their numerical data. They can



* Look at differences in performance from 1896 to 1984
* Look at differences in performance between men and women
* Draw graphs across time
* Draw graphs across events.



Students may choose to ask 'what if' questions such as

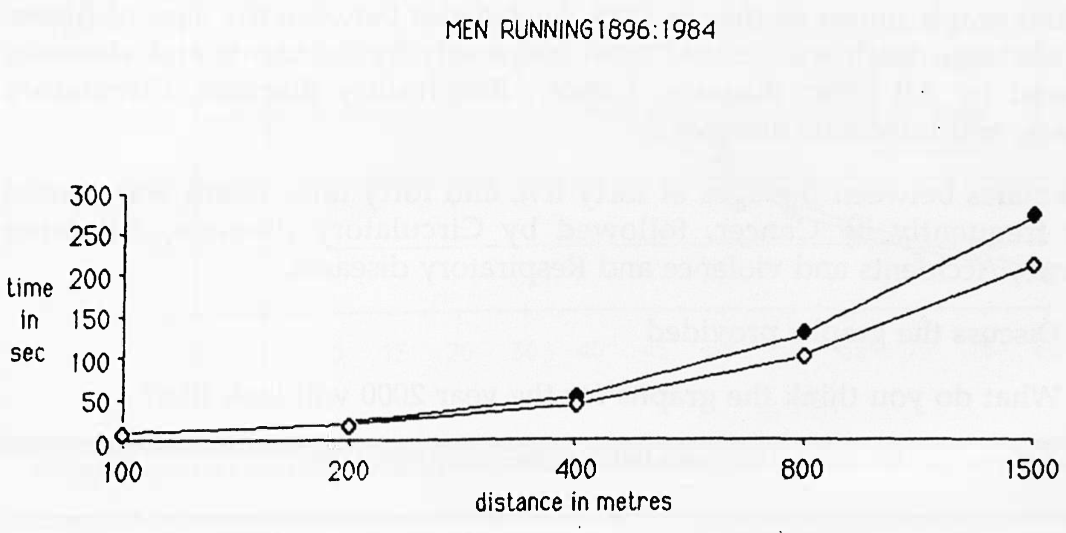
* What if the times for 200 metres were twice as big as the 100 metres?
* What if the times for 800 metres were eight times greater than the 100 metre times?

The use of spreadsheets avoids much tiresome calculation, and enables us to focus upon making and testing hypotheses.

Some teachers may wish to allow students to move away from the topic of sport, and this is entirely acceptable. For some students, the collection, organisation, display, and analysis of their own data relating to another field may be much more fruitful and worthwhile. During school trials students looked into

* Financial trends
* Population trends - human, animal, plant
* Diseases
* Birth rates
* Unemployment - predictions
  - seasonal factors.

When investigating trends in situations for which a considerable amount of past data is available, one interesting approach is to omit the most recent values. Students can then analyse the data provided, and attempt to predict values for which data is available. Students can later compare their predictions with the actual values. This provides immediate feedback, thus providing considerable motivation and a high interest level for future tasks. The question students may choose to ask themselves is 'Could I have predicted today's results ten years ago?'.



LIFE OR DEATH

The only certainty in life is death

* But how long do people live?

* Why do people die?

The graphs on the next resource sheet can help us to answer the first question. They show us that in 1984 a fifteen year old female could expect to live for another sixty three years. They also show us that in 1951 a fifteen year old male could expect to live for a further fifty four years.

* You may wish to discuss these graphs in more detail.

* How are the trends suggested here likely to affect your future life?

The graphs on the following two resource sheets can help us to answer the question, *Why do people die?*

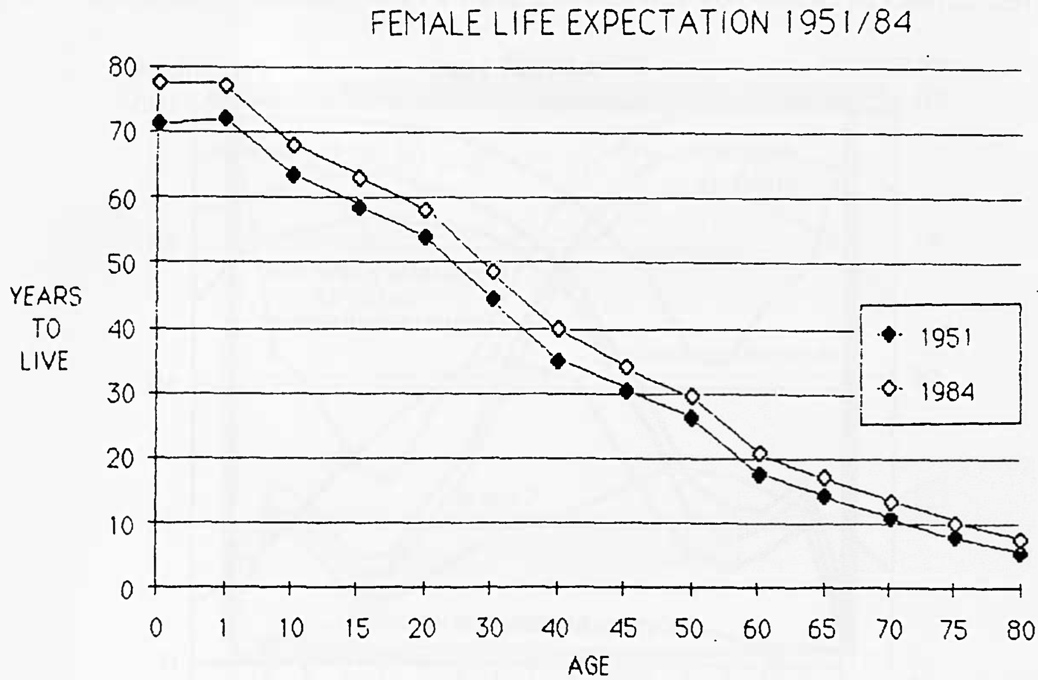
The first graph shows us that in 1985, for females between the ages of fifteen and nineteen, death was caused most frequently by Accidents and violence, followed by All other diseases, Cancer, Respiratory diseases, Circulatory diseases, and Infectious diseases.

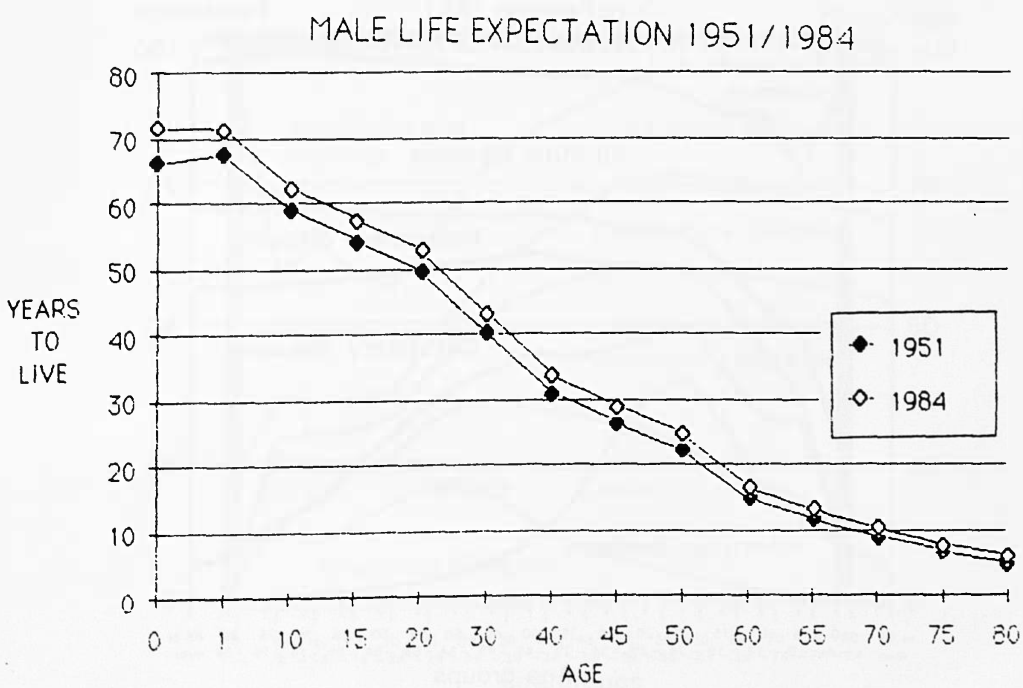
For females between the ages of forty five and forty nine, death was caused most frequently by Cancer, followed by Circulatory diseases, All other diseases, Accidents and violence and Respiratory diseases.

* Discuss the graphs provided

* What do you think the graphs for the year 2000 will look like?

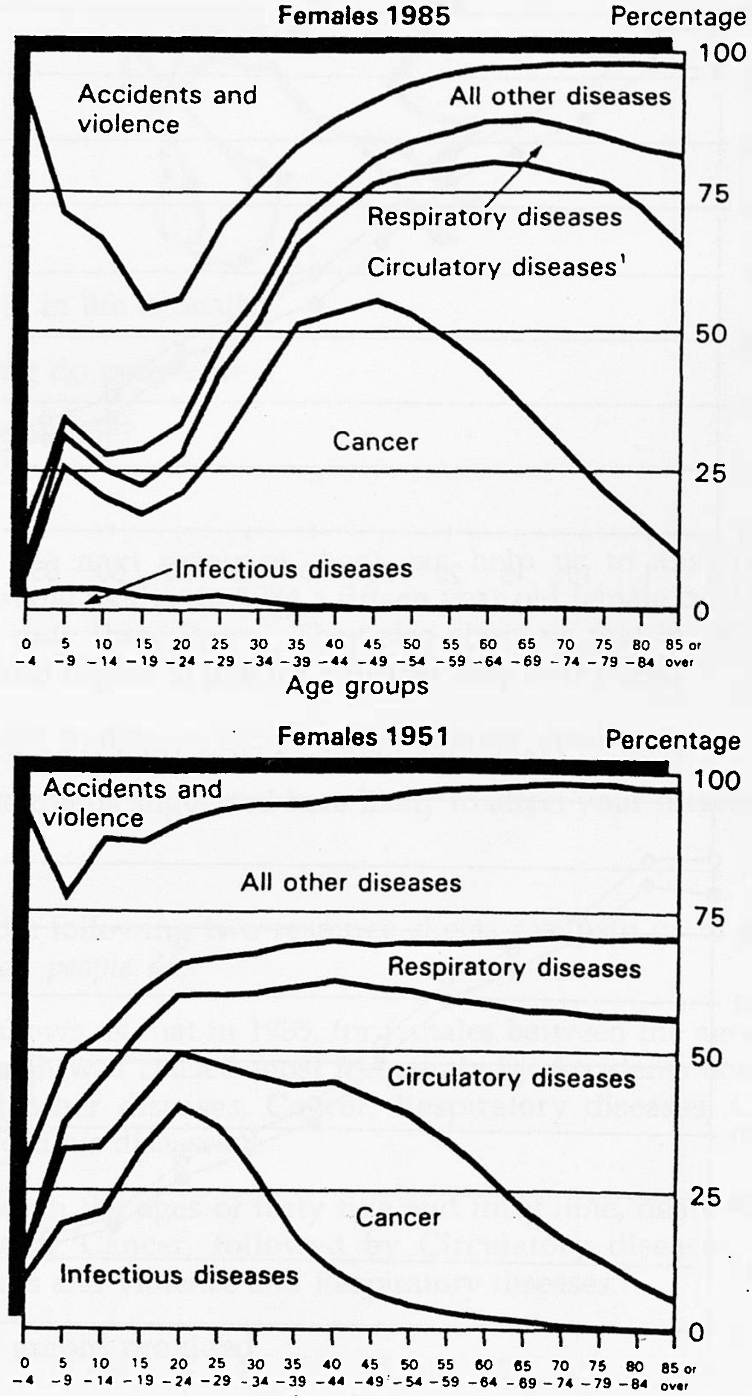
LIFE OR DEATH? : continued





LIFE OR DEATH? : continued

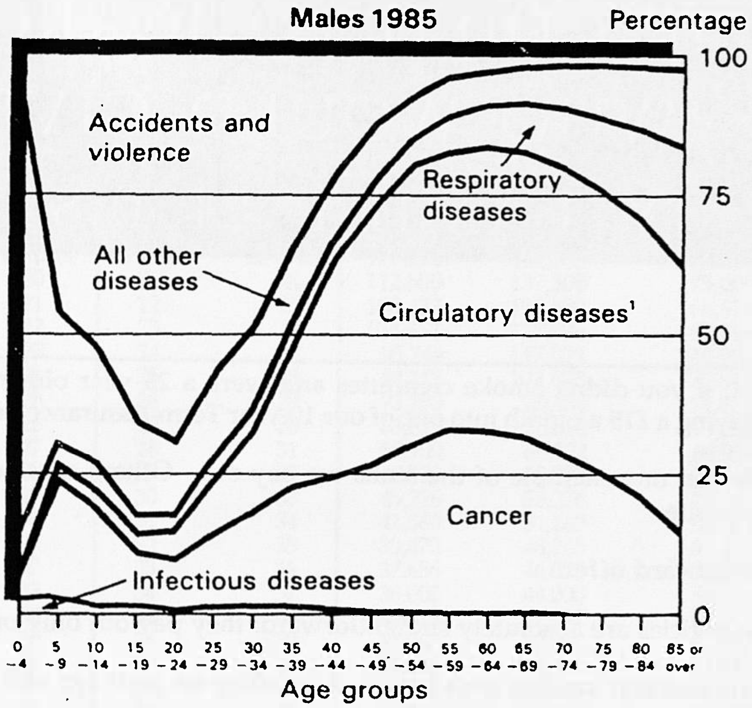
Selected causes of death : by sex and age, 1951 and 1985. United Kingdom.

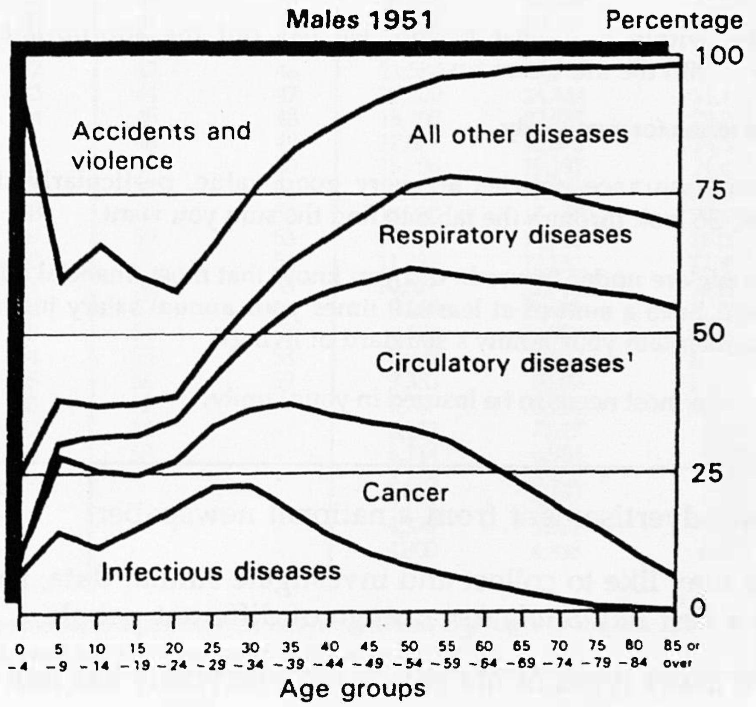


1 Includes heart attacks and strokes

LIFE OR DEATH? : continued

Selected causes of death : by sex and age, 1951 and 1985.





LIFE OR DEATH? : continued

"IF I DIED TOMORROW, WHO WOULD GIVE MY FAMILY £130,841?"

We would, if you didn't smoke cigarettes and were a 25 year old man, or 28 year old woman, paying a £15 a month into one of our 10-year Term Assurance policies.

And that's just one example of the sums we pay out. Others are shown in the table of figures opposite.

A straightforward offer.

Our Term policies are absolutely straightforward: they pay out only on death.

You pay in a certain amount each month, depending on your age and what you can most easily afford.

If you die within a 10-year period, we pay out the appropriate guaranteed sum. Promptly. With the minimum fuss.

Generous terms for everybody.

Our Term Assurance policies are very good value, particularly if you don't smoke cigarettes. So look through the table to find the sum you want.

(Most people are under-insured. did you know that most financial advisers currently say you should have a sum of at least 10 times your annual salary just to generate enough money to maintain your family's standard of living?)

So think, who most needs to be insured in your family?

This is an advertisement from a national newspaper.

* You may like to collect and investigate similar data, so that you can carry out a *Best Buy Study* for a range of different people

There are many types of life policy and everybody has individual needs.

LIFE OR DEATH? : continued

COVER AND PREMIUM. YOUR CHOICE

Age Last Birthday (At Entry)				SUM ASSURED SECURED BY MONTHLY PREMIUM OF		
Smoker		Non-smoker*		£10.00 per month	£12.00 per month	£15.00 per month
Male	Female	Male	Female	£	£	£
-	-	18	18 to 21	116,883	142,857	181,818
-	18 to 19	19 to 20	22 to 23	115,384	141,025	179,487
-	20	21	24	112,500	137,500	175,000
18	21	22	25	108,433	132,530	168,674
19	22	23	26	104,651	127,906	162,790
20	23	24	27	95,744	117,021	148,936
21	24	25	28	84,112	102,803	130,841
22	25	26	29	73,170	89,430	113,821
23	26	27	30	63,829	78,014	99,290
24	27	28	31	55,900	68,322	86,956
25	28	29	32	49,723	60,773	77,348
26	29	30	33	45,226	55,276	70,351
27	30	31	34	41,860	51,162	65,116
28	31	32	35	39,473	48,245	61,403
29	32	33	36	37,656	46,025	58,577
30	33	34	37	36,000	44,000	56,000
31	34	35	38	34,615	42,307	53,846
32	35	36	39	32,967	40,293	51,282
33	36	37	40	31,468	38,461	48,951
34	37	38	41	29,900	36,544	46,511
35	38	39	42	28,213	34,482	43,887
36	39	40	43	26,548	32,448	41,297
37	40	41	44	24,861	30,386	38,674
38	41	42	45	23,195	28,350	36,082
39	42	43	46	21,582	26,378	33,573
40	43	44	47	20,000	24,444	31,111
41	44	45	48	18,480	22,587	28,747
42	45	46	49	17,077	20,872	26,565
43	46	47	50	15,706	19,197	24,432
44	47	48	51	14,469	17,684	22,508
45	48	49	52	13,293	16,248	20,679
46	49	50	53	12,228	14,945	19,021
47	50	51	54	11,235	13,732	17,478
48	51	52	55	10,321	12,614	16,055
49	52	53	56	9,483	11,591	14,752
50	53	54	57	8,720	10,658	13,565
51	54	55	58	8,028	9,812	12,488
52	55	56	59	7,383	9,023	11,484
53	56	57	-	6,787	8,295	10,558
54	57	58	-	6,232	7,617	9,695
55	58	59	-	5,714	6,984	8,888
56	59	-	-	5,238	6,402	8,149
57	-	-	-	4,792	5,857	7,454
58	-	-	-	4,379	5,352	6,812
59	-	-	-	4,000	4,888	6,222

* A non-smoker is a person who has not smoked cigarettes in the last 12 months and has no intention of doing so in the future.

Life or Death? - Teacher's Notes

As students begin to tackle many of the other problems within this cluster, they are offered some numerical data. Through organising the information provided, and representing it in diagrammatic form, they become able to answer questions and make recommendations.

In this case, the initial information provided is in graphical form. The graphs on page 35 were drawn using the spreadsheet Excel and information from *Key Data 1988* published by HMSO. The graphs on pages 36 and 37 are from the same source.

It is important that students should be able to interpret information presented in graphical form; yet many of them find this difficult. The Shell Centre/JMB module, *The Language of Functions and Graphs* contains a wealth of interesting and stimulating material which has been designed to enhance students' skills in this area. As they attempt to gain an understanding of a situation when the information is presented in graphical form, students draw great strength from small group discussion.

Although the presentation of the introductory task is different, the underlying purpose is the same as the other tasks within this cluster. It is intended that students should ask questions, which are of some personal significance, and that they should gather some data, which needs to be organised and analysed in order to answer the questions posed.

The graphs provided show us the national scene, several years ago.

Using this starting point, students may decide to carry out their own surveys in order to determine the ages and causes of death, female and male, within their own families, town, villages etc. They may decide to use questionnaires, parish records or commercially available databases such as *NLEV51* with INFORM or *DATCH* with QUEST.

They may, in fact, decide to produce their own local database based on the findings from their questionnaires, or searches of the parish records.

Each student may only have time to do a limited amount of research, but databases produced using *Grass* can be merged if consensus is reached about how information is to be entered.

* Different areas may produce very different life spans.

* The causes of death may be different in cities and villages.

The resource sheets on pages 38 and 39 provide some possible avenues which could be explored by students who wish to look at some financial implications relating to the introductory task. For this particular insurance company, age, sex, and smoking habits, affect the premiums payable and the amounts paid out in the event of death.

The table provided contains an abundance of data

* Are there any patterns/trends?

* What facts emerge?

* Would it be useful to display the data graphically?

* Do other insurance companies take into account the same range of factors?

* Do all companies charge the same premiums for the same payout?

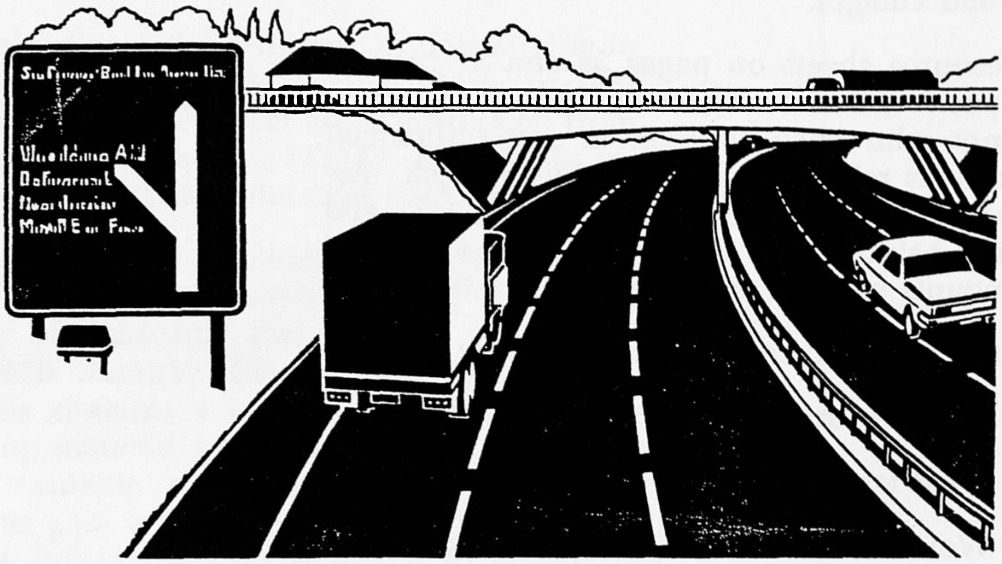
Some students may prefer to survey car insurance premiums, rather than those for life insurance. As long as they ask questions, or make conjectures, which they attempt to answer using the data they collect and analyse, this is quite acceptable.

More able students may wish to attempt to answer

* What would you charge for life insurance policies if you were in charge?

In which case, the discussion and table in *Solving Real Problems with CSE Maths* by the Spode Group may prove useful.

JAM TOMORROW?



The M25 is one of Britain's busiest motorways. At peak travel times there are many long delays.

Building new motorways takes time and it is expensive.

It has been suggested that traffic flow on busy roads can be improved by controlling the speed at which vehicles can travel.

Assuming that drivers obey the Highway Code

* What speed do you think is likely to improve traffic flow on our overcrowded motorways?

Investigate The Problem

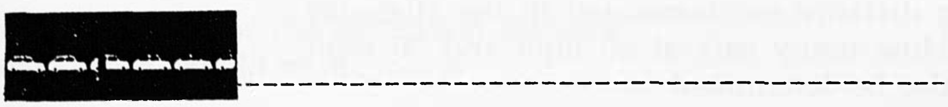
JAM TOMORROW? : continued

Shortest stopping distances - in feet			
mph	*Thinking*	*Braking*	*Overall stopping distance*
20	20	20	40
30	30	45	75
40	40	80	120
50	50	125	175
60	60	180	240
70	70	245	315

On a dry road, a good car with good brakes and tyres and an alert driver, will stop in the distances shown. Remember these are shortest stopping distances. Stopping distances increase greatly with wet and slippery roads, poor brakes and tyres, and tired drivers.

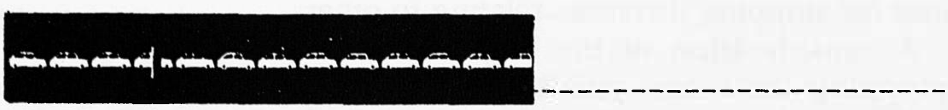
At 30 mph

Thinking distance	Braking distance	Overall stopping distance
30 ft	**45 ft**	**75 ft**



At 50 mph

Thinking distance	Braking distance	Overall stopping distance
50 ft	**125 ft**	**175 ft**



At 70 mph

Thinking distance	Braking distance	Overall stopping distance
70 ft	**245 ft**	**315 ft**

The distances shown in car lengths are based on an average family saloon.

Jam Tomorrow? - Teacher's Notes

This task is designed to provide a context within which students can consider a variety of aspects relating to cars and travel, as they complete an applications task. Some students may decide that they would prefer to collect, organise, display and analyse data concerning the traffic flow along a busy local road, rather than to concern themselves in answering questions about remote motorways. However, it is important that they should ask some questions, and that they should use the data collected to make some recommendations.

Students' intuitive responses to questions about how to increase traffic flow are normally to suggest that the traffic should be allowed to move more quickly. However, this may be over-simplistic. Moreover, we have suggested that the Highway Code must be obeyed! Students should be encouraged to tackle this question practically, as they begin to come to terms with the wide range of issues which could be considered. Initially, students will probably choose to ignore the lengths of cars, as they consider issues such as how many cars can use a single lane of motorway one mile long if the traffic moves at 70 mph, and the separation between vehicles is equal to the overall stopping distance recommended in the Highway Code. How many cars at 50 mph and 30 mph should also be determined.

The results which emerge may surprise students, and if they attempt to graph the results they do not obtain a straight line. Clearly, it would be useful to have values for stopping distances relating to other speeds. A consideration of the Highway Code overall stopping distances, yields the facts that thinking distance in feet has the same numerical value as the speed in miles per hour, and braking distance in feet is one twentieth of the square of the speed in miles per hour. Overall stopping distances for other speeds can then be determined. A graph of *Speed* against *Rate* of flow yields interesting results!

At this stage, some students may wish to conduct a survey of the speed at which vehicles travel and separation distances along a local road. They will need to consider and discuss questions such as

* How can we determine the speed of vehicles along a road?

* How can we measure the distances between two fast moving vehicles?

* How accurate are our measurements?

More able students may feel that they need to refine their original model. Is it appropriate to ignore the length of each car when looking at the separation of vehicles? If not, what value should they use? Again, students have reached a point when a survey, or some data search, could prove useful

* How long is the average car?

Using whatever value they decide to be appropriate, students can refine their original model as they again attempt to determine what speed maximises traffic flow? Higher level students may feel that they wish to question whether the separation between cars needs to be the *overall* stopping distance recommended in the Highway Code. They may suggest that the separation need be only the *thinking* distance

* Using this value for the separation distance at what speed should traffic move?

* Can traffic move safely at such speeds and with such separations?

* What about the effects of inclement weather, accidents etc?

* What about reduced volumes of traffic e.g. half-full motorways?

Again, we have a range of questions which can give rise to student surveys, as they attempt to answer questions which are of some personal significance. This topic can provide a wide range of sharply focussed surveys which can be brought together and integrated, to produce a useful overall picture of the local scenario.This topic is pursued theoretically in *Solving Real Problems with Mathematics* by the Spode Group.

SEAL YOUR FATE

MEGTOWN GAZETTE

VIRUS INFECTION STRIKES SEALS

A virus infection spreads through the seal population. It causes the population to decrease at a rate of 50% per annum for five years.

Biologists develop a vaccine, and some seals become immune to the virus. The population then begins to increase at a rate of 50% per annum.

* How long will it take for the seal population to reach its original size?

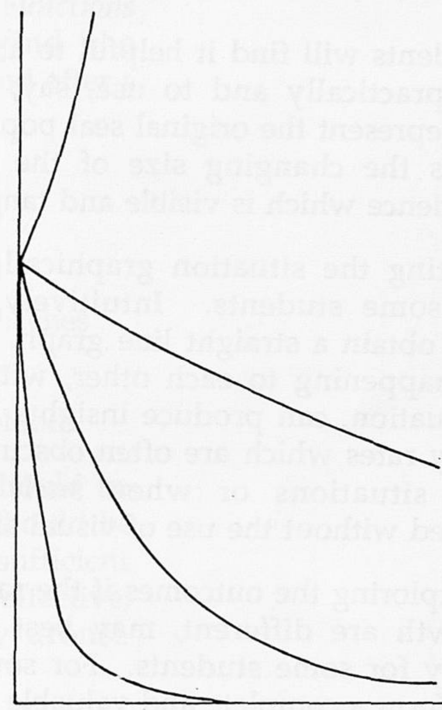
* What would happen if the rates of decay and growth were different?

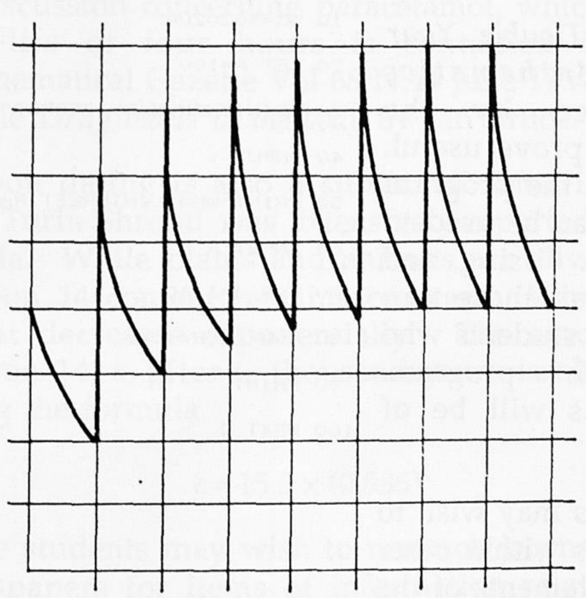
Investigate The Problem

SEAL YOUR FATE : continued

You may like to consider growth and decay rates in relation to other things. Some possible areas include

* Drugs
* Diseases
* Human populations
* The value of money
* The size of debts

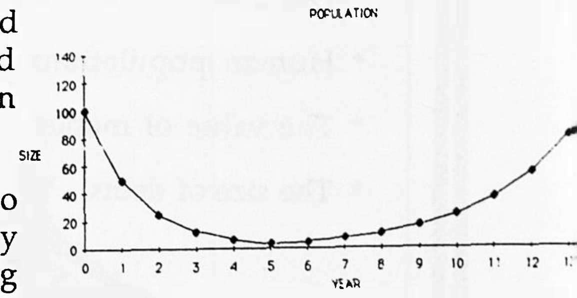




Seal Your Fate - Teacher's Notes

This simple starting point is intended to promote discussion and cognitive conflict among those students who respond intuitively, but over-rapidly, and suggest that after a further five years the seal population will again reach its original size.

Some students will find it helpful to approach the problem practically and to use, say, a hundred cubes to represent the original seal population and to discuss the changing size of the population using evidence which is visible and tangible.



Representing the situation graphically may also surprise some students. Intuitively, they may expect to obtain a straight line graph. Explaining what is happening to each other, within a small group situation, can produce insights into growth and decay rates which are often obscured in more complex situations or when such issues are approached without the use of visual aids.

Again, exploring the outcomes if the rates of decay and growth are different, may best be pursued practically for some students. For some students this will form a complete and valuable study.

Short computer programs such as *Double Your Money*, which is included in *Mathematics Homework on a Micro*, published by the Mathematical Association may also prove useful. Although the context within which the program is written is financial, the program can be used to model the seal population situation. Using, and modifying, short programs such as these can arouse a great deal of interest among students who would find it difficult to write such a program. Writing their own short programs will be of interest to other students.

```
10 @%=&02020A
20 LET A=100
30 PRINT"HOW MANY YEARS?"
40 INPUT Y
50 PRINT"WHAT INTEREST RATE (%pa)?"
60 INPUT R
70 FOR J=1 TO Y
80 A=A*(1+R/100)
90 PRINT " ";A
100 NEXT J
```

After the introductory stage, students may wish to look into the growth and decay rates within other types of population. The essential elements of the main task are that students should ask questions or make hypotheses relating to growth and decay rates, and that they should collect or produce data which enables them to answer their questions.

During recent years there has been much discussion about how much the 'pound in your pocket' is really worth, and students may wish to look into the 'real' value of money or the Retail Prices Index. *Key Data 1988* published by HMSO is a useful and inexpensive resource.

Some students may find it interesting to look at exponential functions in relation to Hypnotic Drugs, as suggested in *The Language of Functions and Graphs*, Shell Centre/JMB. To find the amount of , say, nitrazepam left in the blood after a period of time we can use the formula

$$y = A \times (0.97)^t$$

Where y = amount of drug in the blood

t = time in hours after the drug reaches the blood

A = size of the initial dose in the blood.

Discussions about what size initial dose should be prescribed, and how frequently the drug should be taken, if we wish to ensure that there is a sufficient amount of drug in the bloodstream to be effective, but not so much that it is lethal, may arouse considerable interest in some students.

A discussion concerning paracetamol, which has a half-life of four hours is contained in The Mathematical Gazette Vol 68 N.44 June 1984, in the article *Drug levels in the body* by Ian Bruce.

Carbon dating is also a subject of some interest. The Turin Shroud was extensively reported in the media. While plants and animals are alive, their Carbon 14 content remains constant. When they die it decreases exponentially. The amount of Carbon 14, a, after t thousand years is obtained using the formula

$$a = 15.3 \times (0.886)^t$$

Some students may wish to research journals and newspapers for items of information relevant to such issues. However, *The Language of Functions and Graphs* includes many such rich and valuable areas for consideration by the more able student.

WHO'S WON?

END OF SEASON MIXED HOCKEY LEAGUE TABLE

	Played	Won	Lost	Drawn	Points
Asdown	10	6	1	3	15
Brigtown	10	7	2	1	15
Cheltree	10	2	4	4	8
Donkley	10	4	6	0	8
Exham	10	2	5	3	7
Fulflow	10	3	6	1	7

During a season, each team plays every other team, at home and away. Points are obtained in the following way

two for a win

one for a draw.

In order to improve play, it is suggested that the points system should be changed to

three for a win

one for a draw.

* Do you think this will make any difference?
* What type of scoring system do you suggest?

Investigate The Problem

WHO'S WON? : continued

The following table shows the British Election Results from 1945 to 1987.

Some people feel that our present system for winning parliamentary seats is unfair. They suggest that we should have proportional representation.

* What do you think?

BRITISH ELECTION RESULTS 1945 - 1987

	CONSERVATIVE		LABOUR		LIBERAL		OTHERS		
YEAR	% VOTES	% SEATS	% VOTES	% SEATS	% VOTES	% SEATS	% VOTES	% SEATS	OVERALL MAJORITY
1945	39.6	32.8	48.0	61.4	9.0	1.9	3.4	3.9	LAB 147
1950	43.4	47.7	46.1	50.4	9.1	1.4	1.4	0.5	LAB 6
1951	48	51.3	48.8	47.2	2.6	1.0	0.6	0.5	CON 16
1955	49.7	54.8	46.4	44.0	2.7	0.9	1.2	0.3	CON 59
1959	49.4	57.9	43.8	41.0	5.9	0.9	0.9	0.2	CON 99
1964	43.4	48.3	44.1	50.3	11.2	1.4	1.3	-	LAB 5
1966	41.9	40.1	48.0	57.8	8.6	1.9	1.5	0.2	LAB 97
1970	46.4	52.3	43.1	45.7	7.5	1.0	3.0	1.0	CON 31
1974 (F)	37.9	46.8	37.2	47.4	19.3	2.2	5.6	3.6	NONE
1974 (O)	35.8	43.6	39.2	50.2	18.3	2.1	6.7	4.1	LAB 4
1979	43.9	53.4	36.9	42.4	13.8	1.7	5.4	2.5	CON 44
1983	42.4	62.7	27.6	33.0	25.4	3.6	4.3	0.6	CON 161
1987	42.3	58.1	30.8	35.5	22.6	3.4	4.6	2.9	CON 105

Who's Won - Teacher's Notes

This task is designed to provide a situation within which students collect information relating to scoring systems as they attempt to come to terms with the notion that changes in the scoring system may affect who wins in a competitive situation. The introductory task provides a league table for only six teams in order to permit easy entry to the situation. Students will find it useful to work on the limited task as they discuss their responses to the initial questions posed.

Some students may feel that they would like to allocate points for goals scored, in which case they will need to add further, hypothetical, columns to the table provided. This is to be encouraged. Again, it is the case that each student will develop their own individual study to a level appropriate to their own interest and ability. Further issues raised during school trials included giving bonus points, rewarding goals scored for and penalties for goals against, considering crowd size etc.

Whilst soccer usually dominated this task for students of both sexes, some students may then wish to move on to discuss league tables and scoring systems relating to their favourite sport. They may wish to look at the current season's league tables. Alternatively, they may choose to look at past seasons' results. It is important that students should ask themselves questions before embarking upon their data collection activities. Some students may choose to hypothesise that with a certain specified different scoring system, a particular team would have been top of the league, or alternatively, would not have been relegated to a lower league. Consequently, they may wish to recommend that their suggested scoring system should be adopted.

Clearly, for this task a calculator, at least, should be available. Again, however, we have a situation in which a database or a spreadsheet has much to offer. As the number of teams under consideration increases, ranking teams and graphing results is quickly, easily and reliably accomplished using modern technological aids. Data needs to be entered accurately and carefully into both databases and spreadsheets, but the pay off is high. The ease with which students can test their conjectures, relating to more than one variable, can lead to rapid insights into the situation which is being investigated. The delight demonstrated by students, as they search their data, in order to answer their questions, is a joy worth experiencing.

This approach enriches the task for students of all abilities. The less able student gains considerably more success through the use of the technology, and the most able student is assisted as she moves further and deeper into her task.

Some students may wish to pursue their main task within the sports arena. Others, however, may choose to move on to discuss other situations.

We have suggested that British Election Results may be of interest. Students may wish to collect information concerning proposals made in this country. Alternatively, they may choose to look at how other countries manage their political affairs.

In addition to the national scene, there is also the possibility of looking into the local election results. Students may wish to look into the figures produced during recent local elections.

* Would changes have the same effects nationally and locally?

* Could they devise further alternative rating systems?

* Mock elections within their class, or the whole school, using a variety of scoring systems could enable students to gain insights into different electoral systems.

As they pursue this task, it is important that students should collect their own data, relating to an area of their choice, and that they should attempt to answer a question which is of some personal significance and interest.

PRICE IT RIGHT

A student consumer group recorded the following prices in three supermarkets during May 1989.

	SAFEBURY £	SAINSWAY £	OPCO £
Coffee (100g)	1.79	1.79	1.94
Tea bags (80)	1.09	1.09	1.12
Orange juice (1 litre)	0.69	0.69	0.70
Fresh milk (1 pint)	0.27	0.27	0.29
Margarine (500g)	0.72	0.72	0.74
Butter (250g)	0.59	0.58	0.59
Cheddar Cheese (1 lb)	1.34	1.36	1.55
Bread Whitesliced (800g)	0.44	0.44	0.45
Green Beans (frozen)	0.55 (1 lb)	0.55 (1 lb)	0.39 (8 oz)
Yoghurt	0.89 (4)	0.89 (4)	0.24 (1)
Beefburgers	3.29 (12)	2.18 (8)	1.32 (4)
Chips (frozen)	0.74 (2 lb)	1.39 (4 lb)	0.65 (2 lb)

* Consider their findings.

PRICE IT RIGHT : continued

You may like to survey food prices in your own local supermarkets.

Alternatively, you may prefer to survey prices of non-food items, or to use mail order catalogues.

* What do you think you will have to pay for these goods in the year 2000?

* What do you think they cost ten years ago?

It is suggested that in 1986 the length of time necessary to work to pay for various items was as follows. This is the time for a two-earner couple with two children under 11. Both man and wife are on average hourly earnings, and their net income pays for the goods.

	1986 Hours	Minutes
1 large loaf (white sliced)		4
1 lb of rump steak		27
500 gr of butter (home produced)		10
1 pint of fresh milk		2
1 dozen eggs (medium size)		9
100 gr of coffee (instant)		13
125 gr of tea (medium priced)		4
1 pint of beer		7
1 bottle of whisky	1	14
20 cigarettes		13
Weekly gas bill		45
Weekly electricity bill		38
1 gallon of petrol (4 star)		16
1 cwt of coal		51
Weekly telephone bill		22
Motor car licence	15	16
Colour television licence	8	51

* What do you think would be the appropriate times today?

Price It Right - Teacher's Notes

The context for this applications task is costings, budgeting and indexing. The price of the food we eat regularly, affects us all. Consequently, this topic provides a rich starting point for many students.

The short list of food items together with prices in three supermarkets, is intended to provide a focus for small group discussion. A whole class discussion, during which a representative from each small group presents the agreed views and recommendations of their small group, could follow.

Initially students may, merely, total the bill for the items listed for each supermarket, and then suggest that the lowest bill identifies the best supermarket. They will then take into account factors such as weights and numbers. Students, hopefully, will realise that they also need to consider

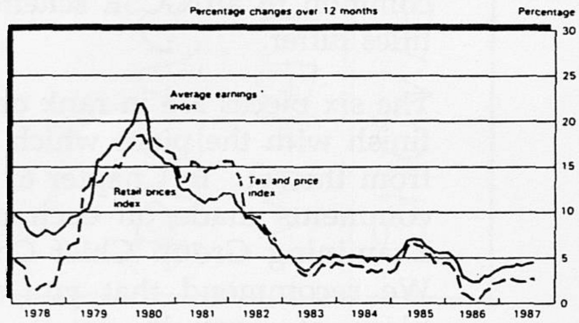
* prices over a wider-range of items
* prices of items they purchase regularly
* the quantities they purchase regularly
* the brands they buy
* the quality of the goods etc.

After discussion within small groups, many of these points should emerge during class discussion, as should notions that one person's best value supermarket is not necessarily another person's best value supermarket. The cost of travel, and the convenience, or availability of car parking, also need to be considered.

Many students will wish to complete their main task within the context of shopping at their local supermarkets. However, it is important that they should ask questions or make hypotheses before they begin to collect their data. It is also important that their questions, and hypotheses, should be sharply focussed. For example, they need to look at the *best* supermarket for, say, a specified range of items. They also need to show an awareness of price fluctuations, week to week, season to season, as they make their recommendations.

The data students collect needs organising. The information collected and organised may benefit from graphical display. An analysis needs to be made for a particular type of family unit, or range of family units.

The data collection can consume a large proportion of the time available, if each student collects all the information she needs, and wishes to complete the task within fifteen hours. However, a group of students can organise themselves, so that each person collects data which can be shared, in order that each of them can reach some valid recommendations concerning their own different questions, within the time available.



Some students may find it stimulating to consider prices, past and future, and to relate today's prices to the Retail Prices Index. The data contained in the table on page 55 is extracted from a larger table in *Key Data 1988,* HMSO. This information can produce much lively discussion

* Would you be willing to work twice as long for a loaf of bread as you would for a pint of milk?

* Is 100 grams of instant coffee worth three times as much as 125 grams of tea?

As with all the other tasks in this cluster, the essential components are that each student should collect, organise and analyse data relating to a question which is of some personal significance, and that some recommendations should emerge which are based upon the analysis of the evidence collected.

During our classroom trials, many students found it useful to spread this task over a period of more than three weeks. It often proved useful to introduce the task and allow students to discuss the situation and then to allow a data collection period. When the data collection had been completed further time-tabled sessions were provided, so that students could organise and analyse their data.

5 *Students' Work*

These six pieces of work cover a wide range of achievement. Two pieces of work are offered at each of the three levels of GCSE study; Foundation, Intermediate and Higher. These three levels are common to all GCSE schemes although the level titles differ.

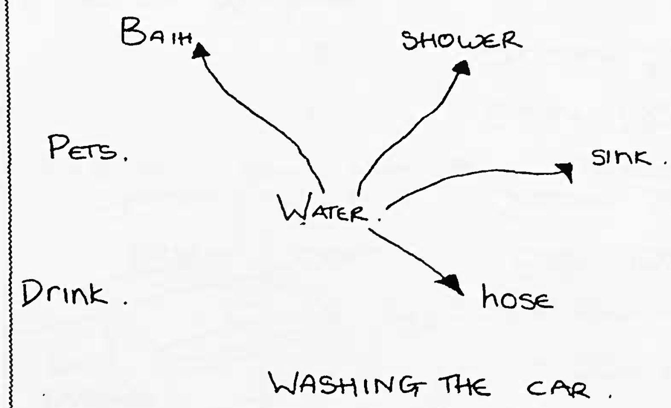
The six pieces are in rank order of attainment and finish with the piece which is considered the best from the set. In Chapter 6, you will find detailed comments made on each piece by the Midland Examining Group Chief Coursework Moderator. We recommend that you should consider each piece of work in detail, make a few written comments and attempt to grade each student's work, before you read the moderator's comments.

For identification purposes, the six student's scripts are labelled A2/1 to A2/6. Because of space constraints the project team decided to reduce the size of the student's scripts, in order to include a wide range of student achievement. In addition to the loss of quality through the reduction in size, some scripts suffer from the loss of colour which originally added emphasis and clarity to the arguments presented. Nevertheless, we are hopeful that much of the strength inherent in the original scripts will become apparent as you read through the following pages.

TITLE. Should you have A WATER METER in one house.

A2/1

<u>Thinking about should you have A WATER METER IN YOUR HOME.</u>



1 GALLONS = 4·5 L.

I was not shore what to use gallons or litres so I use litres because it is easy to calculatore.

I looked at a lot of ways to measure how much water we used

BATH	SHOWER.
Andrew	Dad
Dad	Mum
Mum	Mark
Andrew	Andrew
Marck	Mark
Andrew	Mum
Dad	Dad
Andrew	Dad
Mark	Mum
Mum	Mark
Dad	Mum
Andrew	Andrew
Dad	Dad
Andrew	Andrew
Mark	Mum
	Dad
	Dad
	Ryan
	Mark
	Mark.

PLEASE ADD NAME WHEN YOU HAVE A SHOWER OR BATH

Should you have a water meter in Your house.

In our house we use L.

	Bath	Shower
Dad.	4.	5.
Mum.	2	6.
Brother.	6	3.
me.	3	7.
	15	21.

Bath . 100L. Bath. 100 × 15 × 52

Shower . 30 L. Shower. 30 × 21 × 52

Bath= 78000 L

Shower. 32760 L

Washing Machine.

Automatic Front. Loader. L.

Per wash = 99 L. × 5 = 495 L. × 52 = 2 5740 L

Dishwashing machine. 67.5 L × 4 = 270 × 52

= 14040 L.

Toilet flush = 8L × 4 × 5 × 7 × 52 = 58240L per year.

How much does a meter cost.

For a Water meter to be Put in at my house it would cost £20 £50 for a straight forward job.

Where should it be located.

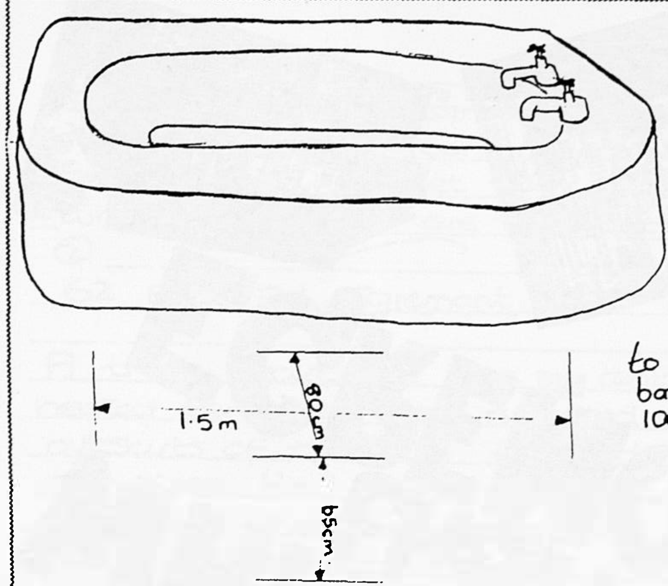
The meter must be fitted in a place where it will measure all water going into the house this is usually under the kitchen sink or in a cupboard in the house.

Inspection.

They must inspect and appove the meter installation when fitted before you can be charged on it reading.

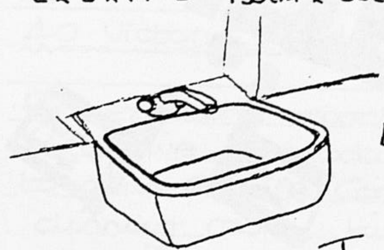
Number of people in house.	high	Average	Low
1	14,000	12,000	10,000
2	33,000	23,000	18,000
3	~~43,000~~	33,000	27,000
4	$\boxed{50,000}$	36,000	33,000
5	60,000	40,000	36,000
6	65,000	43,000	36,000

	Rateble value.					
	500	400	300	250	200	150
12,000	148	111	73	55	35	17
14,000	144	107	69	51	31	13
18,000	134	97	60	42	22	4
23,000	124	87	49	31	11	–
27,000	115	78	40	22	2	–
33,000	101	64	26	8	–	–
36,000	95	58	20	2	–	–
40,000	86	49	11	–	–	–
43,000	79	42	4	–	–	–
50,000	63	$\boxed{26}$	–	–	–	–
60,000	41	4	–	–	–	–
65,000	30	–	–	–	–	–



to fill up the bath I need 100L or 20 g.

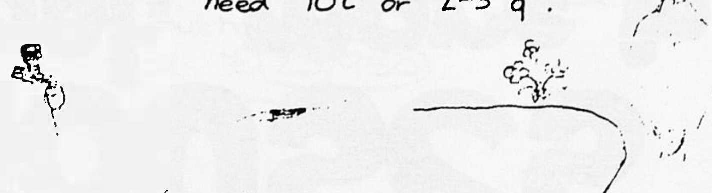
L × B × h = 150cm × 65cm × 80cm. 780000 cm³.



L × B × H = 45cm × 35cm × 20cm

= 31500 cm³.

To fill the sink I would need 10L or 2-3 g.



1 bucket = 10L.
it takes 1·20 seconds to fill 1 bucket
the garden is 25 m by 35 m

and that take 15 minutes to water the garden

SO

1·20 minutes ÷ 15 minutes = 12·5 × 10L = 125L

125L × 10 – 15 times a year = 1250L to 1875L per year.

The shower uses 20L I know this because I filled up bucket and sore how long it took and then see how long I person took in the shower.

Are Rates Value of are house is £~~4~~00 and there is 4 people that live in are house my Brother my mum and Dad and me are water bill is Average and on· the AMOUNT OF WATER USED IN GALLONS we use 50,000 GALLONS.

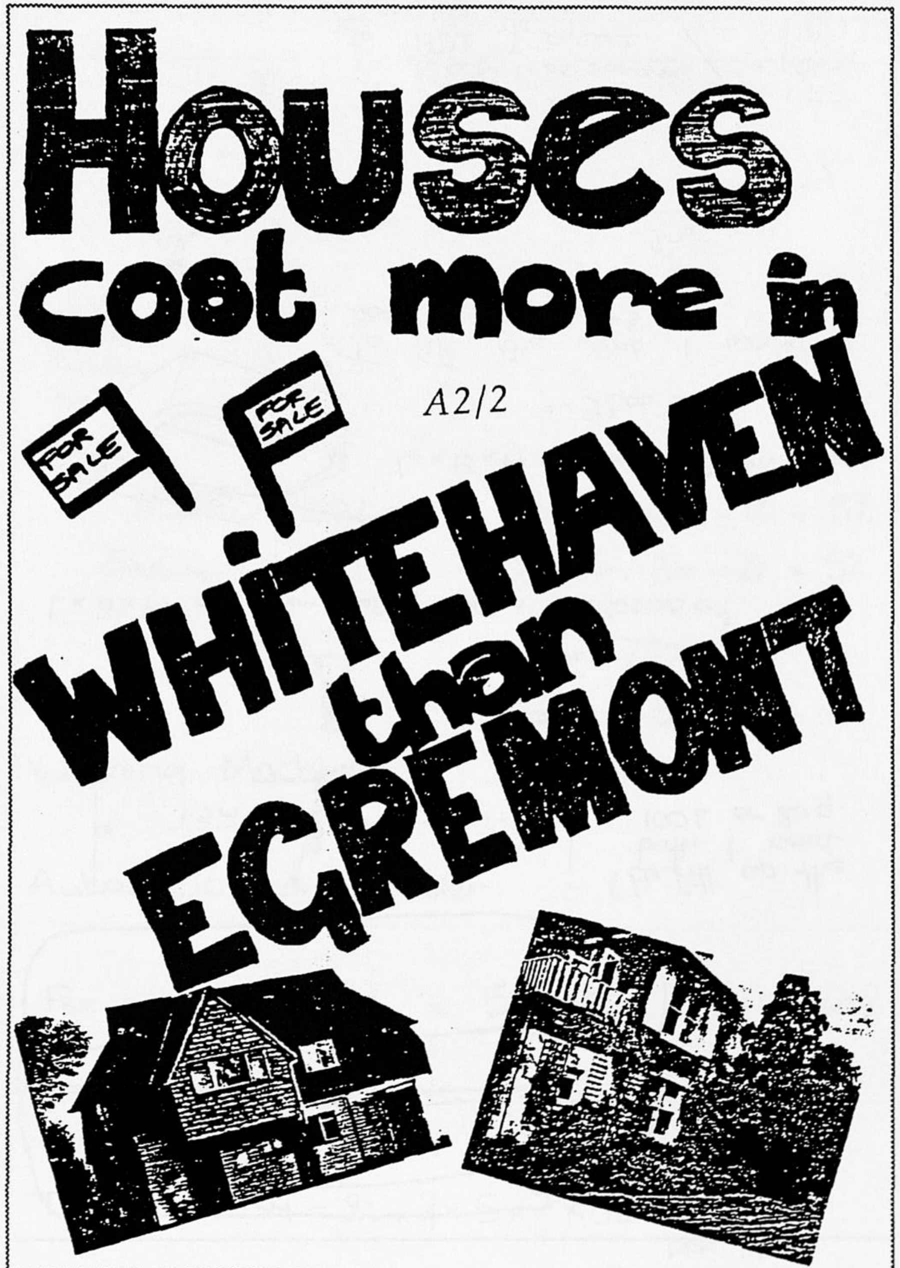
Yes it would be cheaper to have a WATER METER.

we would save £26 per Year in two years we would get are money back and in 20 year we will make 18 × 26 = £468.

49000 × 4·5 = 220500 L

We use in 1 year 49000 gallons

220 g = 990L. 220500 ÷ 990 = 222·72 × 52p = £115·44.



A2/2

Houses cost more in Whitehaven than in Egremont

Introduction

The idea of this investigation is to find out whether the statement: "Houses cost more in Whitehaven than in Egremont" is true or not.

Firstly I compared the price of 3 bedroomed houses in Whitehaven with 3 bedroomed houses in Egremont.

Results:

1

26 Dale view Gardens Egremont

A 3 bedroomed semi detached gas central heating house, situated in a cul-de-sac on this popular estate. Hall, lounge/diner, kitchen, 3 bedrooms, garage garden to front and rear.

Price £26,500

1

61, Balmoral Road Whitehaven

A desirable modern semi detached house with large garage, pleasantly situated on a good residential estate and having well maintained accomodation comprising: Entrance hall, lounge, dining room, kitchen, bathroom, 3 bedrooms and gardens.

Price £23,950

(I will carry on comparing these like this so that I can collect better results until I get the final place where the houses are the most expensive)

②

62, East Rd Egremont

A three bedroomed gas centrally heated terraced house situated on the outskirts of the town. Accomodation comprises: Hall, living room, dining room kitchen, three bedrooms / W.C. Yard to rear and Garage.

Price £23,000

②

40 Victoria Road, Whitehaven

An excellent spacious family home in an attractive overlooking the town and back to open fields. Comprises: Hall, lounge, dinning room, kitchen, landing, 3 bedrooms boxroom and bathroom. Lawned garden and outhouses.

Price £25,950

Smithy Cottage Bootwell, Egremont

Rebuilt in 1933 to a very high standard gas central heating double glazed windows throughout, comprises: Hall, lounge / diner, small sun lounge / study, fitted kitchen, three bedrooms, bathroom attached garage, insulated loft, fenced garden to side and yard to side.

Price: £29,750

21, the Crest Hillcrest Whitehaven

A spacious modern house with central heating throughout. Entrance Hall, lounge, dinning area, fully fitted kitchen, rear hall, utility room, bathroom 3 bedrooms, garage, gardens.

Offers over £26,000

13, Westfield Drive, Egremont

Attractive 3 bedroomed detached house situated on this pleasant estate. Gas centrally heated comprises: Hall, downstairs toilet, kitchen, lounge / diner, 3 bedrooms, bathroom, garage. Gardens to front side and rear.

Price £32,950

4

15, Oakbank Avenue, Whitehaven

An attractive and quietly sited 3 bedroomed, two reception rooms, semi detached house with part night store heating (westerly sea views) with the chance to add value by improvement
Price: £23,950

5

31, The Rowans, Orgill, Egremont,

A spacious well appointed 3 bedroomed house with garden pleasantly situated : Entrance Hall, lounge, kitchen / dining area, bathroom, rented garage.
Price: £ 21, 950.

5

17, Grant Drive, AIRBANK, Whitehaven

Modern semi, through lounge / diner, kitchen, 3 bedrooms, tiled bathroom with shower, full gas central heating Garage, garden to front & rear.
Price: £ 25, 750.

Hillside, Briscoe Road, Egremont 6

(Chalet Bungalow)
Easy access to fells. Five minutes from shops. Comprises: Through living room, large half tiled kitchen, combined half tiled bathroom and toilet. Double bedroom dining / morning room. Upstairs: - - - -- Two good sized bedrooms / storage space. Gas central heating throughout. Good sized brick shed. £-acre attractive mature gardens to front and rear.
Price £42,000

11, Landsdowne Grove, Hillcrest, Whitehaven

A family home, offering sunny 3 double bedroom, two reception centrally heated accomodation in a first class residential cul-de-sac. Further distinguished by large kitchen, second WC, screened rear gardens and a south west aspect.
Price: £36,950

48, East Road, Egremont 7

Modernized end terraced house with gas central heating. Comprises: entrance hall lounge with feature fireplace, attractive arch through to dining room, kitchen rear store. First Floor: Bathroom with 3 piece suite and shower 3 bedrooms Floored and insulated loft. Rear yard.
Price: £21,500

(7)

4, Mosswell Terrace, Whitehaven.

Mid terraced house (well maintained).
Comprises: Entrance Hall, lounge, sitting room, large kitchen, two bedrooms, bathroom, large attic bedroom.
Rear Yard, coalhouse & store - good vegetable garden. Carpets included in the sale.

Price: ₤23,000

(8)

8, Crosside, Egremont

Midterraced house with pleasant outlook. comprises: Hall, lounge with double glazed pvc windows, sitting room fitted kitchen with large dining area.
First floor: 2 double bedrooms, bathroom
Carpets included.

Price: ₤19,000

26, Hugh Street Bransty Whitehaven.

Modernized 3 bedroomed mid terraced house, popular area. comprises: Hall Living room, kitchen with fitted units.
First floor: 3 bedrooms with bathroom with coloured suite.

Price: ₤17,000

(9)

37, Dent View, Egremont

3 bedroomed link house with gas central heating, Everest secondary double glazing throughout. Comprises: Hall, lounge dining room, kitchen, 3 bedrooms, bathroom/WC and detached garage. Garden to front and rear

Price: ₤27,000.

18 Loop Road South, Whitehaven.

[redacted] Spacious gas centrally heated 3 bedroomed home. Comprises: Part double glazed porch, hallway, lounge, 21ft. sitting/dining room, fitted kitchen, landing and 4 piece bathroom.
Classic family houses in popular residential location.

Price: ₤32,950

Houses cost more in Whitehaven than in Egremont

(10)

'Mithian" Gill foot Mansions, Egremont

Modern 3 bedroomed detached bungalow in $\frac{3}{4}$ acre. Comprises: Entrance Hall lounge, dining room, kitchen, bathroom three double bedrooms, conservatory, garage. Solid fuel central heating.

Price: £38,000

4, Eden Drive, Moresby Parks, Whitehaven
Attractive spacious dormer bungalow, solid fuel heating. Well appointed accomodation Comprising: Hall, lounge, kitchen/dining area, bathroom. First Floor: 2 bedrooms and a bedroom/dining room, bedroom also on ground floor.

Detached Garage.

Gardens to front side and rear.

Price: £34,950

Conclusion and Results:

So, I have found out that the statement "Houses cost more in Whitehaven than in Egremont" is not true.

I compared 10 houses from Whitehaven with 10 houses from Egremont so I could find out which town had the most expensive houses.

There wasn't always enough to compare because all the way through I compared 3 bedroomed houses from each town sometimes I had to look through at least 4 different Whitehaven news before I could get the information I was looking for.

I wrote out all the houses I compared and out of every two houses I compared I ringed the most expensive with red pen.

Out of the 20 I compared with each other I ringed 10 of them.

RESULTS

Egremont had 6 houses more expensive than Whitehaven.

Whitehaven had 4 houses more expensive than [redacted] Egremont.

Houses are more expensive in Whitehaven than Egremont

RESULTS:

The information I have collected tells me that HOUSES IN EGREMONT ARE MORE EXPENSIVE THAN HOUSES IN WHITEHAVEN.

At first I thought that the houses in Whitehaven would be the most expensive as it is bigger than Egremont, but I was proved wrong. It seems that the smaller the place and where its positioned puts a higher value on the house.

There are lots of houses for sale in Egremont but they are sold quickley because it is a popular area and if people are moving into West Cumbria and are going to be working at BNFL Egremont is most likely to be the place they will pick.

There are quite an amount of houses for sale in Whitehaven and I had no trouble finding houses to compare in Whitehaven but, when I came to get some information on houses at Egremont I just managed to scrape together 10 houses from Egremont and 10 houses from Whitehaven to compare

So this means its a difference of 2 (2 of the houses in Egremont are more expensive at Whitehaven)

Even so, it still means that Egremont is more expensive for buying houses.

When I did the averages I had to search through the notes I had and find all the different sections. This was quite difficult because in some advertizements it didn't tell you what kind of house it was though you could usually work it out.

On number 8 out of the two I compared I had to use an advert (for Egremont) for a two bedroomed house because I couldn't find another 3 bedroomed house in Egremont.

Suprisingly enough the two bed-roomed house was priced at £19,000 but the one at Whitehaven which I compared it with had 3 bedrooms cost a mere £2,000 less, it just shows what the position of the house can do to the price of it.

against each other.
It was quite difficult to get information on the houses, because I only had Whitehaven News dating back to about 4 weeks ago and there tended to be the same houses in each week.
If I had had more time I would of continued and try[redacted] to find other price differences: for instance comparing two other towns or villages such as Cleator moor and Gosforth or Moor Row and St Bees, until I had found the results for them.
Also I would of liked to have compared 4 bedroomed houses with each other, but unfortunately I couldn't find enough information.

AVERAGES

Semi Detached

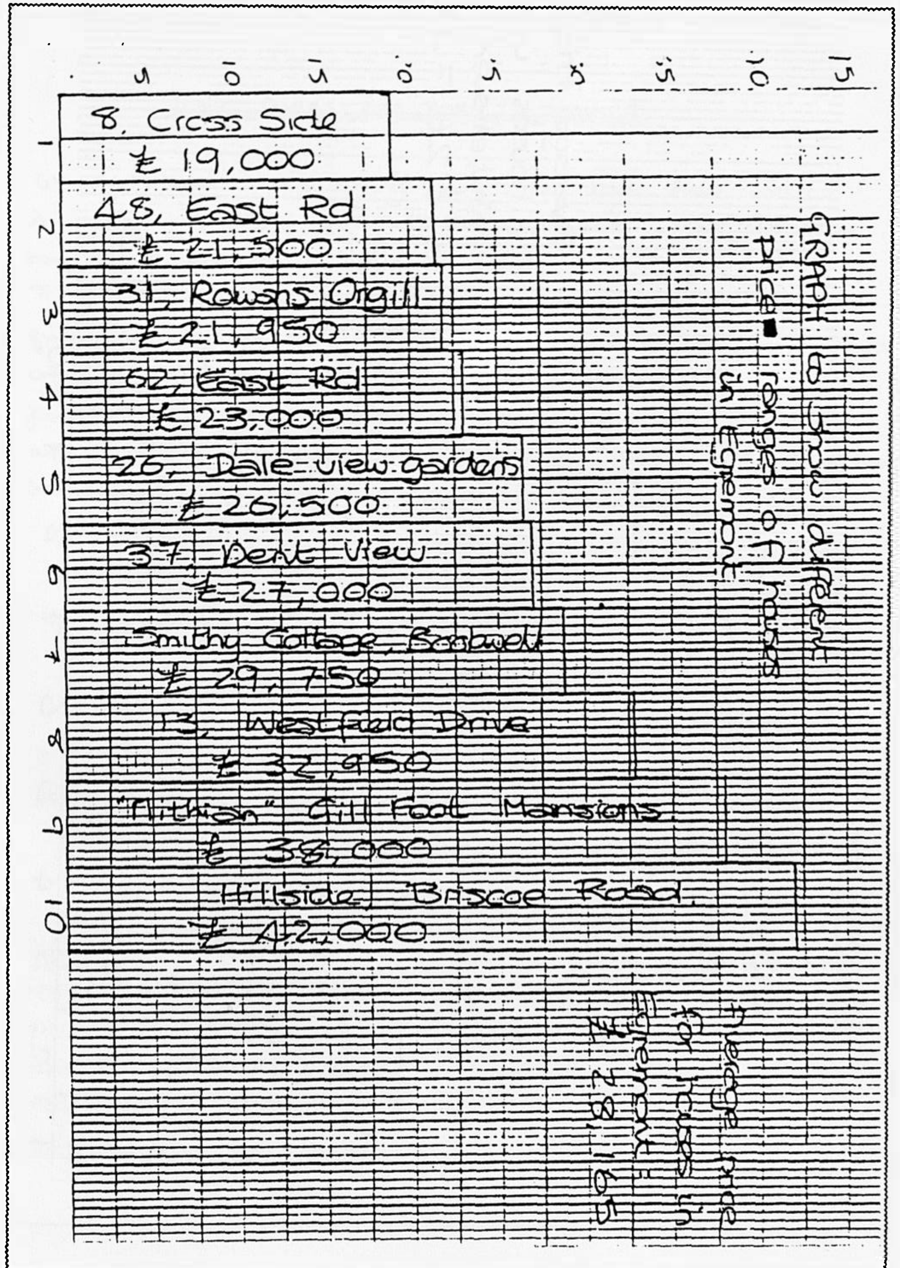
Egremont has 3 semi detached houses out of the ones I compared: I decided to find their average price

1
26, Dale View Gardens = £ 26,500
2
31, The Rowans, Orgill = £ 21,950
3
37, Dent View = £ 27,000

Average Price for the semi detached in Egremont is £ 25,150.

Whitehaven has 5 semi detacheds houses (out of the ones I compared)

1
61, Balmoral Road = £ 23,950
2
21, the Crest Hillcrest = £ 26,000
3
17 Grant Drive, AIRBANK = £ 25,750
4
11, Landsdowne Road, Hillcrest £ 36,950



EGREMONT

⑤ 18, Loop Road South, £ 32,950

Average price for semi detacheds in Whitehaven is £ 29,120

Terraced

Egremont terraced houses:

① 8, Cross Side = £19,000

② 62, East Road = £ 23,000

③ 48, East Road = £ 21,500

Average = £21,700

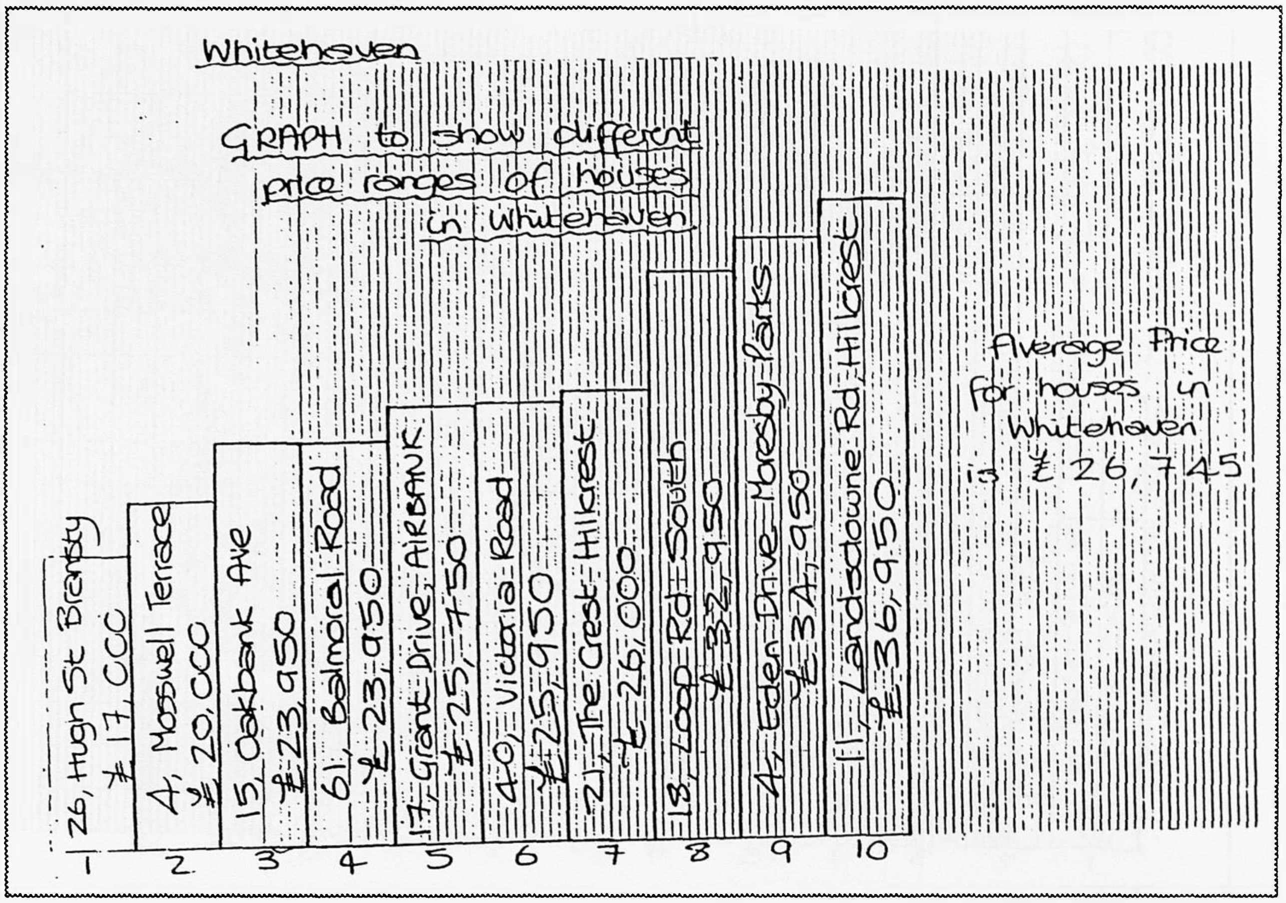
Whitehaven terraced houses:

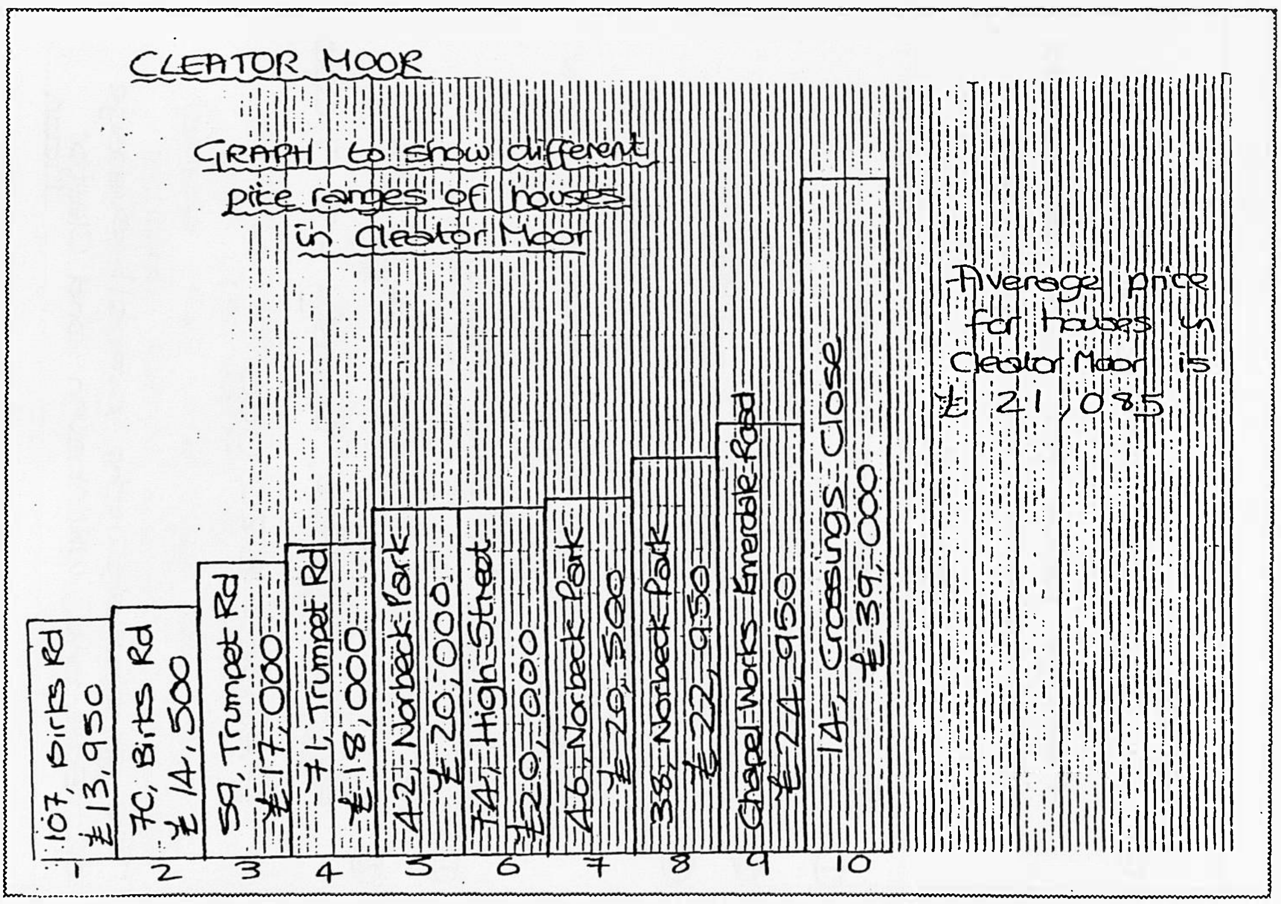
① 4, Mosswell Terrace = £ 23,000

② 26, Hugh Street, Bransty = £ 17,000

Average = £ 20,000

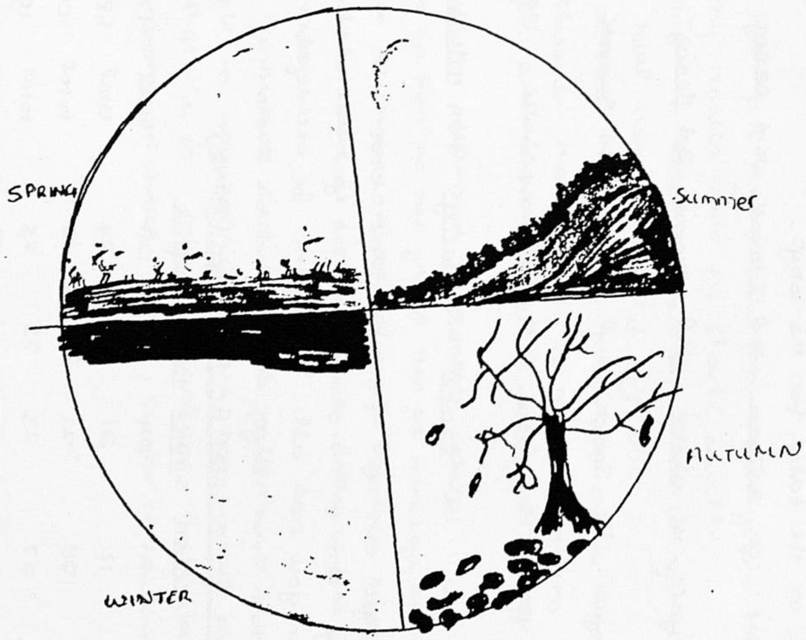
The graphs show the overall average of Egremont, Whitehaven and Cleator Moor.


Whitehaven
GRAPH to show different price ranges of houses in Whitehaven
26, Hugh St Bransty £17,000
4, Mosswell Terrace £20,000
15, Oakbank Ave £23,950
61, Balmoral Road £23,950
17, Grant Drive, AIRBANK £25,750
40, Victoria Road £25,950
21, The Crest Hillcrest £26,000
18, Loop Rd South £32,950
4, Eden Drive Moresby Parks £34,950
11, Landsdowne Rd Hillcrest £36,950
1 2 3 4 5 6 7 8 9 10
Average Price for houses in Whitehaven is £26,745


CLEATOR MOOR
GRAPH to show different price ranges of houses in Cleator Moor
107, Birks Rd £13,950
70, Birks Rd £14,500
59, Trumpet Rd £17,000
71, Trumpet Rd £18,000
42, Norbeck Park £20,000
74, High Street £20,000
46, Norbeck Park £20,500
38, Norbeck Park £22,950
Chapel Works Ennerdale Road £24,950
14, Crossings Close £39,000
1 2 3 4 5 6 7 8 9 10
Average price for houses in Cleator Moor is £21,085

Are There More Girls Born In Summer?

A2/3



MORE GIRLS ARE BORN IN SUMMER

What I have been doing over the past few weeks is trying to find out if the statement 'More Girls are Born In summer' is true or flase.
To find out this what I did was get hold of all the girls' dates of birth who are in Wyndham School from years one - five. I also got the boys' aswell because I was going to compare them at the end of my investigation.
what I had to decide was which months fit into each Season, this is how I put them.

SPRING	SUMMER	AUTUMN	WINTER
march	June	September	December
April	July	October	January
May	August	November	February.

I looked through the years one-by-one looking for each person born in the 1st month then the 2nd month etc.
This is how I put them down onto a table for each year.

1st year girls.

January	11	July	8
February	4	August	8
march	8	September	6
April	6	October	7
may	8	November	12
June	6	december	12.

I did exactly the same for all the girls in the school, then the same for all the boys through out the school.

1st year : 1st Winter. 2nd Autumn 3rd + 4th together Summer and Spring

2nd year : 1st Spring 2nd Summer. 3rd Autumn 4th Winter.

3rd year : 1st Spring 2nd Summer 3rd Autum 4th Winter

4th year : 1st Winter 2nd Summer 3rd Spring 4th Autumn

5th year : 1st Summer 2nd Autumn 3rd Spring 4th Winter

When I looked at the figures for everybody in the school (the girls from all the years added together, the boys added up together seperatly) I found that there were more girls born in the spring, But when I looked at the figures for the boys' more were born in Summer (for the whole school).

I looked at each year seperatly to see which season people were born in more for all the years for boys and girls. Here are my results.

GIRLS.

As you can see there is only one year for the girls which more people are born in the summer than any other season.

Here is the table for the boys'.

1st year : 1st Autumn 2nd Summer 3rd Spring 4th Winter

2nd year : 1st Winter 2nd Summer. 3rd Spring. 4th Autumn

3rd year : 1st Spring 2nd Autumn 3rd Summer 4th Winter

4th year : 1st Spring 2nd Autumn + Winter . last Summer.

5th year : 1st Summer 2nd Spring 3rd Autumn 4th Winter.

As you can see from the table above there are only more boys born in the summer for one year out of the school. When you add all the figures for each year for the same season more boys ARE born in the Summer.

Here is a table for the school (BOYS)

		SPRING	SUMMER	AUTUMN	WINTER		
	1st	21	24	32	20	total	97
Boys	2nd	12	21	11	24	total	68
	3rd	28	23	27	22	total	100
	4th	27	23	25	25	total	100
	5th	28	39	23	21	total	111

Here is a table for the school (GIRLS)

	SPRING	SUMMER	AUTUMN	WINTER	
1st	22	22	25	27	total 96
2nd	41	28	27	19	total 115
3rd	30	26	25	22	total 103
4th	26	30	19	36	total 111
5th	24	32	28	22.	total 103

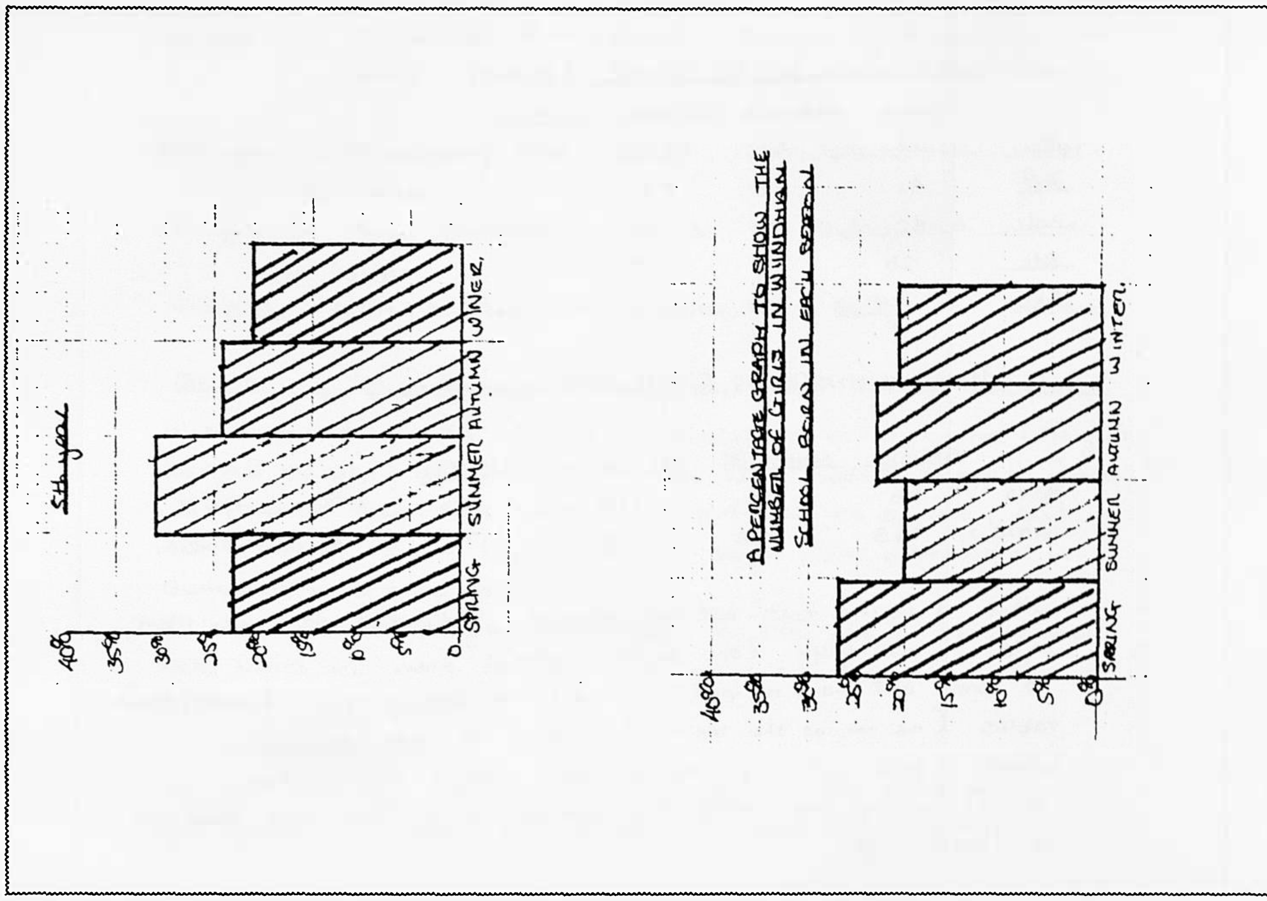
Here is the total for the whole school added up.

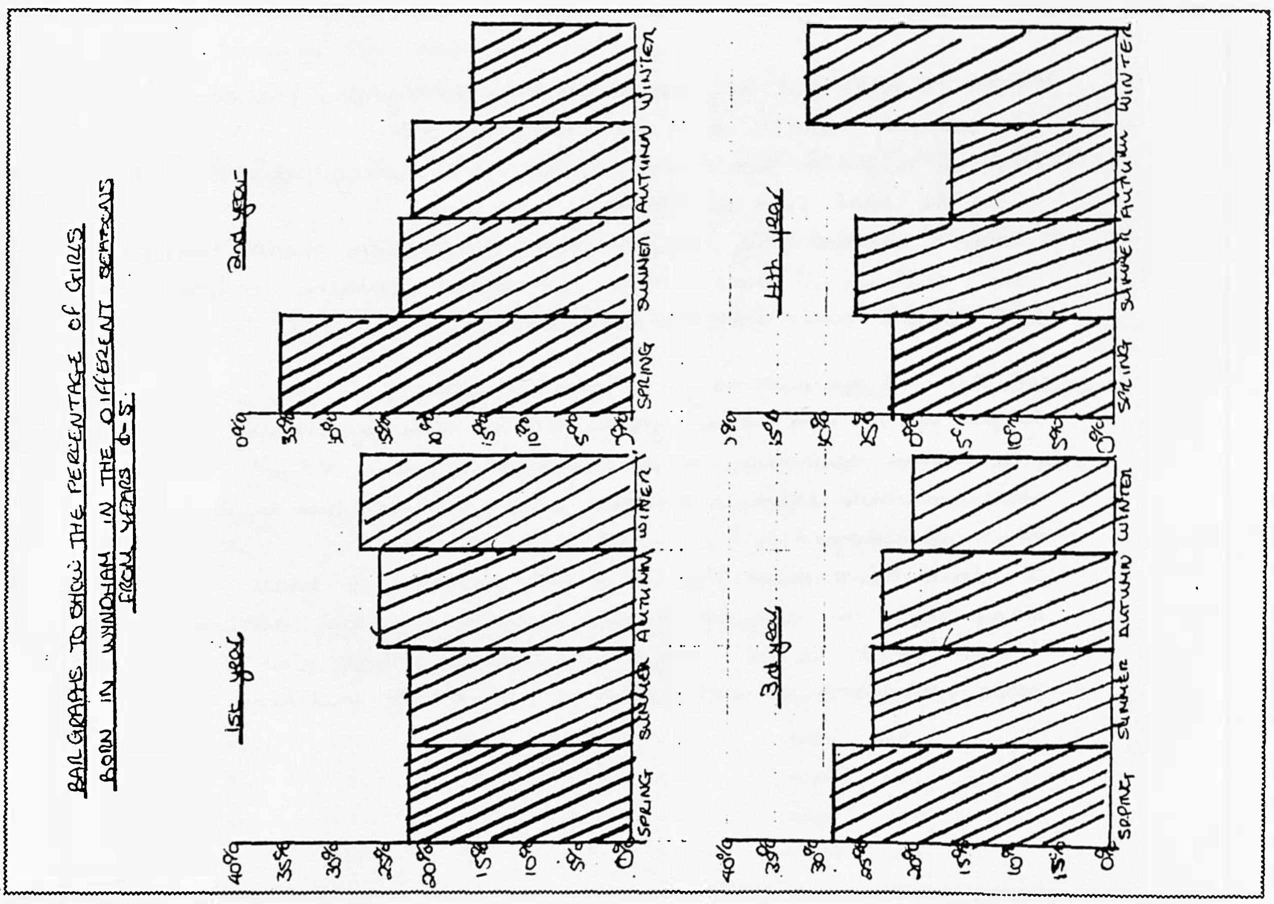
	SPRING	SUMMER	AUTUMN	WINTER	
BOYS :	116	130	118	112	total 476
GIRLS :	143	138	121	126.	total 528

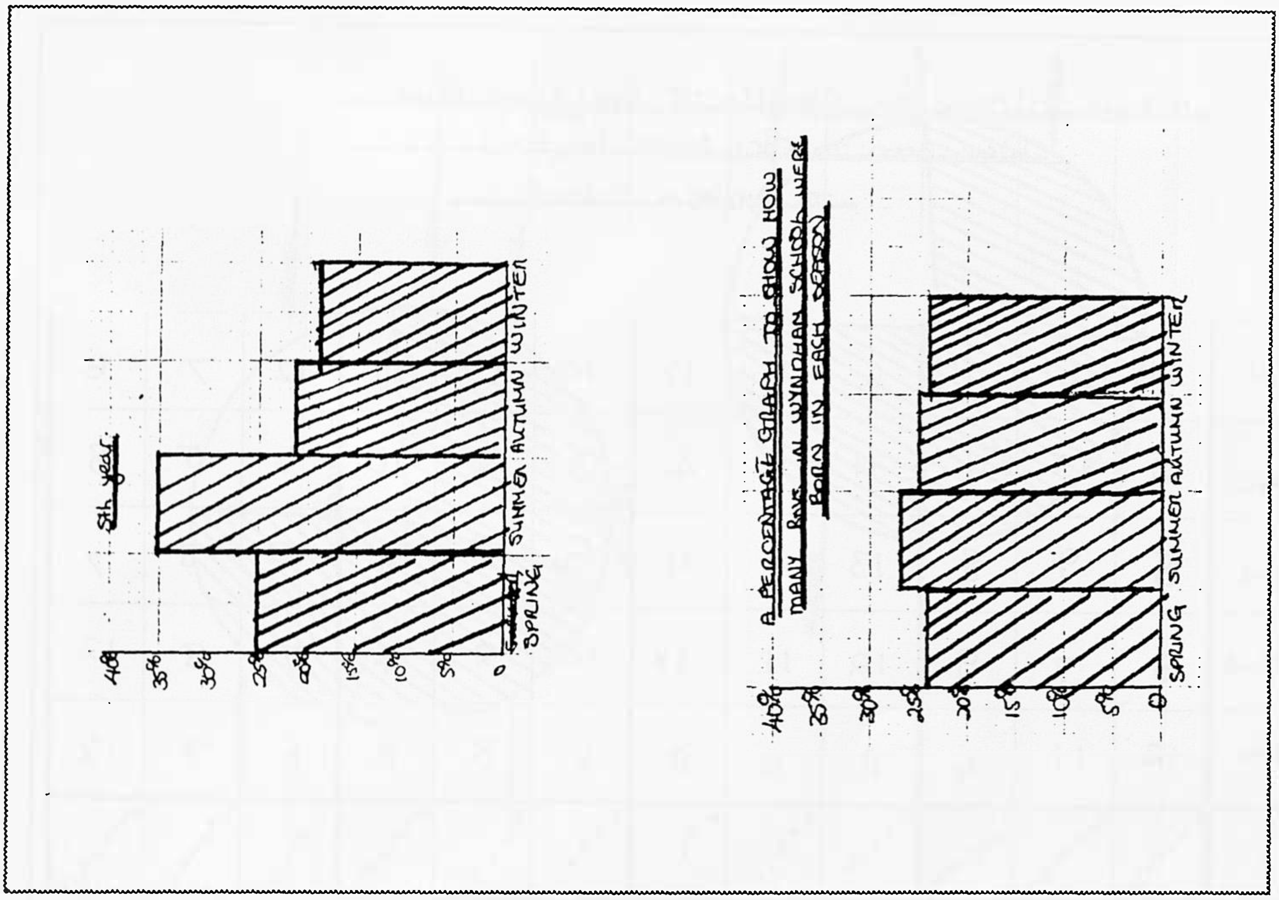
When I found out all my results I decided to put them onto a bar graph (one for each year).
To find out how to put them onto a bar graph I used these tables (the one at the top of this page) to help me.
What I did was get the number I was using then divide it by the total then multiply it by 100. this gave me a percentage.

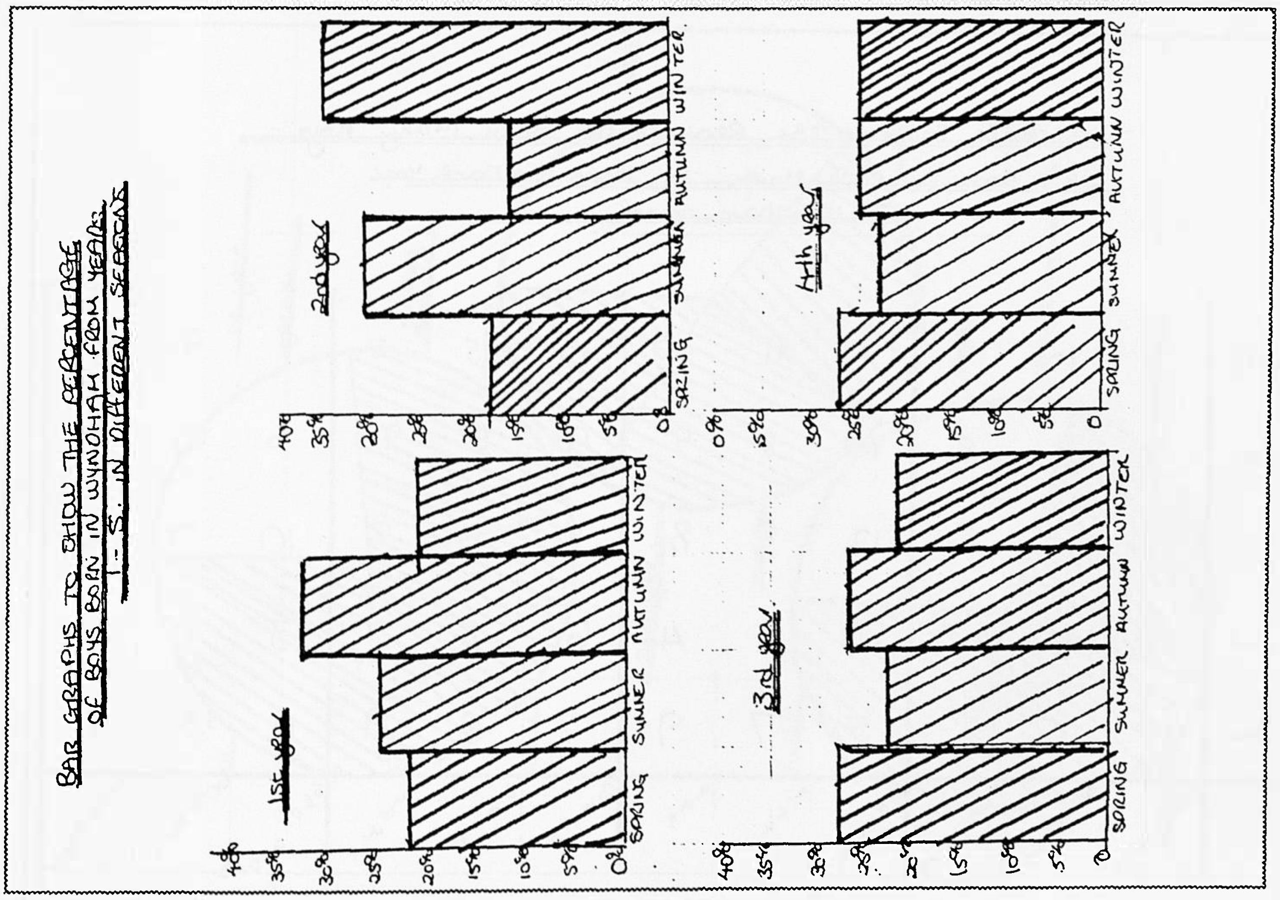
After I had put my results onto block graphs I decided to put my results onto pie charts aswell.
To do this I took the number I was using divided it by the total then multiplied it by 360.
When I studied my graphs and pie charts I have come to the conclusion that there is no set pattern to how many people are born in each season.

and there are no patterns in the numbers either.
As you can see from the bar graphs there are more boys and more girls born in the Summer in the 5th year at Wyndham School, but I don't think there is a pattern in it, I think that it is only a coincidence.
I don't think that there is a set pattern to how many people in any age group are born in each season. I think that it is only a coincidence that alot of people are born in Winter, Spring, Summer or Autumn.


5th year
A PERCENTAGE GRAPH TO SHOW THE NUMBER OF GIRLS IN WINDHAM SCHOOL BORN IN EACH SEASON


BAR GRAPHS TO SHOW THE PERCENTAGE OF GIRLS BORN IN WYNDHAM IN THE DIFFERENT SEASONS FROM YEARS 1-5
1st year
2nd year
3rd year
4th year


5th year
SPRING SUMMER AUTUMN WINTER
A PERCENTAGE GRAPH TO SHOW HOW MANY BOYS AT WYNDHAM SCHOOL WERE BORN IN EACH SEASON
SPRING SUMMER AUTUMN WINTER

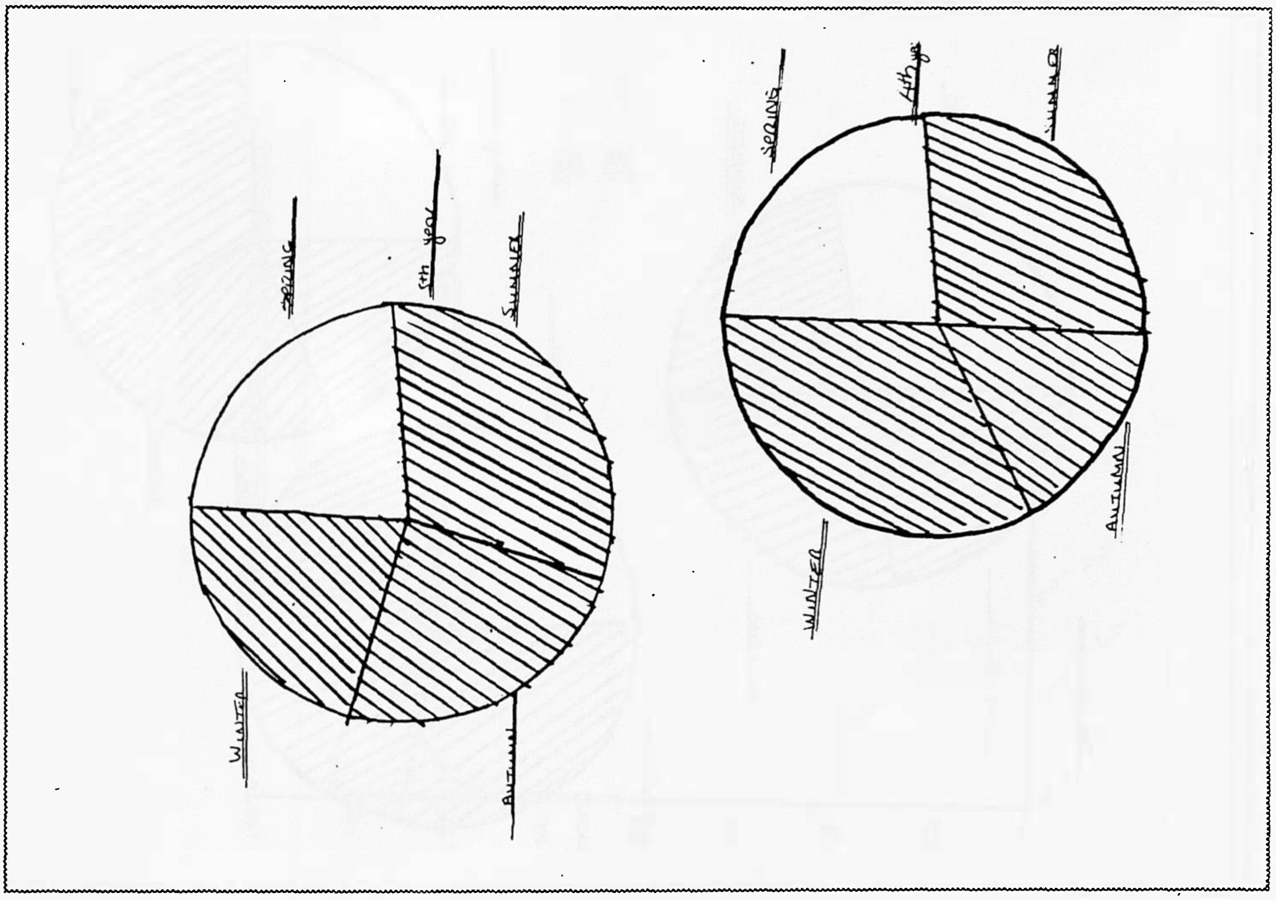

BAR GRAPHS TO SHOW THE PERCENTAGE OF BOYS BORN IN WYNDHAM FROM YEARS 1 - 5. IN DIFFERENT SEASONS
1st year
2nd year
3rd year
4th year
SPRING SUMMER AUTUMN WINTER

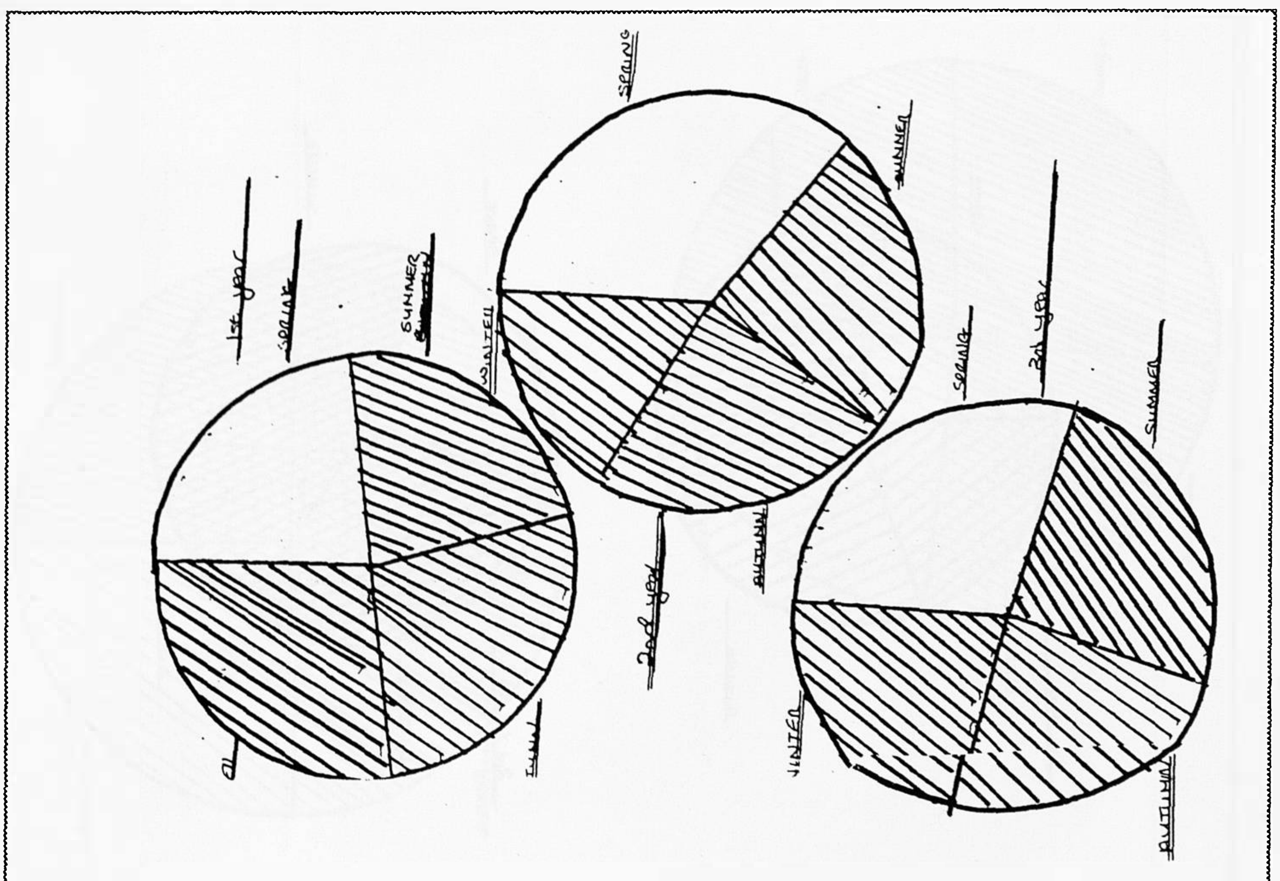
A Table To Show The Results Of How Many Girls Were Born In Each Month for People In Each Year In Wyndham School.

	Winter			Spring			Summer			Autumn		
5th	11	6	5	6	6	12	10	13	9	12	7	6
4th	12	13	11	11	11	4	12	8	10	6	5	8
3rd	9	9	8	13	6	11	14	8	4	10	8	7
2nd	3	7	9	12	11	18	15	9	4	7	8	12
1st	12	11	4	8	6	8	6	8	8	6	7	12
	December	January	February	March	April	May	June	July	August	September	October	November

A Table To Show The Results Of How Many Boys Were Born In Each Month for People In Each Year In Wyndham school.

5th	8	10	3	7	11	10	12	15	12	9	6	8
4th	6	11	8	10	8	9	9	5	9	6	10	9
3rd	9	8	5	12	8	8	8	7	8	10	7	10
2nd	8	9	7	8	9	4	6	8	7	3	4	4
1st	10	5	5	5	7	9	7	8	9	11	13	8
	December	January	February	March	April	May	June	July	August	September	October	November


SPRING
5th year
SUMMER
AUTUMN
WINTER
SPRING
4th yr
SUMMER
AUTUMN
WINTER


1st year
SPRING
SUMMER
SPRING
SUMMER
WINTER
AUTUMN
2nd year
SPRING
3rd year
SUMMER
WINTER
AUTUMN


3rd Year
SPRING
SUMMER
WINTER
AUTUMN
4th Year
SPRING
SUMMER
WINTER
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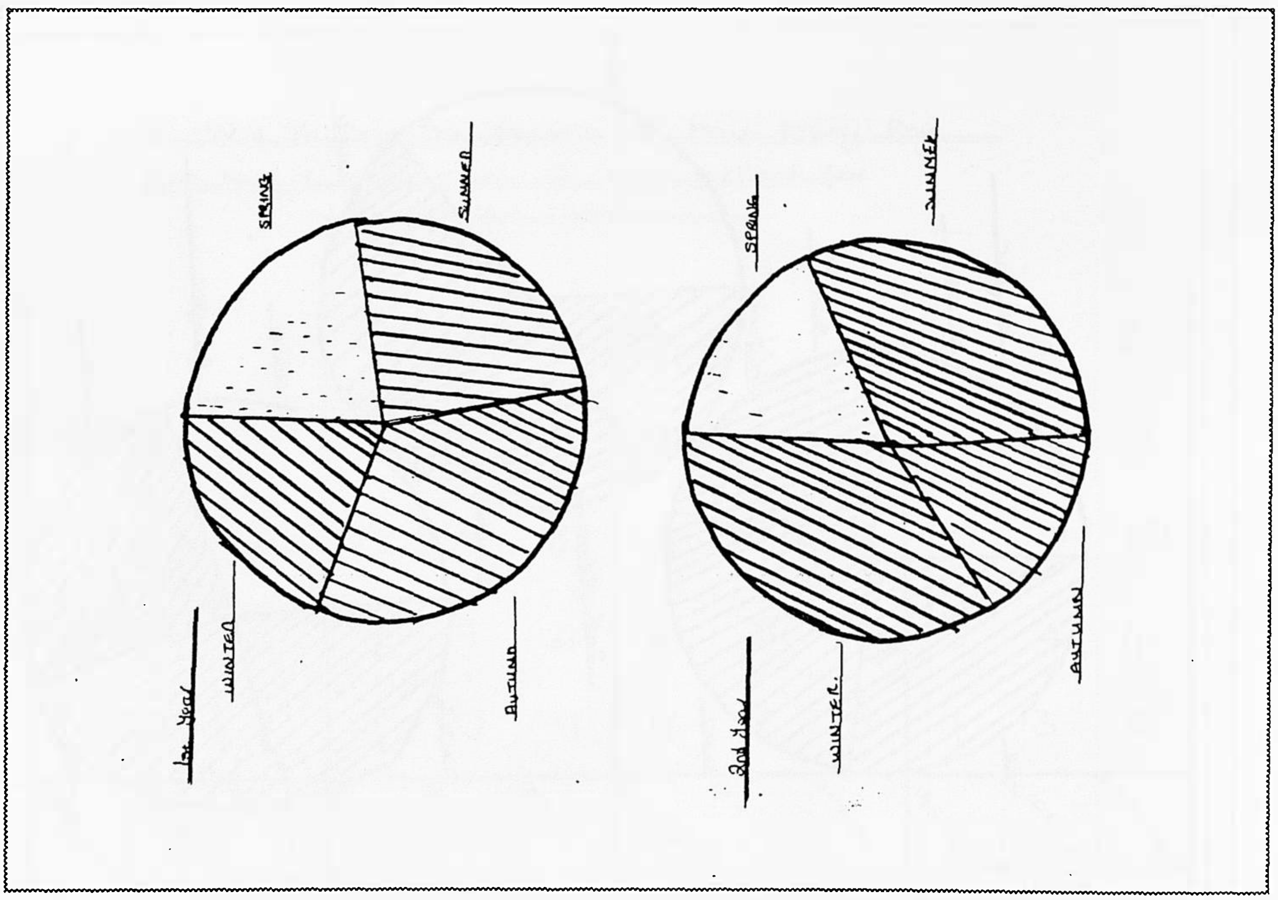
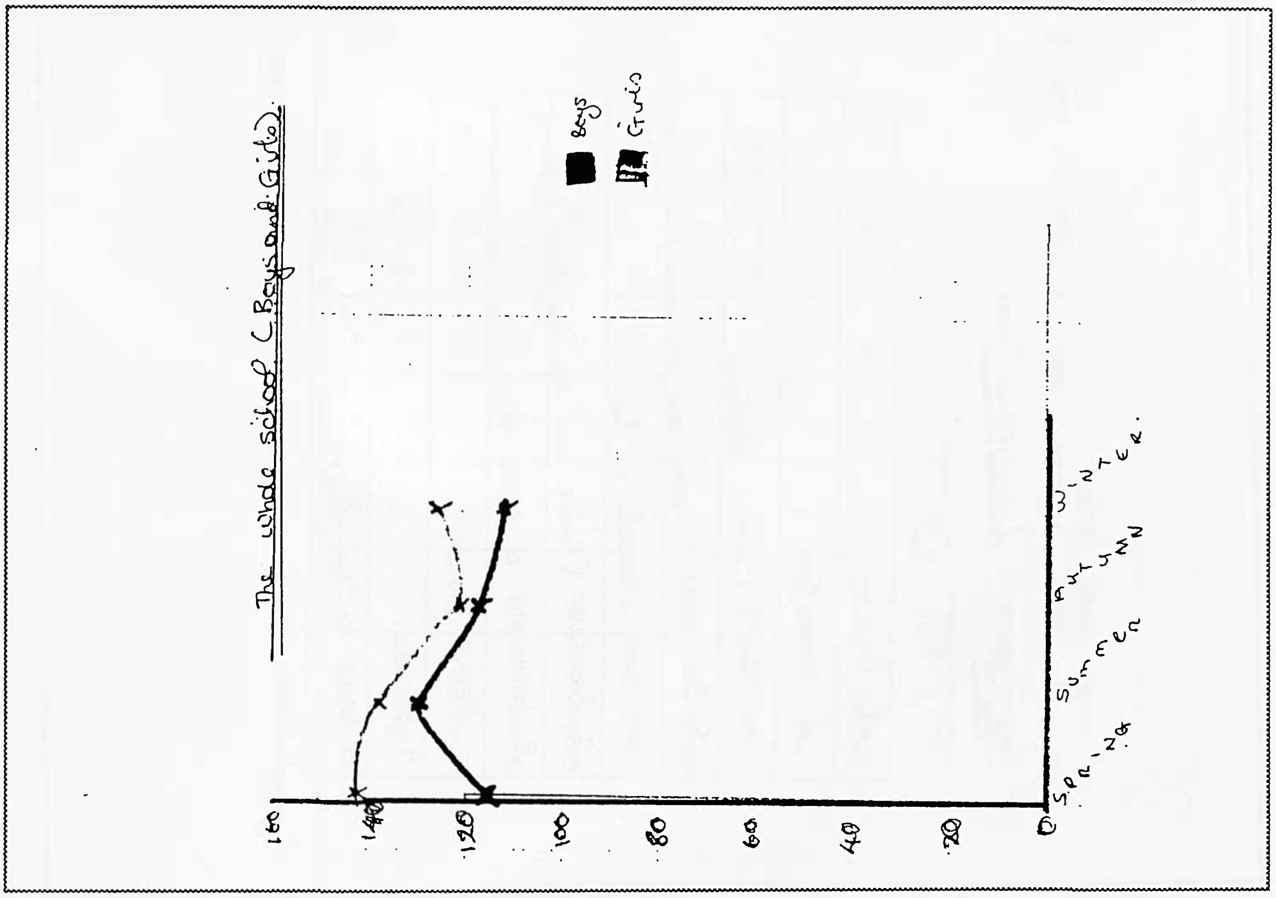
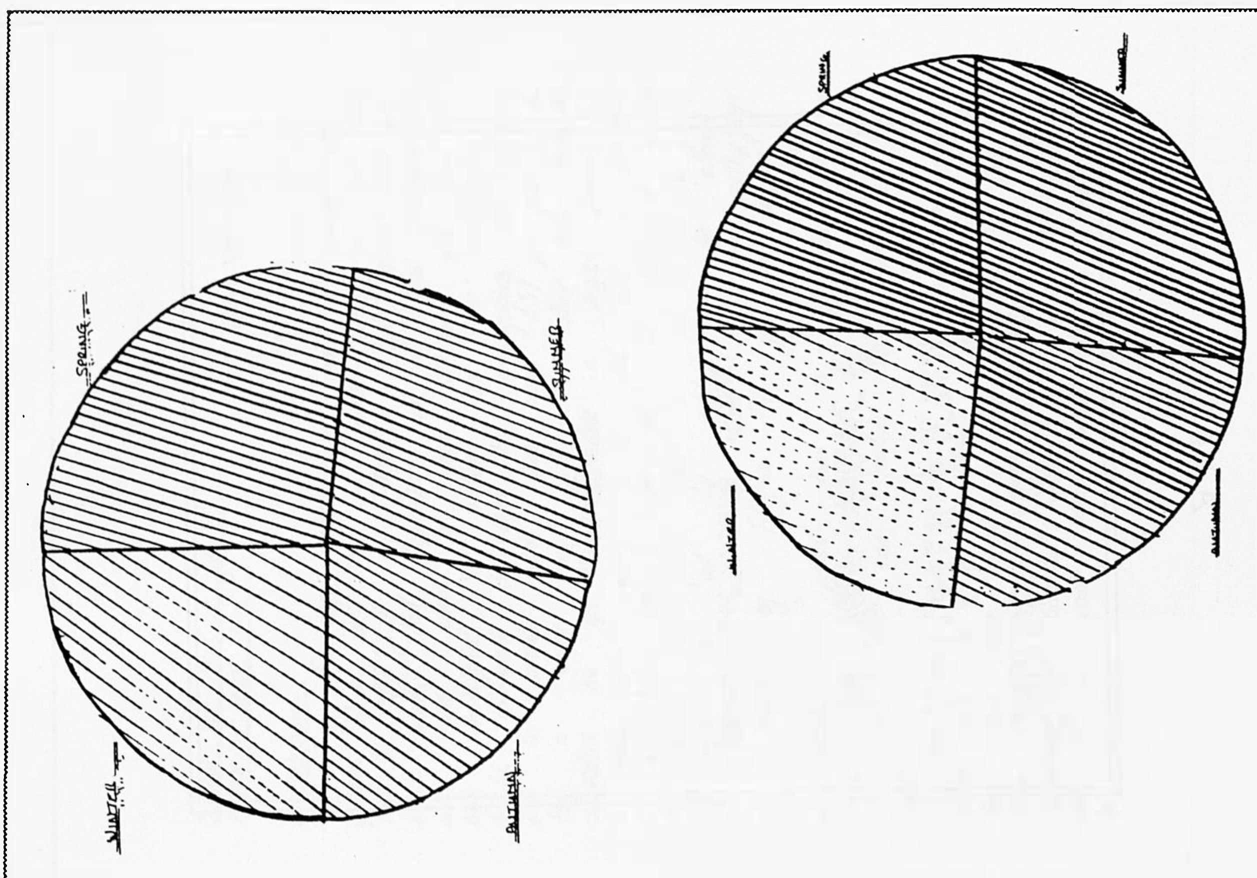
5th Year
SPRING
SUMMER
WINTER
AUTUMN


1st Year
SPRING
SUMMER
WINTER
AUTUMN
2nd Year
SPRING
SUMMER
WINTER.
AUTUMN


The whole school (Boys and Girls)
Boys
Girls
160
140
120
100
80
60
40
20
0
SPRING
SUMMER
AUTUMN
WINTER


SPRING
SUMMER
WINTER
AUTUMN
SPRING
SUMMER
WINTER
AUTUMN

A2/4

'SHOULD YOU HAVE
A WATER METER
IN YOUR HOME'?

'FOURTH YEAR MATH'S PROJECT'...

10/5/88

YES OR NO

ROOM 104, 424.

'CONTENTS':

PAGE NO:

1. TITLE PAGE.
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3. INTRODUCTION.
4. RESULTS (LAWRENCE HOUSEHOLD).
5. BAR CHART (GALLONS USED PER WEEK).
6. RESULTS (HOUSEHOLD OF TWO).
7. BAR CHART (GALLONS USED PER YEAR / THREE FAMILIES).
8. INSTALLMENT OF WATER METER
   PRESENT SYSTEM
9. CONCLUSION.
10. ANSWER TO BIG QUESTION.
11. ROUGH WORK.

SHOULD YOU HAVE A WATER METRE IN YOUR HOME ?

INTRODUCTION :

For my project we got to answer the question 'Should we have a water metre in our home'. For the start of my project I was issued with an article which had appeared in a local newspaper. This article was about a local schoolgirl who had recently investigated a problem in her mathematics G.C.S.E coursework class. From her investigations she discovered that her parents would save about £57 per year if they had a water meter fitted. In their house. From this information we got to produce a project showing if a water meter would be a good idea in our home or a bad idea. To do this we got to workout the amount of gallons used in our home a year. I'll work this out by adding up the amount of gallons a week we used, then by multiplying the answer by fiftytwo I'll get the answer.

With my results I'll present them in a table showing each USE and its results. And to make my presentation a little more creative I'll produce a BAR CHART.

From my own results I'll compare my families water use to our next-door neighbours water use who have two more people in their household. And then from these results I'll compare them to my Grandma and Grandad's water use and then try and find out if a water meter would be a good idea or not.

RESULTS

(APPROX.)

USE ...	FAMILY USE A WEEK ...				A WEEKS TOTAL	TOTAL GALLONS.
	M	D	P	N		
BATH	7	3	3	3	16 × 20	= 320
SHOWER	7	0	7	0	14 × 6	= 84
OUTDOOR TAP	0	1	0	0	1 × 5	= 5
WASHING MACH.	6	0	0	0	6 × 22	= 132
WASHING SINK	14	14	14	14	56 × 9	= 504
WASHING UP	6	3	1	1	11 × 9	= 99
TOILET	21	21	21	21	84 × 2	= 168
TAP	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	1	= 1
COOKING.	7	0	0	0	7 × 9	= 63

TOTAL A WEEK : 1376 gallons.

TOTAL A YEAR : 52 × 1376 = 71552 gallons.

From my survey in our house I came up with these results, shown ABOVE.

'RESULTS' (APPROX).

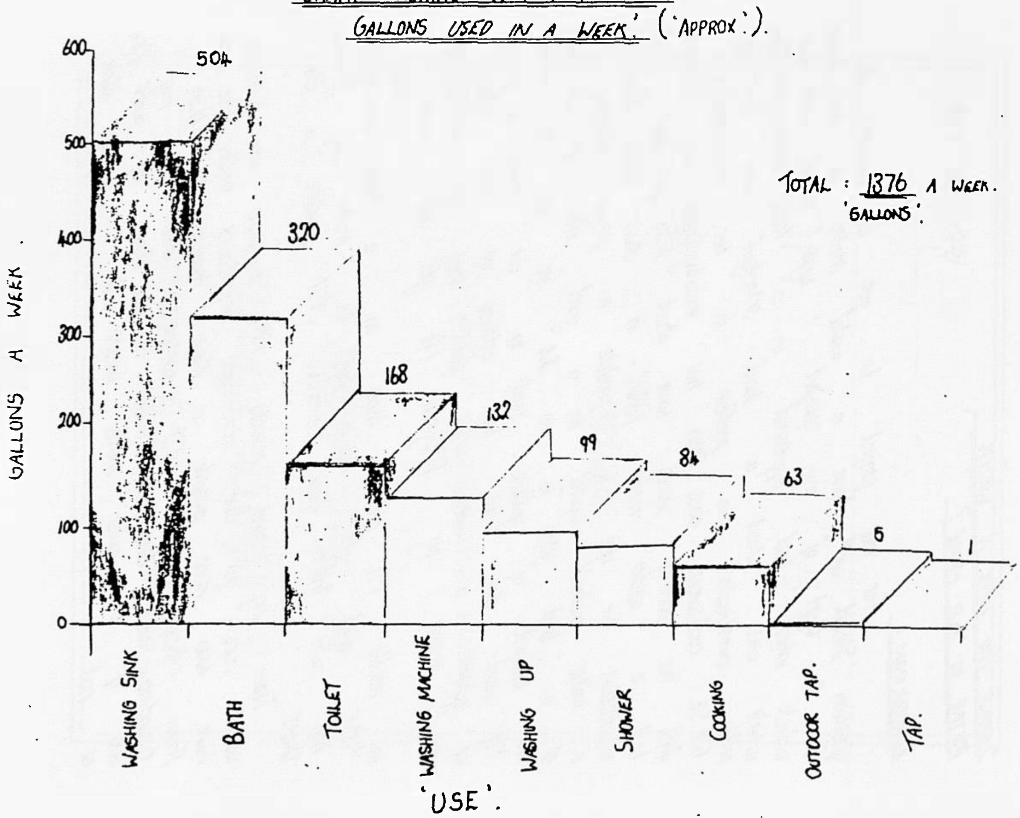
USE ...	A WEEKS TOTAL	TOTAL GALLONS.
BATH	8 × 20	160
SHOWER	7 × 6	42
OUTDOOR TAP	1 × 3	3
WASHING MACH'.	3 × 22	66
WASHING SINK.	28 × 9	252
WASHING UP.	7 × 7	49
TOILET	42 × 2	84
TAP	1 × 1	1
COOKING.	3 × 11	31

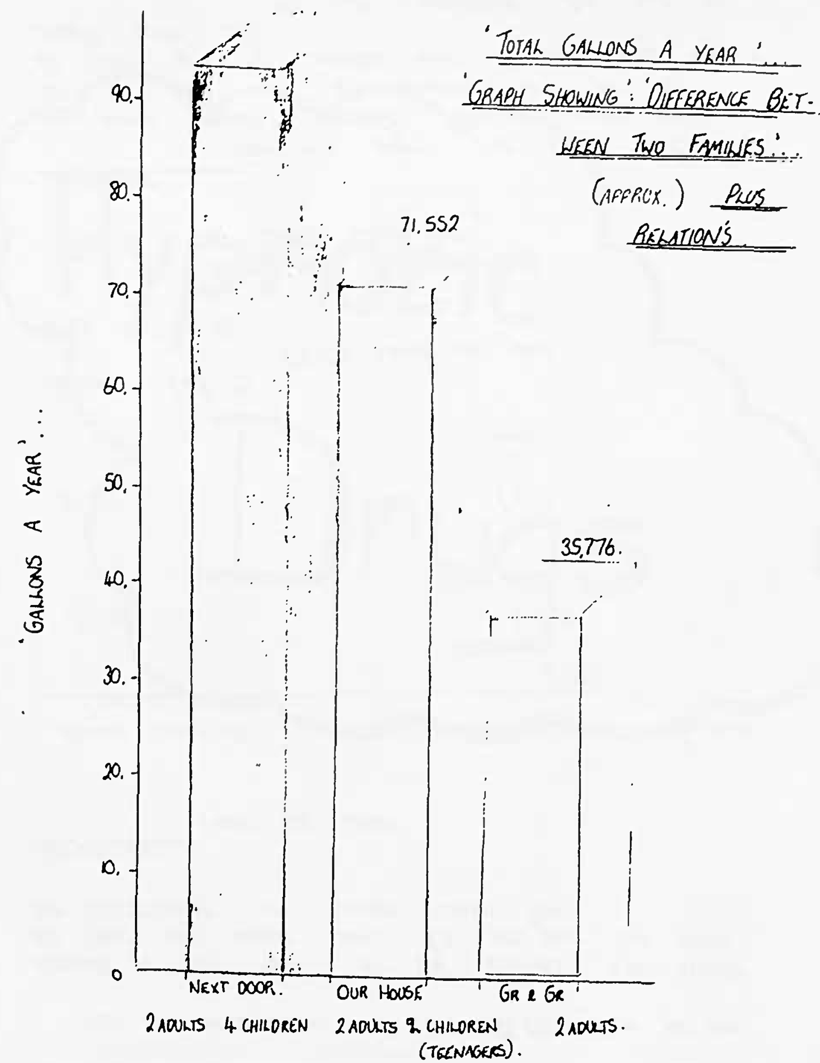
TOTAL A WEEK : 688 gallons

TOTAL A YEAR : 52 × 688 = 35,776 gallons.

RESULTS from a household of two are shown ABOVE

'GRAPH SHOWING HOW MANY GALLONS USED IN A WEEK.' ('APPROX.').





'TOTAL GALLONS USED IN THREE HOUSEHOLDS'

FAMILY OF SIX : 98,384 GALLONS. 'WOULDN'T.'

FAMILY OF FOUR : 71,552 . 'WOULDN'T'

FAMILY OF TWO : 35,776. . 'BENEFIT'

JUST BY LOOKING AT THE RESULTS ABOVE YOU CAN SEE THAT A FAMILY OF TWO WOULD BENEFIT, BUT ANY MORE THAN THREE WOULDN'T.

'COST OF WATER' IF INSTALLED'. To know if a water meter would be a good idea in our homes, especially my families house I've got to work out how much it would cost us a year with a water meter and compare it to how much we already pay.

'WATER RATES':

'PRESENT SYSTEM'

OUR RATEABLE VALUE IS £246

THE WATER SUPPLY CHARGE FOR THE YEAR IS 19.9 % OF THE RATEABLE VALUE.

THEREFORE 19.9 % OF £246

19.9 % × £246

THEREFORE WE PAY :

= £48.95

£48.95 A YEAR WATER RATES.

PLUS SEWERAGE.

'APPROXIMATE WATER USE IN MY HOME PER WEEK'.

	'GALLONS'
AVERAGE COOKING, DRINKING WASHING UP ETC... HYGIENE.	9 PER PERSON PER DAY.
TOILET FLUSHING STANDARD FLUSH	2 PER PERSON
BATH	20 PER BATH
SHOWER	6 PER SHOWER
WASHING MACHINE (AUTOMATIC FRONT LOADER).	22 PER WASH CYCLE.
USE OF HOSEPIPE / LAWN SPRINKLER	2 PER MINUTE.

ON THE WHOLE MY FAMILY IS A HIGH USER OF WATER AFTER ADDING IT ALL UP.

'WE WOULD NOT BENEFIT FROM A WATER METER'.

ANSWER FROM ORRIGINAL QUESTION:

NO

'INSTALLMENT OF WATER METER':

FROM MY INVESTIGATIONS WE USE 72,000 gallons per year.

LOOKING AT THE TABLE IN THE BOOKLET, I'VE WORKED OUT THAT WE WOULD GAIN £4 per year, BUT AFTER THE INSTALLMENT WE WOULD LOOSE OUT.

'WORKING OUT':

FROM THE CHART:

ANNUAL WATER USE (GALLONS)	'RATEABLE' VALUE'.
	£250 ROUNDED UP
36,000	£2.00
72,000	£400 GAINED

×2

PRESENT : £48.95

AFTER : £44.95

£4.00 GAINED per year.

AFTER PRICE OF INSTALLMENT WE WOULD LOOSE OUT.

'CONCLUSION':

From this project I've worked out that my family wouldn't benefit from a water meter beca use of the cost of installment etc... but for the case of my Grandma and Grandad they wou-ld benefit quite alot.

You can understand this just by looking at my results. So from this project you can see that families with occupents of two will benef more than families with occupents of four or more.

A2/5

Hypnotic Drugs

INTRODUCTION

A doctor prescribed a drug called Triazolam (Halcion).

After taking some pills the drug eventually reaches a level of 4 μg/l in the blood formula.

Drug name (and Brand name):	Approx. formula
Triazolam (Halcion)	$y = A \times (0{\cdot}84)^x$
Nitrazepam (Mogadon)	$y = A \times (0{\cdot}97)^x$
Pentobombitone (Sonitan)	$y = A \times (1{\cdot}15)^x$
Methohexitone (Brietal)	$y = A \times (0{\cdot}5)^x$

KEY
A = size of the initial dose in blood
y = amount of drug in the blood
x = time in hours after the drug reaches the blood.

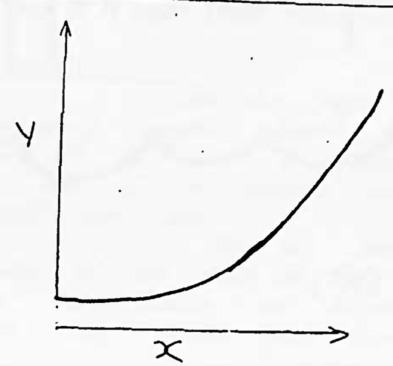
In all the tests done using the drug, the initial dose will be 4μg/l whatever drug is used.

Tables will be drawn to show how the drug wears off during the first ten hours.

PENTOBOMBITONE (SONITAN)

$y = 4 \times (1\cdot15)^x$

Time (hours) x	Amount of drug left in the blood y
0	4
1	4·6 (= 4 × 1·15)
2	5·29 (= 4 × (1·15)²)
3	6·08 (= 4 × (1·15)³)
4	7·01 (= 4 × (1·15)⁴)
5	8·05 (= 4 × (1·15)⁵)
6	9·25 (= 4 × (1·15)⁶)
7	10·64 (= 4 × (1·15)⁷)
8	12·24 (= 4 × (1·15)⁸)
9	14·07 (= 4 × (1·15)⁹)
10	16·18 (= 4 × (1·15)¹⁰)

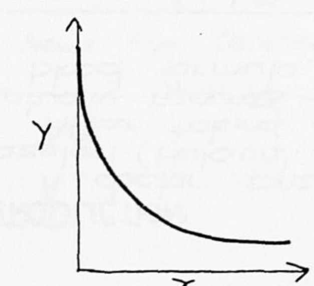


You can tell the shape of the graph without plotting it as the difference becomes larger each time.

METHOHEXITONE (BRIETAL)

$y = 4 \times (0\cdot5)^x$

Time (hours) x	Amount of drug left in the blood y
0	4
1	2·0 (= 4 × 0·5)
2	1·0 (= 4 × (0·5)²)
3	0·5 (= 4 × (0·5)³)
4	0·25 (= 4 × (0·5)⁴)
5	0·125 (= 4 × (0·5)⁵)
6	0·06 (= 4 × (0·5)⁶)
7	0·03 (= 4 × (0·5)⁷)
8	0·02 (= 4 × (0·5)⁸)
9	0·008 (= 4 × (0·5)⁹)
10	0·004 (= 4 × (0·5)¹⁰)



You can tell the shape of the graph without plotting. It as the difference in y becomes smaller each time.

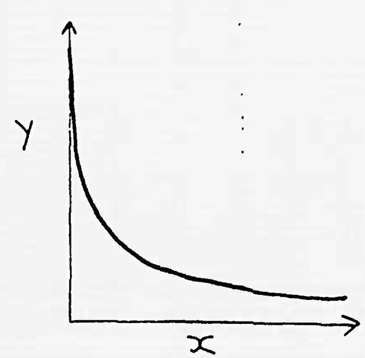
Good point

The drug which is not real is Pentobombitione as the amount of drug in the blood plasma increase the longer after it has been taken. If you took this drug it would multiply so much that it most likely kill

Triazolam (Halcion)

$y = 4 \times (0.84)^x$

Time (hours) x	Amount of drug left in the blood y
0	4
1	3.36 $(= 4 \times 0.84)$
2	2.82 $(= 4 \times (0.84)^2)$
3	2.37 $(= 4 \times (0.84)^3)$
4	1.99 $(= 4 \times (0.84)^4)$
5	1.67 $(= 4 \times (0.84)^5)$
6	1.41 $(= 4 \times (0.84)^6)$
7	1.18 $(= 4 \times (0.84)^7)$
8	0.99 $(= 4 \times (0.84)^8)$
9	0.83 $(= 4 \times (0.84)^9)$
10	0.71 $(= 4 \times (0.84)^{10})$

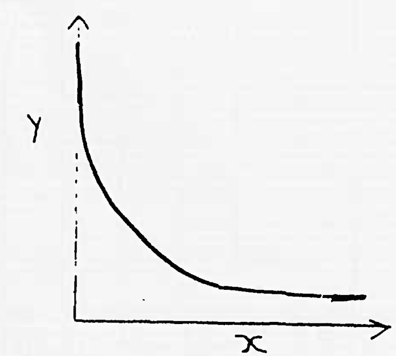


You can tell the shape of the graph without plotting it as at firt the differences are constant and then they become smaller.

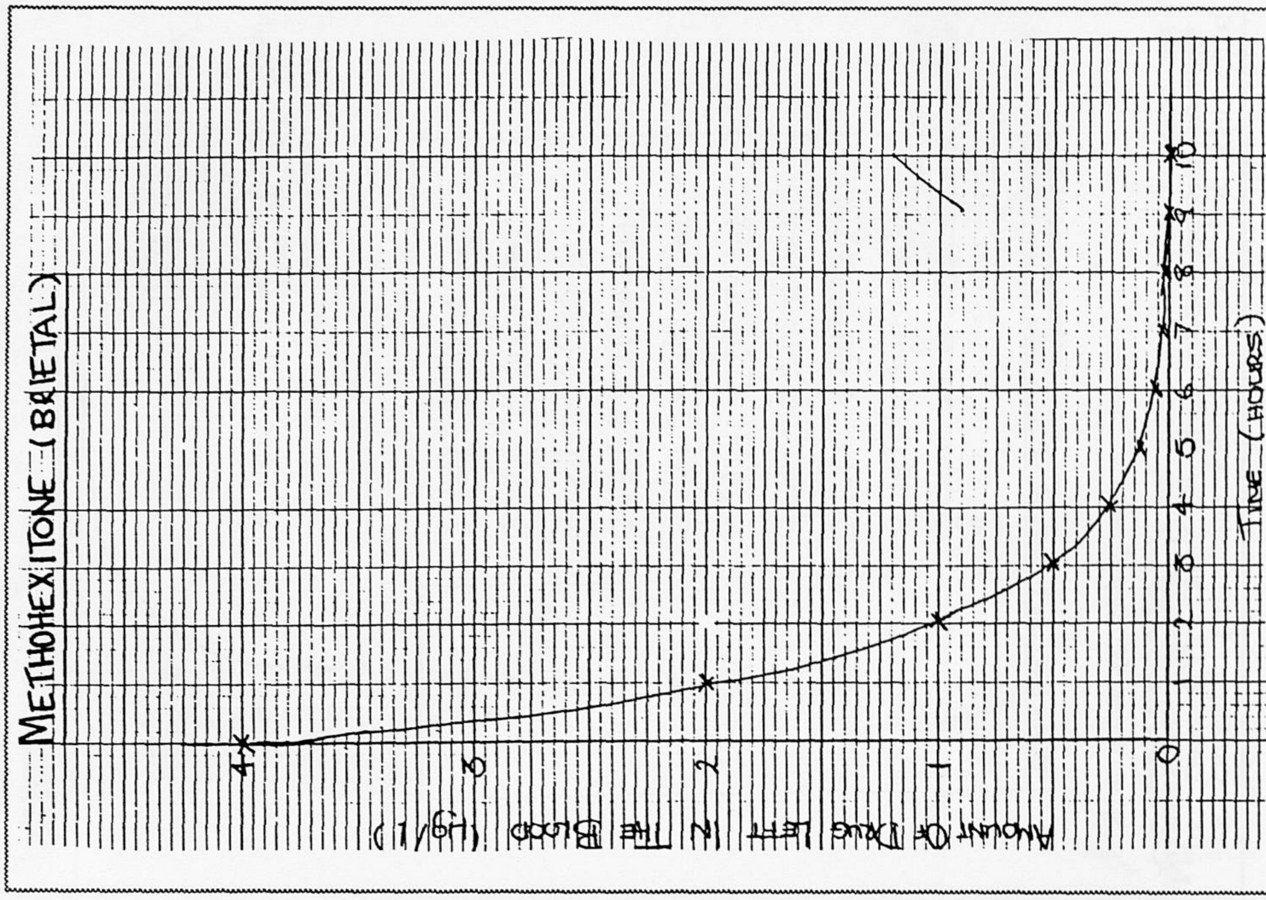
Nitrazepam (Mogadon)

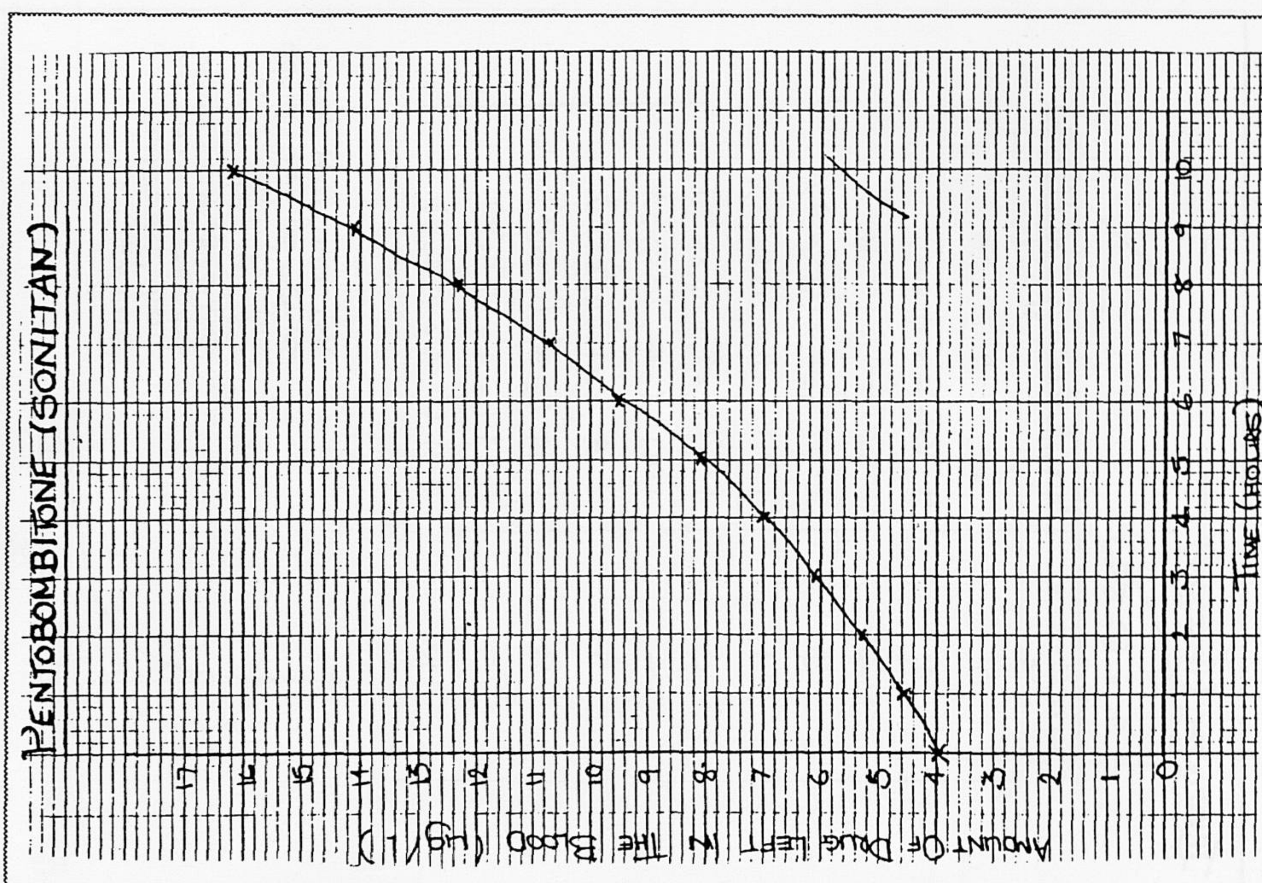
$y = 4 \times (0.97)^x$

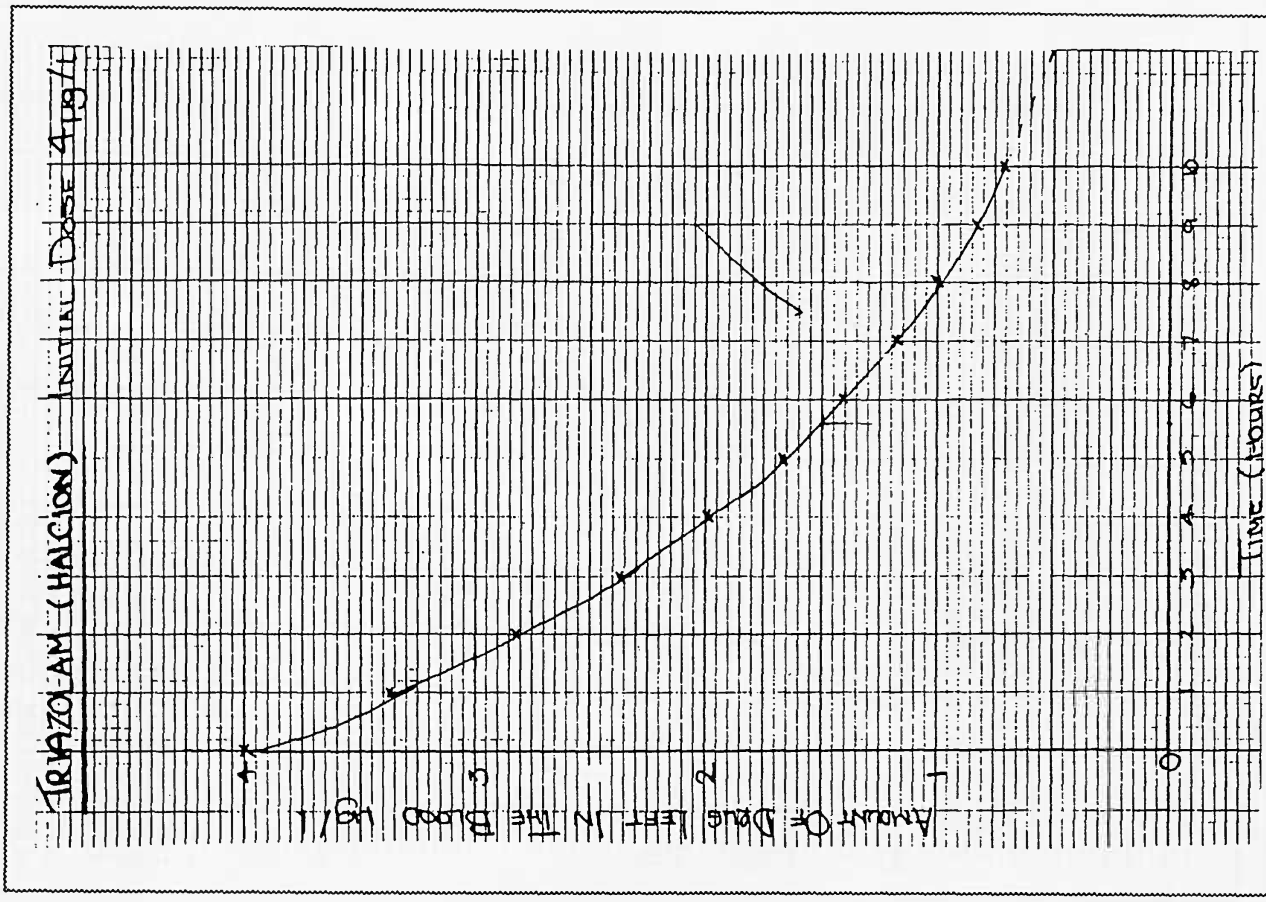
Time (hours) x	Amount of drug left in the blood y
0	4
1	3.88 $(= 4 \times 0.97)$
2	3.76 $(= 4 \times (0.97)^2)$
3	3.65 $(= 4 \times (0.97)^3)$
4	3.54 $(= 4 \times (0.97)^4)$
5	3.43 $(= 4 \times (0.97)^5)$
6	3.33 $(= 4 \times (0.97)^6)$
7	3.23 $(= 4 \times (0.97)^7)$
8	3.13 $(= 4 \times (0.97)^8)$
9	3.04 $(= 4 \times (0.97)^9)$
10	2.95 $(= 4 \times (0.97)^{10})$

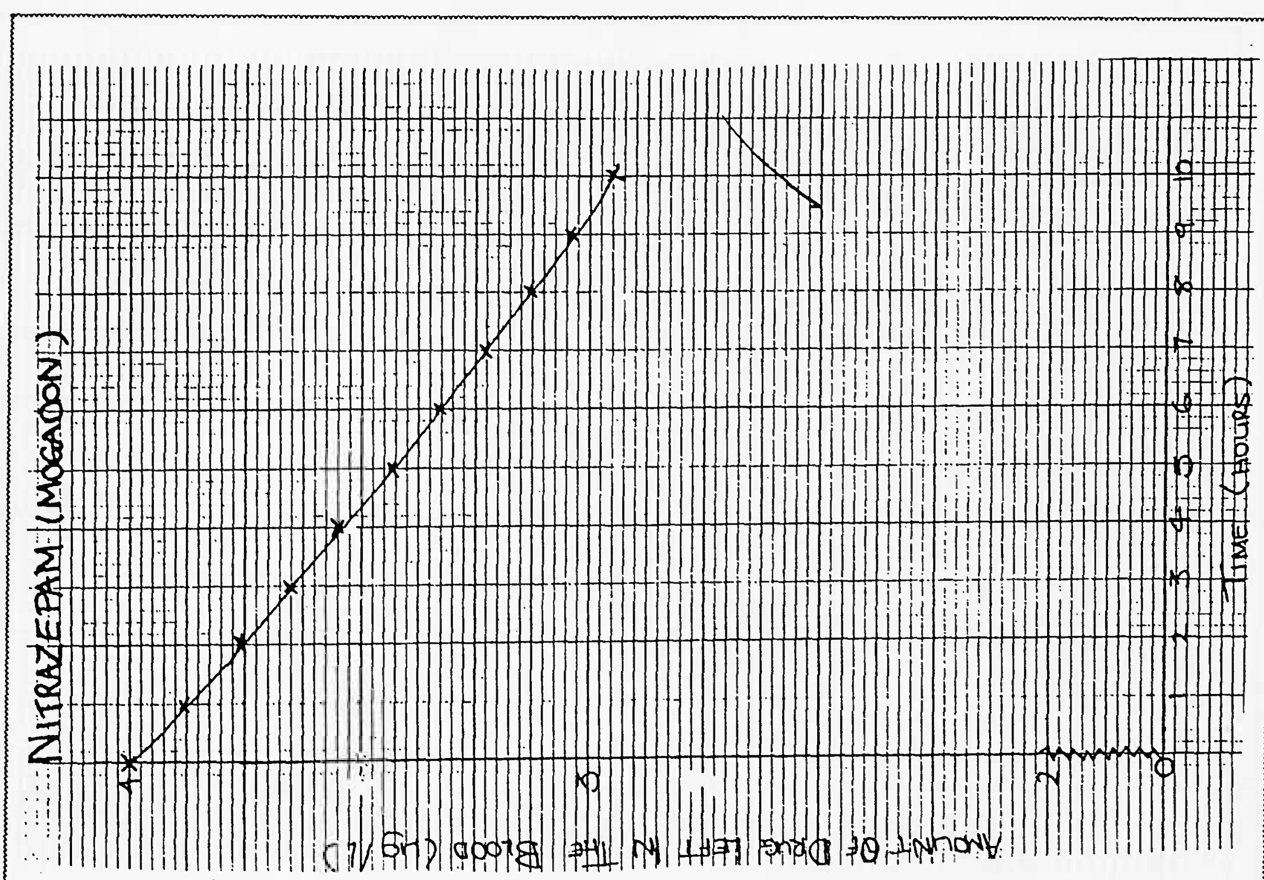


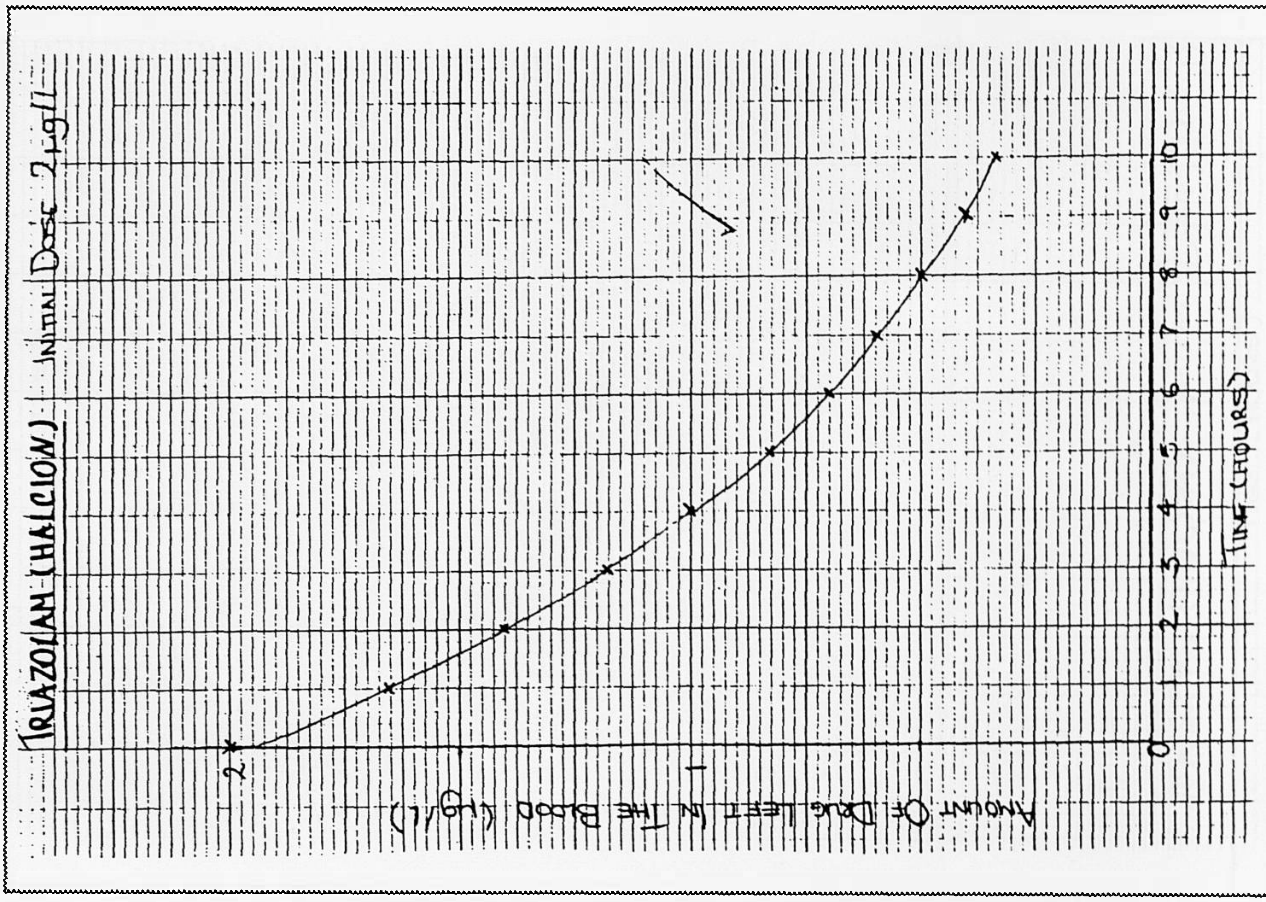
You can tell the shape of the graph without plotting it for the same reason as in the last graph.

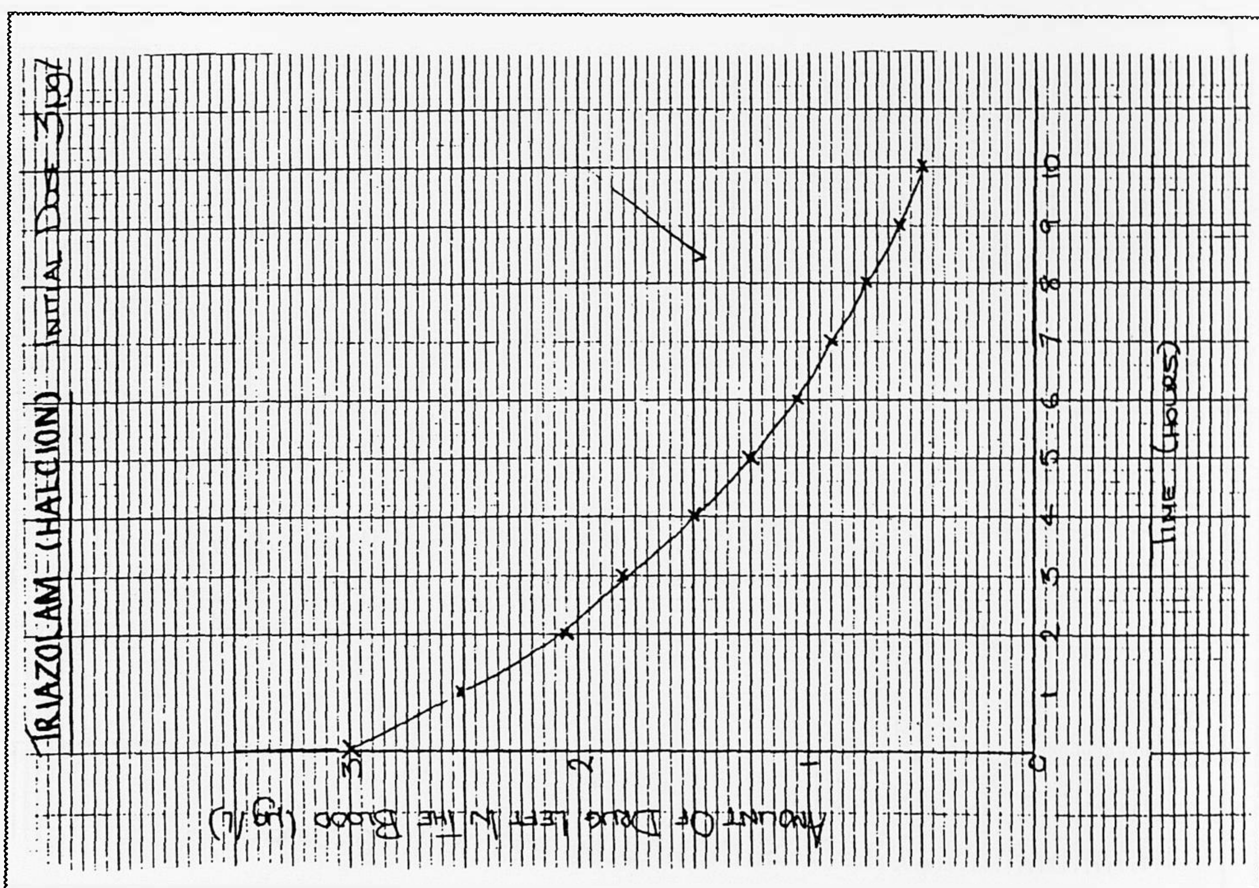

METHOHEXITONE (BRIETAL)
TIME (HOURS)
AMOUNT OF DRUG LEFT IN THE BLOOD (Mg/l)


PENTOBOMBITONE (SONITAN)
TIME (HOURS)
AMOUNT OF DRUG LEFT IN THE BLOOD (Mg/l)


TRIAZOLAM (HALCION)
INITIAL DOSE 4μg/l
TIME (HOURS)
AMOUNT OF DRUG LEFT IN THE BLOOD μg/l


NITRAZEPAM (MOGADON)
TIME (HOURS)
AMOUNT OF DRUG LEFT IN THE BLOOD (μg/l)


TRIAZOLAM (HALCION) INITIAL DOSE 2µg/l
AMOUNT OF DRUG LEFT IN THE BLOOD (µg/l)
TIME (HOURS)
0 1 2 3 4 5 6 7 8 9 10
2
1


TRIAZOLAM (HALCION) INITIAL DOSE 3µg/l
AMOUNT OF DRUG LEFT IN THE BLOOD (µg/l)
TIME (HOURS)
0 1 2 3 4 5 6 7 8 9 10
3
2
1

TRIAZOLAM (HALCION)

The next task was (using the drug Triazolam) to see how much time it took for the amount of drug in the blood to be halved.

When the initial dose was 4 μg the time taken for it to half was 4 hours.

Here is a table showing this idea with different initial doses.

INITAL DOSE (μg/L)	4	3	2	1
TIME TAKE FOR DOSE TO HALVE (hours)	4	4	4	4

Whatever the initial dose of Triazolam, the time taken for the amount of drug left in the bloodstream to halve was 4 hours. This is because the larger the initial dose the more quickly it leaves the bloodstream so that the ~~lower~~ less the more slowly it leaves the blood stream.

PROOF

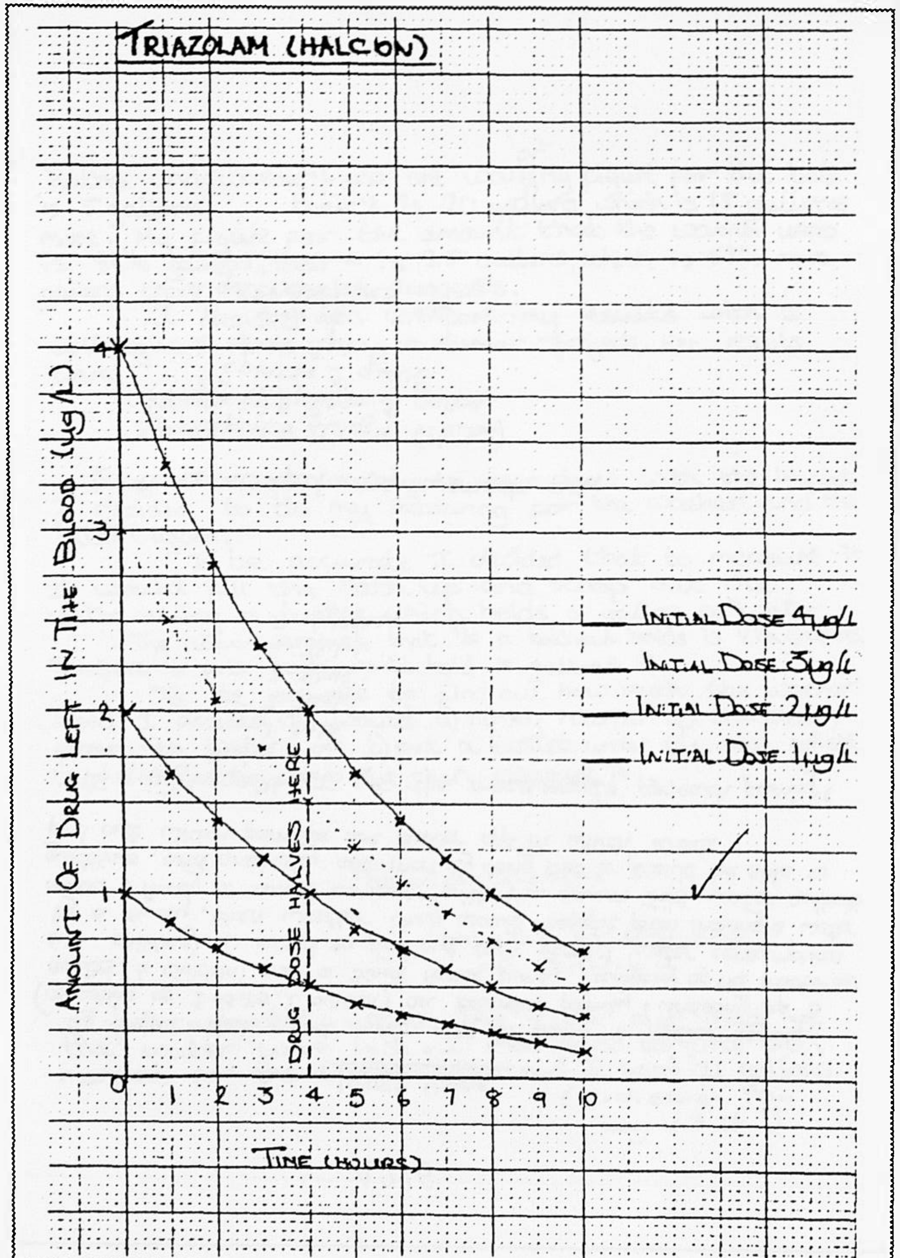
Formula $y = A \times (0.84)^x$

x = time taken (hours)
A = size of initial dose
So when the formula is supposed to have halved in four hours the formula is:

$y = A \times (0.84)^4$

$0.84^4 = 0.5.$

This shows that whenever the time is four hours A is multiplied by 0.5 or in otherwords halved.



A2/6

WATER USAGE

The project that I set myself was to study a Nuclear family (consisting of 2 adults, 2 children) an Extended family (consisting of 3 adults, 4 children) and a Single Parent family (consisting of the mother and two children). I intend to find out each family's water consumption by a survey, then whether they would benefit from having a water meter. firstly I would compare with the Severn Trent water authority guidelines, and gradually add more. By doing this I would be able to find out which families are better off in which areas.

To begin with I got the measurements for each family's house of the:

1. bath
2. Basin
3. Sink
4. Toilet
5. Washer

Some useful measurements are:-.

1 pint = 20 oz's (1¼ lbs)
(4 quarts) 8 pints = 1 gallon.
2 pints = 1 quart.
4 gills = 1 pt.
1" = 2.54 cm.
1 gallon = 4 litres.

THE POLLARD FAMILY. (EXTENDED)

Their house is situated in New Westwood. It is a terraced house which has three bedrooms and a bathroom, sitting room and a lounge and a kitchen. There is an outbuilding in which another toilet is located.

In this family there is a mother, father and 5 children. Except one boy, the rest of the children are girls. The father works as a draughtsman and is out of the house from 8am until 5.30pm. The mother is always in the house, except when doing the usual household chores. The is usually always two children to be found in the house at any onetime. They come and go as they please.

I asked the family to keep a record of the times they used any water which they would be charged for (see p.

The measurements for the bath, washbasin, sink, washer and toilet were quite difficult to get in someone else's house, especially the toilet. I got all the measurements in inches so before I could work out how much water they held I had to convert them into centimetres. All the measurement except, the washer, were based on the theory that:-

Excellent

$$\text{length} \times \text{Width} \times \text{Height} = V \text{ (in cm}^3\text{)}$$

To measure the washer, I based it on the theory that:-

$$\frac{4}{3}\pi r^3 = \text{Volume (of sphere)}$$

The results I got were:-

Bath	holds	5	gallons
Washbasin	"	9½	"
Sink	"	6½	"
Washer	holds	84¼	gallons
Toilet	"	1	"

I compared these results with an official leaflet supplied by the Severn Trent water authority. They claimed that

baths	use about	20	gallons
Toilets	"	2	"
Washers	"	25	"

As you may notice my theory on how much

Measurements for The Pollard family.

N.B
1 inch = 2·54 cm
1 litre = 1000 cm³
1 gallon = 4 litres.

The Bath.

length - 58"
Width - 16"
Height - 13"

Inches Into Centimetres
58x2·54 = 147·32 cm
16x2·54 = 40·64 cm
13x2·54 = 33·02 cm

Volume in Cubic Centimetres
147·32 x 40·64 x 33·02 = 19769...

Volume In litres
$\frac{19769.5}{1000}$ = 19·77 (20 ltr)

AMOUNT BATH HOLDS IN GALLONS = $\frac{20}{4}$ = 5 gallons.

The Washbasin.

length - 20"
Width - 9"
Height - 13"

Inches Into Centimetres
20x2·54 = 50.
9x2·54 = 22·86
13x2·54 = 33·02.

Volume into cubic centimetres
50 x 22·86 x 33·02 = 37741·

Volume In litres
$\frac{37741.86}{1000}$ = 37·72 (38 ltr)

AMOUNT BASIN HOLDS IN GALLONS
38 ÷ 4 = 9½ gallons

The Sink

length 13"
Width - 11"
Height - 11"

Inches In Centimetres
13x2·54 = 33·02
11x2·54 = 27·94
" " " " " " " "

Volume In Cubic centimetres
33·02 x 27·94 x 27·94 = 25776·85.

Volume In Litres
$\frac{25776.85}{1000}$ = 25·7 (26 ltr)

AMOUNT SINK HOLDS IN GALLONS
$\frac{26}{4}$ = 6½ gallons

The Washer

length, Width, Height } 17"

Inches Into Cms
17x2·54 = 43·18

Volume In Cubic Cms.
$\frac{4 \times 3.14 \times 43.18 \times 43.18 \times 43.18}{3} = \frac{1011201.1}{3}$
= 337067 cm³

Volume In Litres
$\frac{337067}{1000}$ = 337

AMOUNT WASHER HOLDS IN GALLONS
$\frac{337}{4}$ = 84¼ gallons

baths and washer's use are way out. My figure for the bath is 5 gallons, their's is 20 gallons which is 15 gallons more. My figure for the amount that the washer uses is 84¼ gallons, their's is 25 gallons, which is 59¼ more gallons than the leaflet suggests.

I decided to compare my results with a colleague who is doing a similar project. Her results were:

Washer - 23 gallons
Bath - 16 "

These were approximately in accordance with the leaflet. I decided to do my measuring for the washer and the bath again.

To be accurate I decided that to measure it I would fill the bath up and scoop out the water using a bucket which holds a gallon of water.

The actual amount that ½ a bathful holds is 9½ gallons Therefore a full bath would hold 19 gallons.

To be accurate to find out how much the washer used I decided I would. a) survey how far up the drum fills with water or b) put a bucket under the pipe where the dirty water comes out, then measure it..

Excellent analysis here

Good idea to crosscheck and re-check,

I put a bucket under the pipe, but most of the water was lost. I managed to find the manual for the washer. It said it used 21 gallons.

(much easier this way isn't it ?)

Toilet.

Bottom length = 18".
Height = 6"
Width = 3"

Inches Into Cms
18×2·54 = 45·72
6×2·54 = 15·24
3×2·54 = 7·62

Volume Into Cubic cms
7·62×45·72×15·24 = 4309·4

Volume In litres
$\frac{4309 \cdot 4}{1000} = 4 \cdot 3$ (1 d.p.)

AMOUNT TOILET HOLDS IN GALLONS
$\frac{4}{4} = 1$ gallon

CHART TO SHOW HOW OFTEN

BATH, TOILET, WASHER, SINK + BASIN USED.

USE OF WATER.	1st Day ( )	2nd Day ( )	3rd Day ( )	4th Day ( )	5th Day ( )	6th Day ( )
Nº OF. BATHS	2	5	0	2	4	2
2. Visit to TOILET	23	31	21	33	15	27
3. Times the WASHER used	0	2	0	4	6	0
4. times SINK used.	16	14	14	7	5	11
5. Times W.BASIN used.	8	11	3	6	11	8

ANY OTHER USAGES AND APPROX: AMOUNT. hosepipe → 1½ gals.

Here are the actual amounts that each item uses. These results have been compared. Some are facts and some are based upon theory.

The Bath – originally thought to hold 5 gallons has infact been proved to hold 19 gallons when full.
The washbasin – based on theory it holds 9½ gallons.
The Sink – based on theory, it holds 6½ gallons.
The Toilet – " " " " 1 "
The Washer – originally thought to hold 84¼ gallons, has infact been proved to hold 21 gallons.

If we study the piechart on page , you can see that the toilet is the most used item that contains water. The total Nº of times the toilet was used was 182 times in a week. The bath was used 16 times In a week.
" washer " " 23 " " " "
" sink " " 70 " " " "
The washbasin was used 58 times in a week.

In one week the bath used up 304 gallons of water:–
16×19 = 304

The washer used 483 gallons of water:–
23×21 = 483

The Sink used 455 gallons of water in one week:–
70×6·5 = 455.

The washbasin used 551. gallons of water in one week
58×9·5 = 551

The toilet used up 182 gallons of water.

From this we can see that although the toilet was the most used, it was actually the basin which used the most water.

In one year, not considering the factors which could alter this:-

The sink would use:-
455 × 52 = 23660

The basin would use
551 × 52 = 28652.

The toilet would use
182 × 52 = 9464.

The washer would use

483 × 52 = 25116.

The bath would use

304 × 52 = 15808.

So in one year the total amount of water consumed by the Pollard family would be

gallons
23660
28652
9464
25116
15808 +
74700

74,700 gallons

This may be altered by the winter months as more water is often needed. If there is a drought it may also change. If the people go on holiday this may also change the amount used. ~~How would you take account of this?~~ ~~Is it significant? (How many bath fulls~~

The rateable value of the Pollards house is £63. Looking at the Severn Trent Water authority's leaflet, they would gain nothing by having a water meter installed. This applies in most areas, such as the North West Water authorities area.

CONSIDERING THE FACTORS

The family often go to London, as this is where they originat from. They spend at least two months every year there. This means that the total amount would be

(8×304) + (8×483) + (8×455) + (8×551) + (8×182) = 15,800

74,700 − 15,800 = 58,900 gallons

During the winter months if we add on an extra 1000 gallons for each adult and 500 gallons for each child, the total would be
74,700 + 4,000 = 78,700.

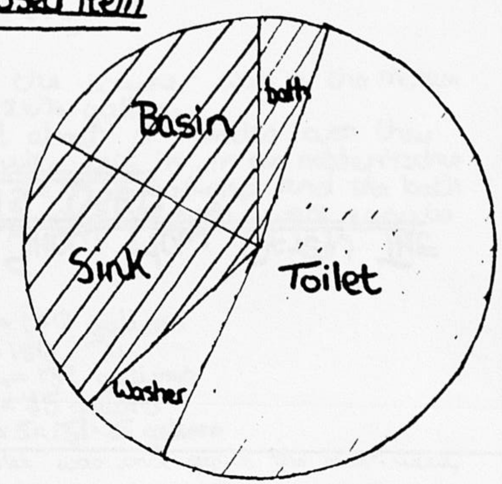
If we put all these toghether:-

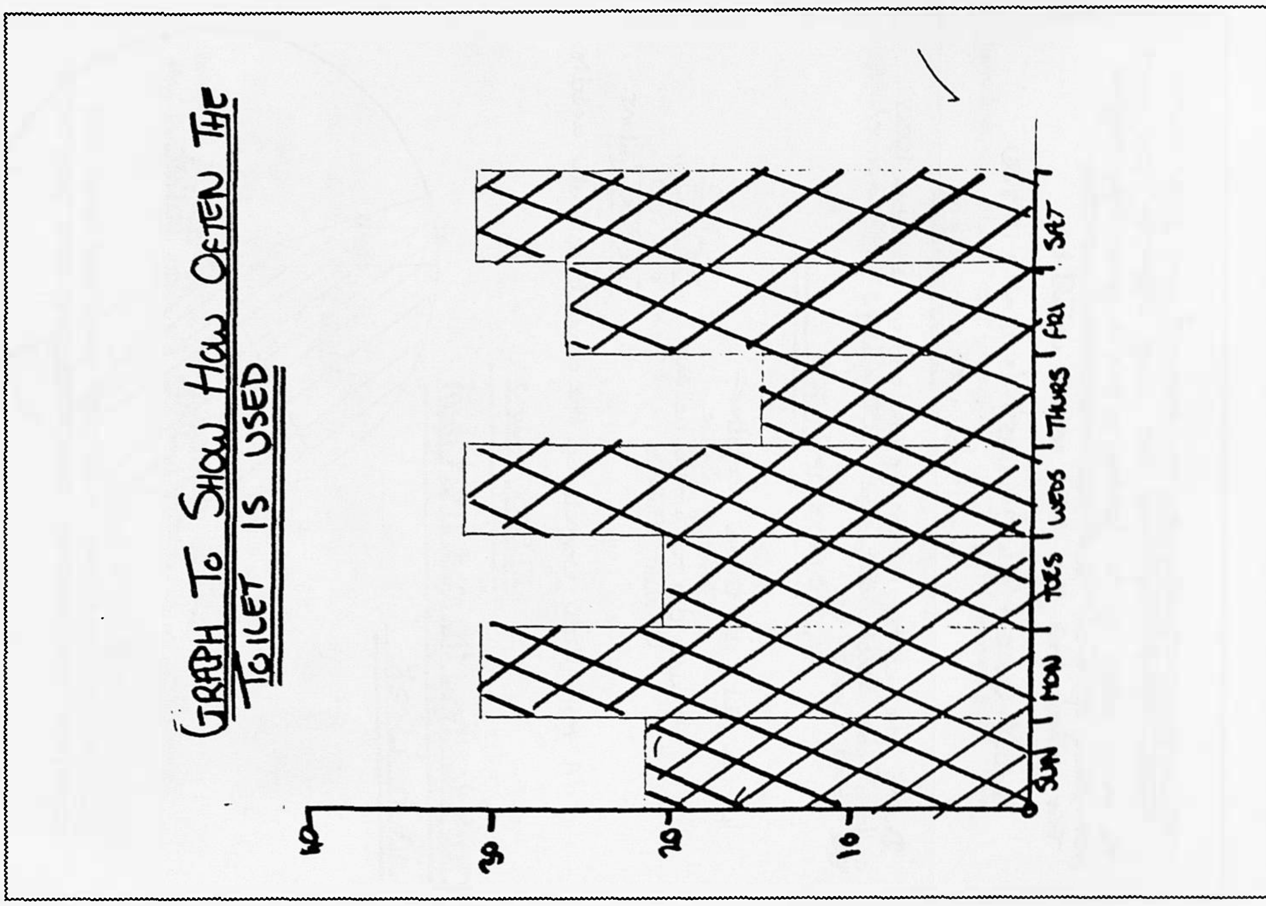
Starting figure	74,700.
Amount due to 2 mnths holiday	58,900.
Winter Months	+ 4,000.
	62,900 gallons.

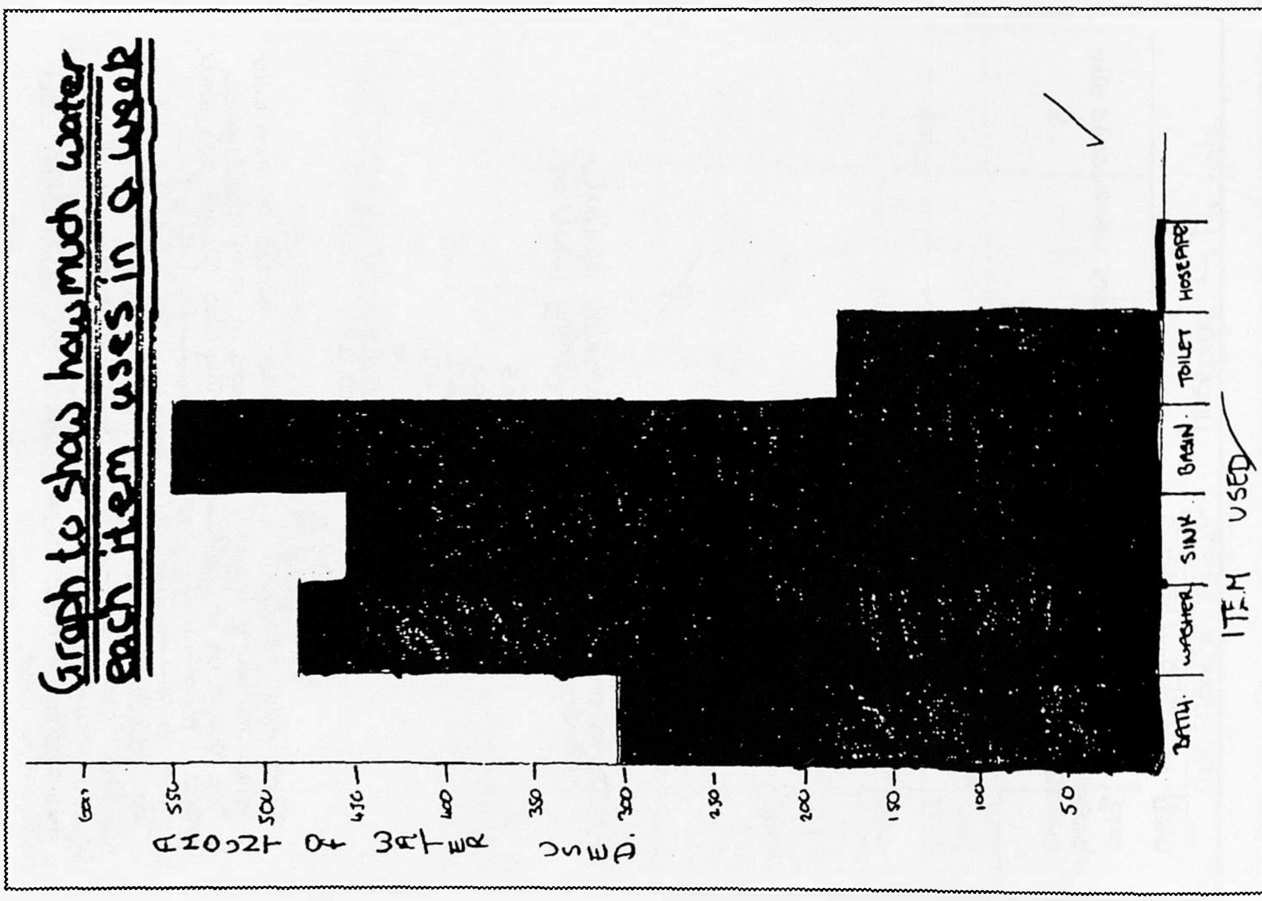
A more likely estimate of the amount of water used is

62,900 gallons

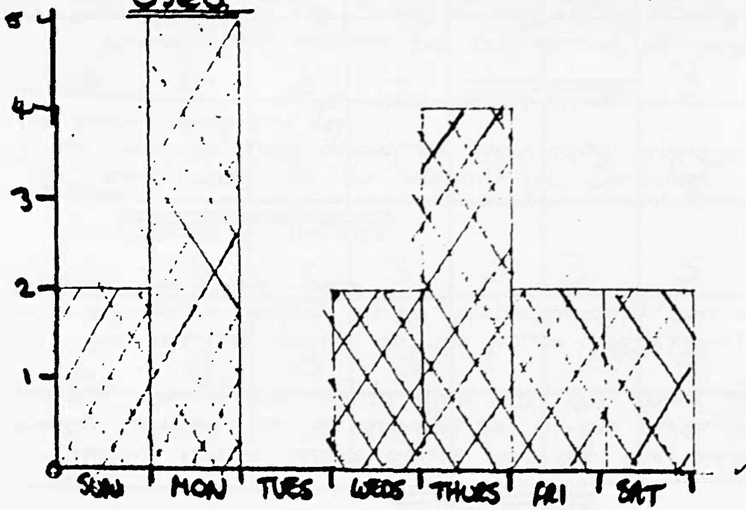
Chart to show the most used item in a week



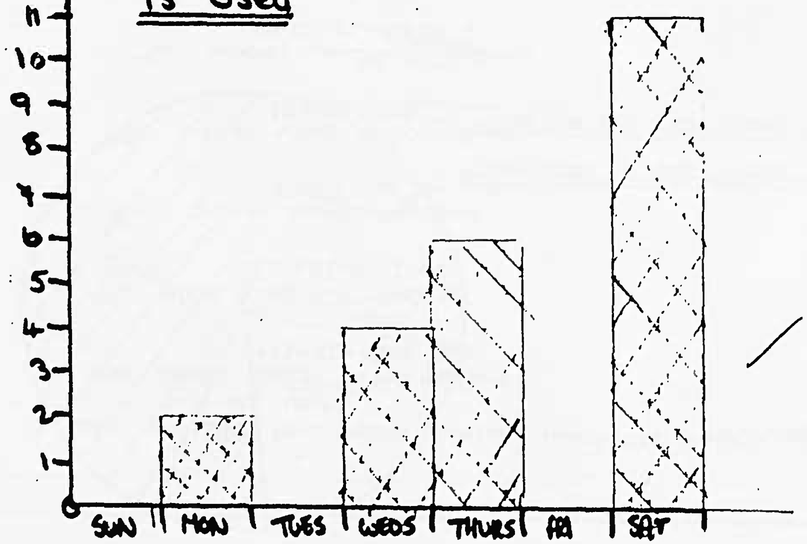

GRAPH TO SHOW HOW OFTEN THE TOILET IS USED
10
20
30
40
SUN
MON
TUES
WEDS
THURS
FRI
SAT


Graph to show how much water each item uses in a week
50
100
150
200
250
300
350
400
450
500
550
600
BATH
WASHER
SINK
BASIN
TOILET
HOSEPIPE
ITEM USED

Graph to show how often bath is used



Graph to show how often washer is used



THE CARTLEDGE FAMILY (SINGLE-PARENT)

The Cartledge family consists of the mum named Freida, a so named Steven and a daughter named Stephanie. Their is no father in this house, but they do have a cleaner/housekeeper so this could alter the amount that was used. It could increase it by as much as half.

Steven isn't very often in the house until after nine o'clock. If he stays in often his mates go in too. He is 14 years old and enjoys computers

Stephanie is always in the house except Tuesday evenings (until ½ past 9) or Friday evenings (until ½ past 11). She is 15 years old and enjoys dancing. She doesn't get on very well with the rest of the family.

Freida is years old. She was married for years, but her husband separated about a year ago, from her. She works every day (except Sundays) until 4pm, but at night, especially Friday's and Saturdays she goes out.

Their house is a well-kept, semi-detached house, which is situated in a very clean area. It has three bedrooms and one large bathroom. There is also a wash-house outside where the washer is kept. In here there is also a toilet. The rateable value of the house is £227.

Excellent

The measurement for the washer was in the minuo it said 104L, which is 20¼ gallons

It just happened that about 2 months ago they had a new bathroom suite put in. In an advertiseme book it said the toilet held 3 gallons and the bath held 17 gallons. All other measurements were easy to find.

In a week the
bath used – 17×10 = 170 gallons
toilet " – 3×52 = 156 "
basin " – 5.5×24 = 132 gallons
sink used – 3×25 = 75 gallons
washer " – 26.25×5 = 131.25 gallons

Although the toilet was once again the most used,

THE CARTLEDGE FAMILY

The Washing Machine. In the manual it said that the washer used 107litres. In gallons that would be:-

$\frac{107}{4} = 26\frac{1}{4}$ gallons.

The Toilet. This uses 3 gallons

The Sink.

Height - 13"
Length - 7"
Width - 8".

INCHES INTO CENTIMETRES.
13 x 2·54 ·33·02.
7 x 2·54 = 17·78·
8 x 2·54 = 20·32.

VOLUME IN CUBIC CMS
33·02 x 17·78 x 20·32
= 11929·783.

VOLUME IN LITRES.
$\frac{11929 \cdot 783}{1000}$ = 11·9 ≈ 12. (1dp)

AMOUNT IN GALLONS
$\frac{12}{4}$ = 3.

The Washbasin

Height - 10"
Length - 15"
Width - 9"

INCHES INTO CMS
10 x 2·54 = 25·4
15 x 2·54 = 38·1
9 x 2·54 = 22·86.

VOLUME IN CUBIC CMS
25·4 x 38·1 x 22·86 = 22122·536

VOLUME IN LITRES
$\frac{22122 \cdot 536}{1000}$ = 22·122536

VOLUME IN GALLONS
$\frac{22}{4}$ = 5·5

BATH This holds 17 gallons

It was actually the bath which used the most water.
In one year:-
the bath used 8,840 gallons
170 x 52 = 8840 gals

the toilet used 8,112 gallons
156 x 52 = 8,112 gals.

the basin used 6,864 gallons
132 x 52 = 6,864 gals

The sink used 3,900 gallons
75 x 52 = 3900 gallons

The Washer used 6,825 gallons
131·25 x 52 = 6825 "

The Total Amount used in one year is:-

34,541 gallons

Factors which could affect this are the winter months. If there is a drought, or if the family are on holiday then this could also alter the above figure.

The rateable value of the house is £227. They just miss-out on a saving of £6. Unfortunately, this is also the case in other areas.

CONSIDERING FACTORS

The family rarely go on holiday. For the winter months if we add on 1,000 gallons for each adult and 500 gallons for each child; we get
34,541 + 2000 = 36,541 gallons.

A more likely estimate for the amount of water used in a year is

36,451 gallons.

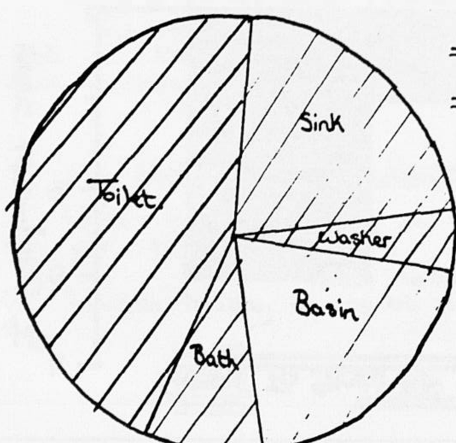
Items used in a week + N° of times

ITEM USED	1st Day	2nd Day	3rd Day	4th Day	5th Day	6th Day	7th Day
Sink	4	3	4	4	4	3	3
Washer	0	1	0	1	3	0	0
basin	3	3	3	3	3	5	4
bath	0	3	3	1	2	0	1
toilet	10	7	5	9	7	11	3

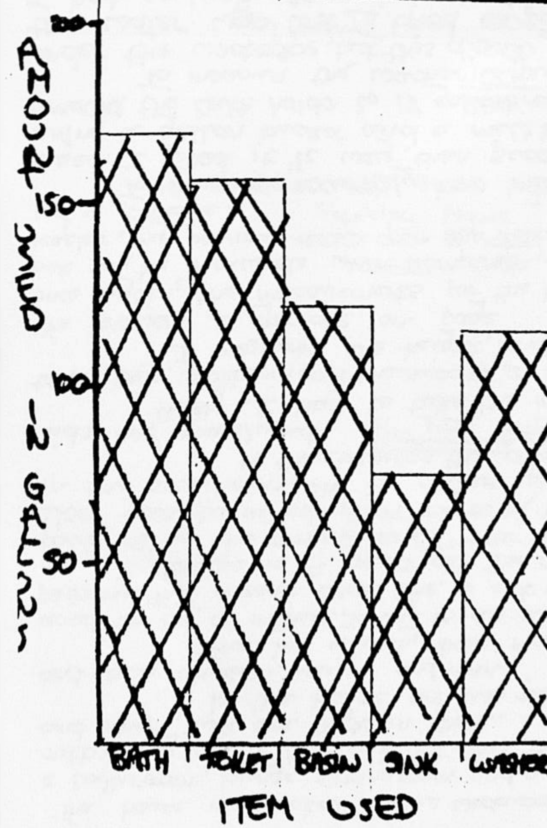
Any other amounts used

None

Chart to show the most used item in one week



GRAPH TO SHOW WHICH ITEM USES THE MOST WATER IN ONE WEEK



THE KAISER FAMILY. (NUCLEAR)

The house is situated in New Westwood. It has two bedrooms, a bathroom, lounge, sitting room and a kitchen. There is also an outbuilding which has a toilet. This is never used as bikes, and other junk are kept in there.

In the house are two parents, John and Jenny, and two children, Louise and Ann.

John has recently been made redundant, but he used to be a miner. Jenny is an overlocker at a local factory. This means that she is out from 10 o'clock until 2 o'c

Louise is 9 years old. She goes to school from ½ past 8 in the morning until four o'clock at night. Ann also goes to school from eight in the morning until four in the afternoon. She is fifteen years old.

In the evenings the parents stay in, but the kids are usually out.

Firstly, I had to take the measurements of the sink toilet, bath, washbasin, and the washer.

I measured the height, length and width of everythi The answers I got are on page . As you can see once again, the measurements for the bath and the washer look to be inaccurate when compared with the Severn Trent leaflet, my previous results for the Pollard family, and the results for a colleague.

To measure accurately how much water the bath used. I filled it ½ way, then scooped out the water using a gallon bucket and a milk bottle. The actual amount the bath holds is 18 gallons exactly.

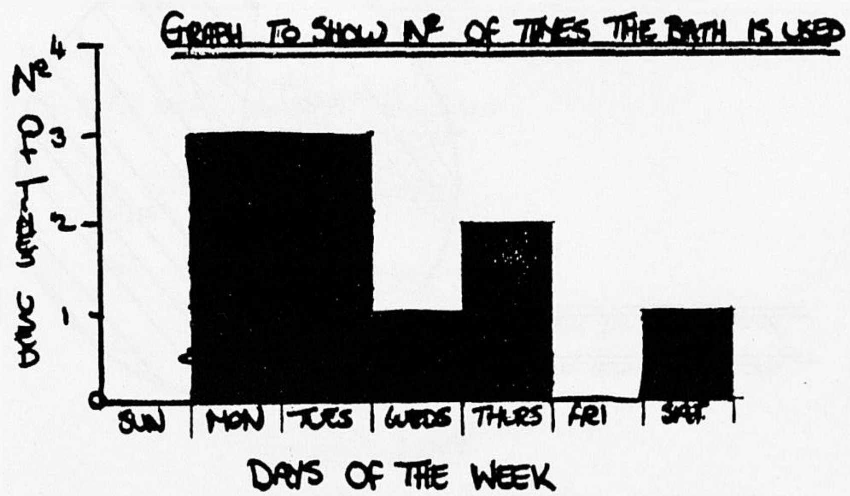
To measure the washer I put a few bucket under the wastepipe, but this didn't work as alot of the water was lost. I tried to find the manual but I had no luck. As a last resort I observed the washe and noticed that it filled 3/4 way up. If we divide 84¼ by 3/4 we get 63.1 gallons. This also looks incorrect

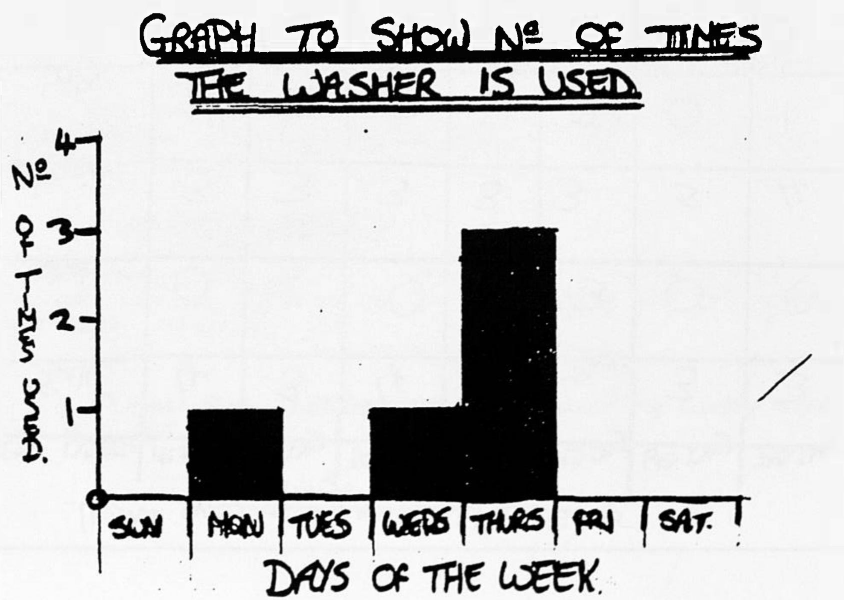
I decided I would use the figure quoted by the Severn Trent Authority. This is 25 gallons.

In one week:

the sink used 299 gallons
46x6.5=299

the basin used 205 gallons
41x5=205





The toilet used 178 gallons:-
137 x 1.3 = 178
the bath used 216 gallons:
18 x 12 = 216
The washer used 528 gallons:
25 x 21 = 528.

Although the toilet was the most used, the washer used the most water.
In a year:
the bath used 11,232 gallons.
216 x 52 = 11,232
the washer used 27,456 gallons
528 x 52 = 27,456
the toilet used 9,256 gallons
178 x 52 = 9,256
the sink used 15,548 gallons
299 x 52 = 15,548
the basin used 10,660 gallons
205 x 52 = 10,660.

The total amount is 74,152 gallons

Factors which might affect this are during the winter months. If there is a drought or the family goes on holiday this could also alter the amount.

The rateable value of the house is £200. If we look at the Severn Trent Authority's leaflet, they would save nothing. This is the same in all areas.

CONSIDERING THE FACTORS

When the family go on holiday (in the summer), they go for two weeks.
In one week 1426 gallons is used. If we take the 2 weeks holiday off of the total amount, this could give us:-

$$\begin{array}{r} 74\,152 \\ 2\,852 \\ \hline 71{,}300 \end{array}$$

71,300 gallons

I decided that during the winter months each adult uses 1,000 gallons and children an extra 500 gallons.

This would be:-

$$\begin{array}{r} 1000 \\ 1000 \\ 1000 \\ \hline 3000 \end{array} \qquad \left.\begin{array}{r} 3000 \\ +74{,}152 \\ \hline 77{,}152 \end{array}\right\} \underline{\underline{77{,}152 \text{ gallons}}}$$

If we combine all these figures:-

Starting figure	77,152
Amount due to holiday	71,300
Winter Months	+ 3000
	74,300

A more likely amount to be used in a year is

74,300 gallons.

An excellent system of refining your original estimates.

THE KAISER FAMILY.

BATH.
length – 60"
Width – 12"
Height – 18"

Inches Into Cms
60 x 2·54 = 152·4.
12 x 2·54 = 30·48.
18 x 2·54 = 45·72

Volume In Cubic Centimetres
152·4 x 30·48 x 45·72
= 212376·35.

Volume In Litres
$\frac{212376 \cdot 35}{1000.}$ = 212·37635.

AMOUNT BATH HOLDS IN GALLONS
$\frac{212}{4}$ = 53 gallons. ✗

BASIN
length – 17"
Width – 8"
Height – 9"

INCHES INTO CMS
17 x 2·54 = 43·18
8 x 2·54 = 20·32
9 x 2·54 = 22·86.

VOLUME IN CUBIC CENTIMETRES
43·18 x 20·32 x 22·86
= 20057·766

VOLUME IN LITRES.
$\frac{20057 \cdot 766}{1000}$ = 20·057766.

AMOUNT BATH HOLDS IN GALLONS.
$\frac{20}{4}$ = 5 gallons.

SINK.
length – 13
Width – 11"
Height – 11"

INCHES INTO CMS.
13 x 2·54 = 33·02
11 x 2·54 = 27·94.
" " "

VOLUME IN CUBIC CENTIMETRES.
33·02 x 27·94 x 27·94
= 25776·852.

VOLUME IN LITRES.
$\frac{25776 \cdot 852}{1000}$ = 25·7 (2sf)

AMOUNT SINK HOLDS IN GALLONS
$\frac{26}{4}$ = 6·5 gallons ✓

WASHER
length
Width } 17"
Height

INCHES INTO CMS
17 x 2·54 = 43·18

VOLUME IN CUBIC CENTIMETRES.
4 x 3·14 x 43·18 x 43·18 x di
= $\frac{1011201}{3.}$
= 337067 cm³.

VOLUME IN LITRES
$\frac{337067}{1000}$ = 337·2.

AMOUNT WASHER USES IN GALLONS.
$\frac{337}{4}$ = 84¼ gals. ✓

TOILET
Bottom length – 18"
Height – 6"
Width – 3"

INCHES INTO CMS
18 x 2·54 = 45·72
6 x 2·54 = 15·24
3 x 2·54 = 7·62.

VOLUME INTO CUBIC CENTIMETRES
45·72 x 15·24 x 7·62
= 4309·4.

VOLUME IN LITRES
$\frac{4309 \cdot 4}{1000}$ = 4·3 (1sf).

AMOUNT TOILET HOLDS IN GALLONS.
$\frac{4 \cdot 3}{4}$ = 1·3 gallons

Although you have carefully worked all of these out, I notice that you always use your common sense and choose a 'sensible' value by employing a more suitable technique for measuring or refering to published data.

USE OF WATER	1st Day (Sun)	2nd Day (Mon)	3rd Day (Tues)	4th Day (weds)	5th Day (Thurs)	6th Day (Fri)	7th Day (Sat)
Number of baths/showers (state which)	3 bath	0 bath	1 bath	6 baths	0 bath	2 Bath	0 Bath
Number of visits to toilet	17.	15	23.	32	12	17	21.
Number of times the washer is used	2.	0	0	5	11	0	3
Number of times the sink was used	7	7	11	11	3	5	2.
Number of times wash basin was used	5	3	7.	10.	3	4	9

Any Other usages of water (e.g. pets, hosepipe, dishwasher, pressure cookers, watering cans) and approximate amount.

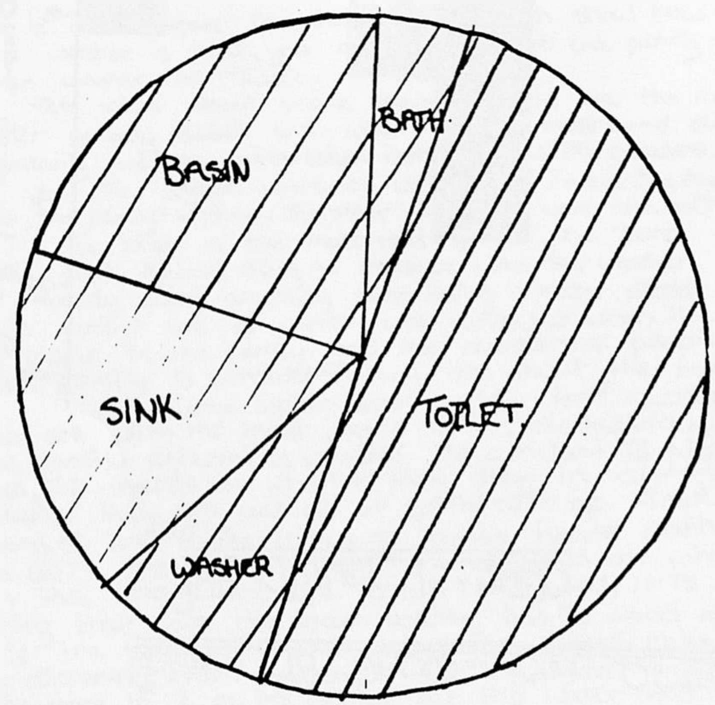
Sunday – Budgie – 2 tblsps.

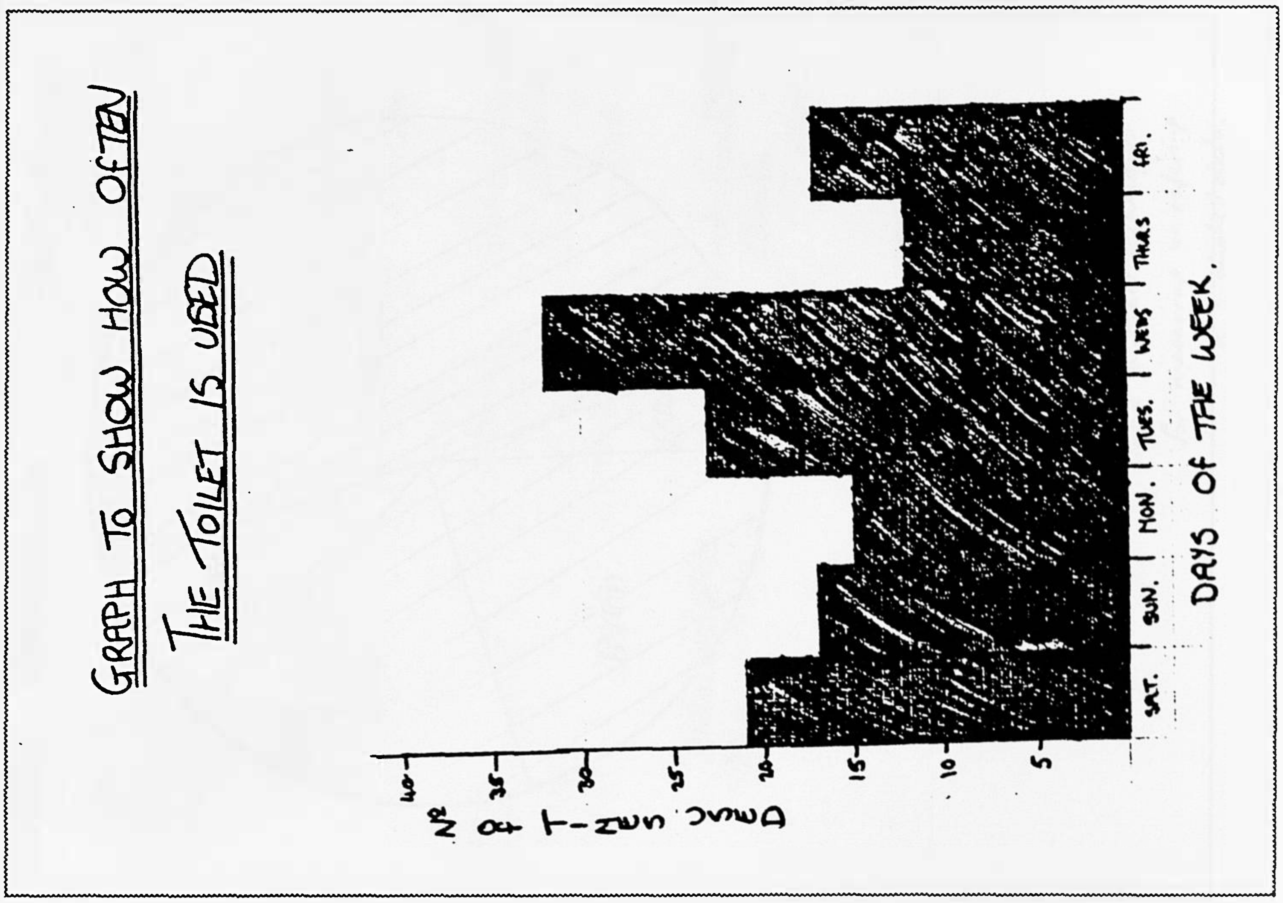
Tues. – Pressure Cooker, plants
7pt.03 3pt.03

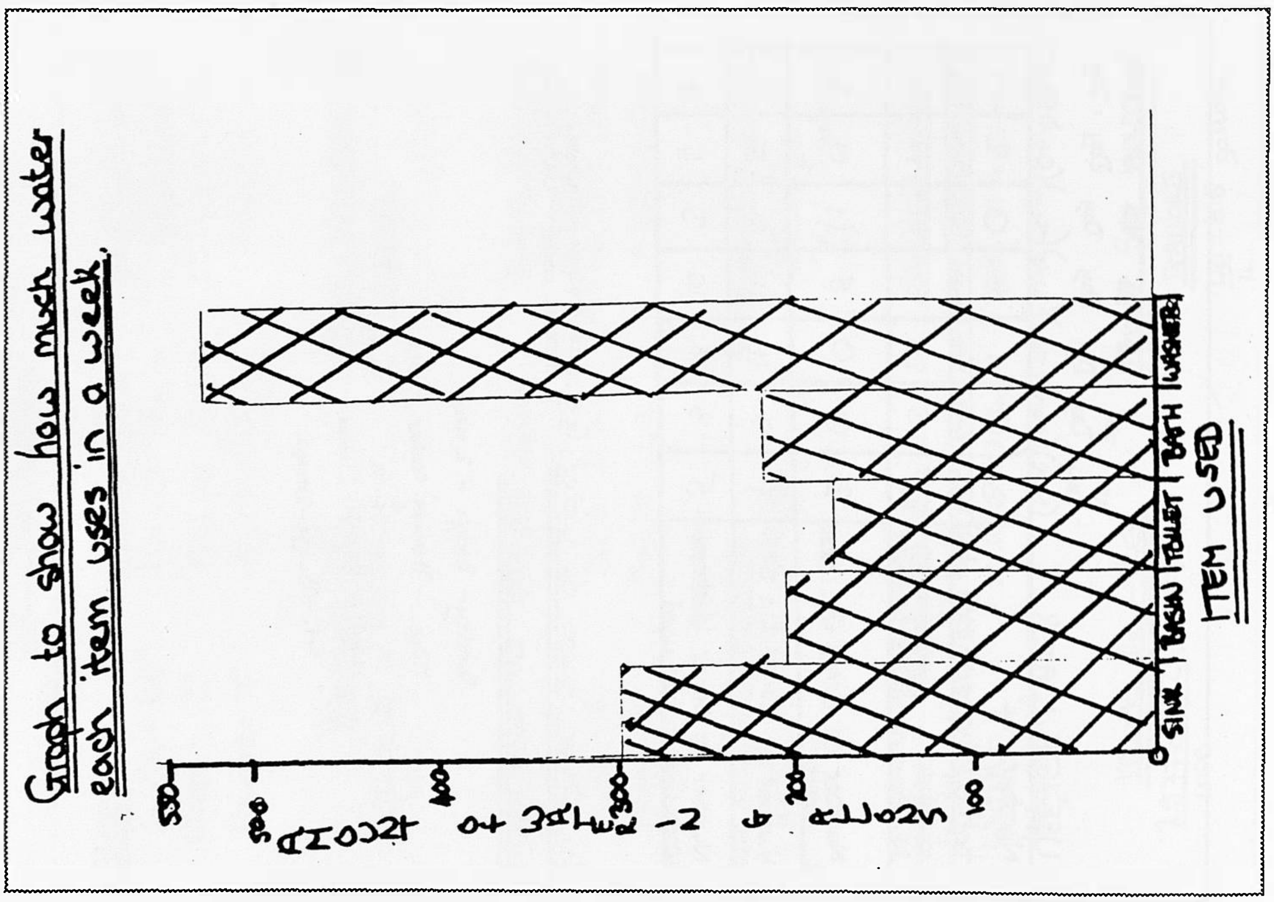
Weds. – Budgie – 2 tblsps.

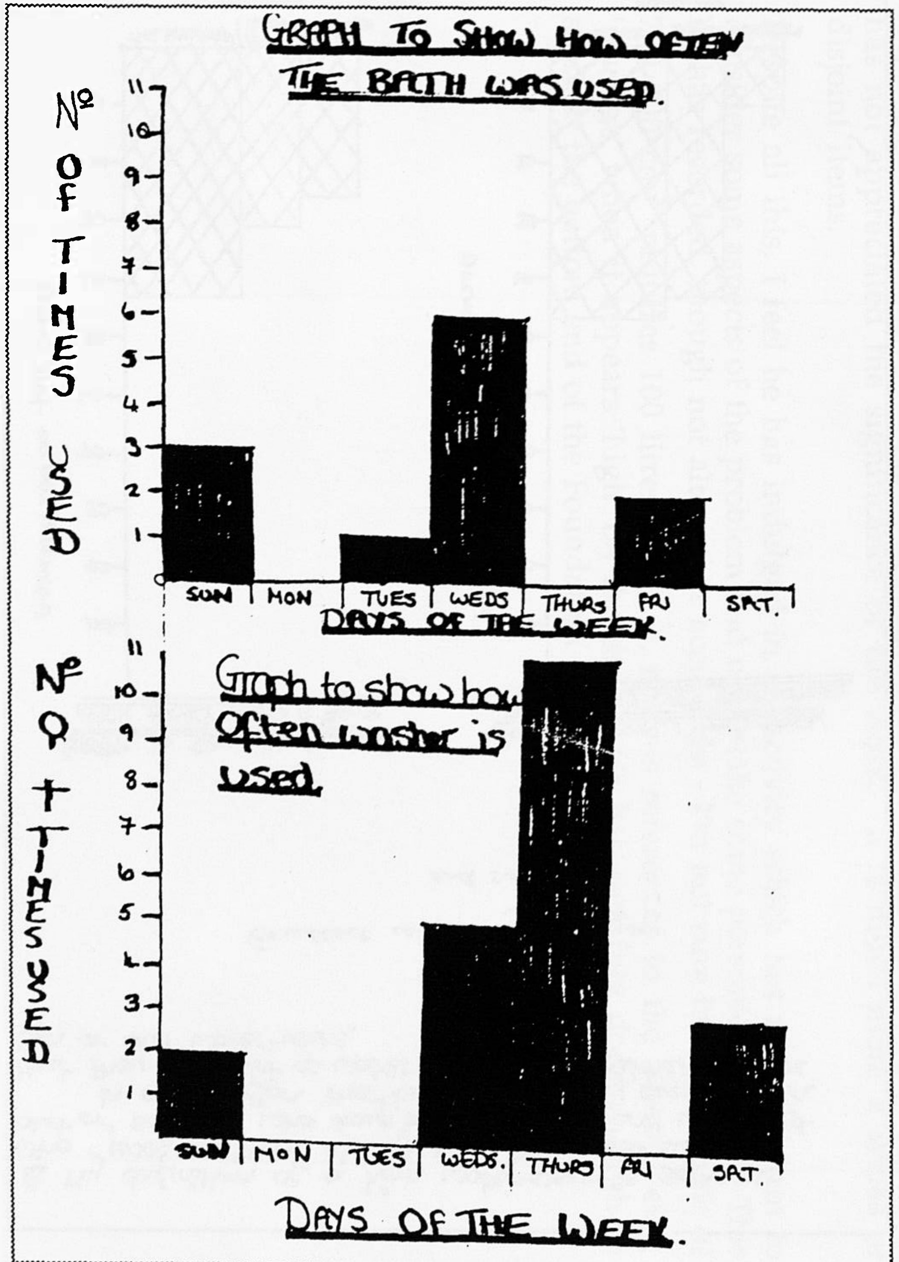
Fri. – Budgie – 2tblsps.

Chart to show which item was the most used in one week




GRAPH TO SHOW HOW OFTEN
THE TOILET IS USED
SAT.
SUN.
MON.
TUES.
WEDS
THURS
FRI.
DAYS OF THE WEEK.
5
10
15
20
25
30
35
40


Graph to show how much water
each item uses in a week.
SINK
BASIN
TOILET
BATH
WASHER
ITEM USED



CONCLUSIONS "Do you need a water meter."

Single-Parent Family - 36,451 gallons a year - Average user group wouldn't save anything if a meter was installed.

Nuclear Family - 74,300 gallons a year - High user group, wouldn't save anything if a meter was installed.

Extended Family - 62,900 gallons a year - High user group, wouldn't save anything if a meter was installed.

/ Good summary

If we compare the three graphs which show how often the washer is used, you can see that not one family used their washer on Tuesday or Friday (?)

What most people thought would use the most water actually didn't and what was the most used didn't neccesarily use the most when compared with others.

The biggest users of water (in 2 out of 3 of the family) was the family's washer. The other big user was the bath.

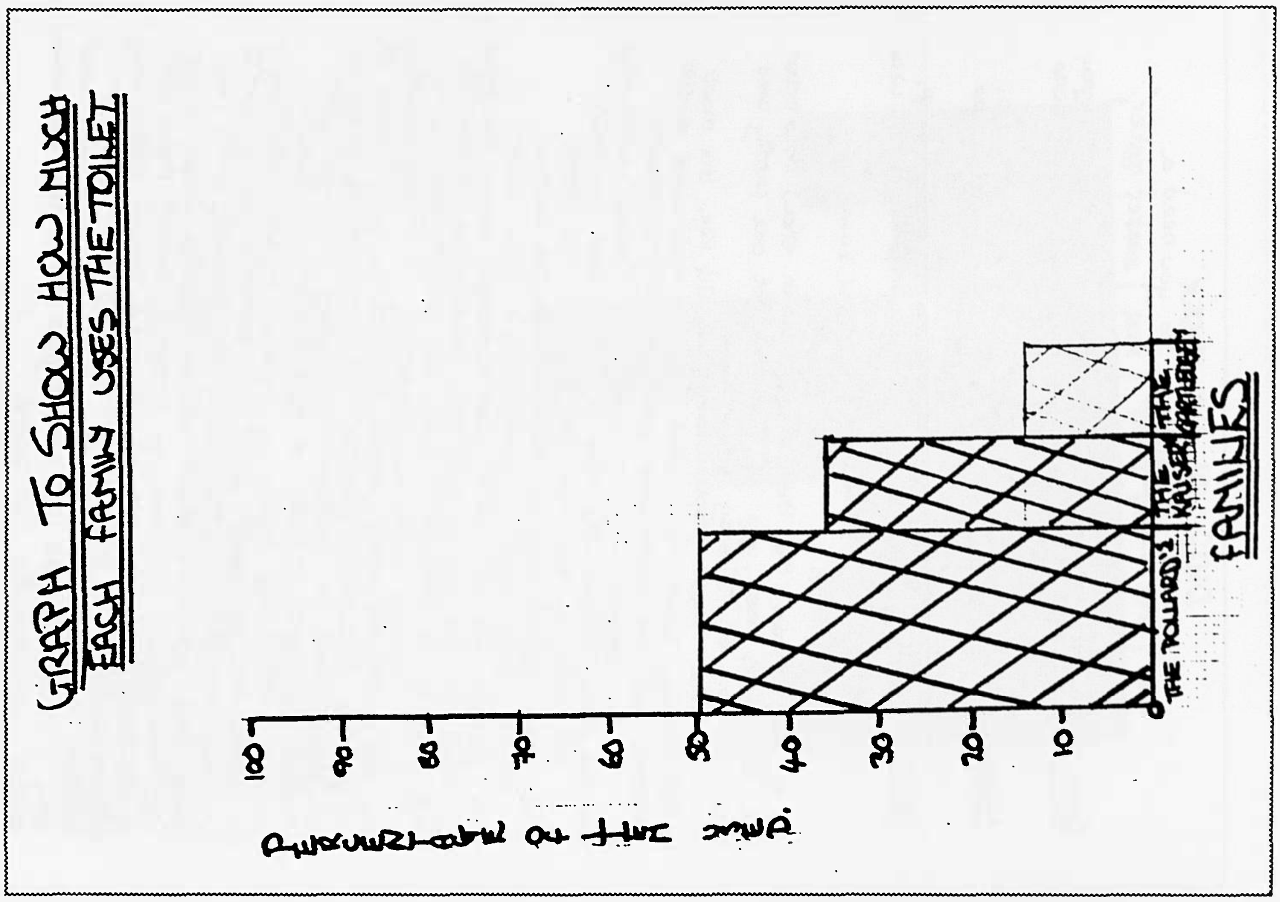
The toilet is the most used off all the items.

The most difficult thing to measure was the washer.

Nobody saved anything from having a meter fitted.

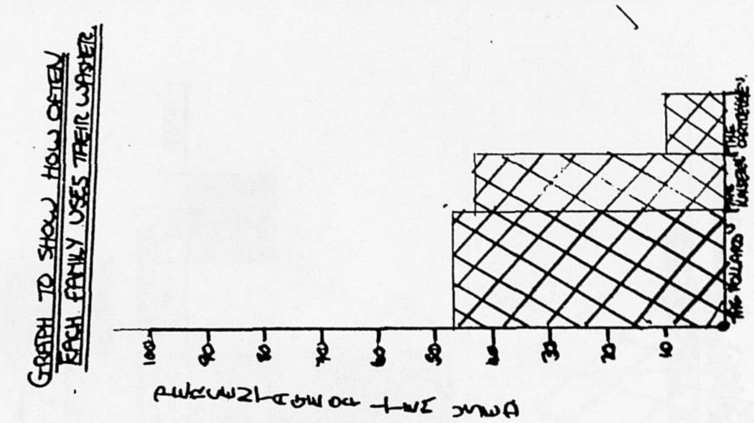
The family's use of water was varied but when the types of people in the family and the number of people in each family is considered they are about the same.

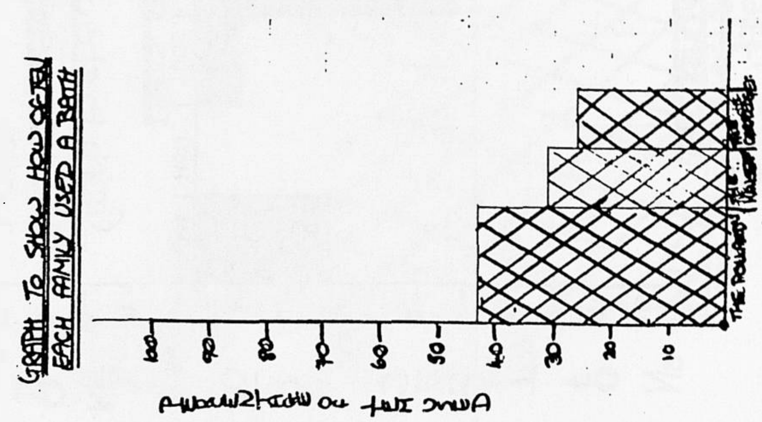
A large water-user family isn't neccesarily the one with the most people in it. The individuals in the family determine whether the amount is high or low. This depends on whether they stay in alot or whether they are active or spend alot of time lounging around. The types of house have nothing to do with the amount used. It depends on what is in the house and the way it is used. It is the thing that uses the least water but is used more (ie the toilet). The use of hosepipes doesn't make alot of difference to my results. Cooking doesn't make any difference to 2 of the family but the water used for cooking by the Kaiser family added on alot. When asked why, they said "We like to eat good food." The appliances owned were exactly the same. /



My definition of a high water-user is someone who uses an item alot but the item used uses not alot or someone who stays in their house and uses alot.
In my opinion the larger the family doesn't mean that they use alot of water, it depends whether they are high or low water-users.

Excellent concluding analysis and summary.





6 *Moderator's Comments*

Water Meter A2/1

Foundation Level

Grade G

The water meter problem is a good one for consideration since everyone can see something they can do and some, potential, relevance in the task.

The work presented here contains many of the 'stamps' of Foundation Level material - imprecise use of language, mathematical concepts and a lack of overall structure to the solution. In fact he doesn't seem to have a real grasp of what is required in the task. He has gone through the motions of what is required but he has not appreciated the significance of the work. It is much more a series of disjoint items.

Despite all this, I feel he has indulged in an activity which has required him to consider some aspects of the problem and undertake some personal research. This he has recorded, though not altogether accurately - I'm not sure how a volume of 780 000 cm^3 requires 100 litres to fill it, nor his references to the 50 000 being 'average' when it appears 'high' on the draft. He has certainly done enough to score at the bottom end of the Foundation Level spectrum.

Houses Cost A2/2

Foundation Level

Grade E

This seems to be a good task to undertake under the category of Applications, with house prices being so prominent in many people's mind. At this level, the student has presented a clearly written project which follows a simple line of argument to reach adequate, if slightly conflicting, conclusions.

When reading the task, it is not stated what the method for establishing the comparisons is going to be, until later on - we have to infer this - but the method is quite clearly adhered to. Perhaps the most regrettable thing is that she has wasted so much time copying out the 'ads' rather than concentrating upon the mathematics of the situation. Had this been done, perhaps some time could have been spent considering the shortcomings of the method, or following up the ideas at the end of the conclusion.

Despite these comments, the project is a good example of what can be achieved at this level with a simple strategy, presentation of results and statements of conclusion. She has used a variety of simple mathematical devices - comparison, average and graphs, and there is a clear personal involvement in the execution of the task.

Applications A2/3

Intermediate Level

Grade E

Well, is this 'applications' or 'statistics'? It would seem to qualify equally well under both, since this is a genuine application of mathematics to an everyday, if somewhat 'academic', problem.

The author is possibly an Intermediate Level candidate. Since she brings in some aspects of mathematics not necessarily clearly grasped by Foundation Level candidates - percentage and pie charts, which appear to have been correctly calculated, if inexpertly drawn. There is no evidence for the angles for each sector being calculated, nor the method used. Nevertheless, she uses quite a variety of forms to present her results in graphs and tables. It is this variety which lifts the project above the lower grades, since the task itself is quite simply dealt with and consists of a single line of enquiry. This is done tidily and, we must assume, accurately though there is no evident marking by the subject teacher to judge by.

My comments are not to be read as to mean that umpteen graphs will cause a project to score highly. Indeed, many candidates waste a lot of time presenting irrelevant graphs, as are many of these. No, I simply imply that the early part of the work is extremely simple, especially at Intermediate Level, but the ability to display, to some purpose, the results in a *variety* of forms is a noteworthy skill.

Applications A2/4

Intermediate Level

Grade C

The arithmetic of this piece is not complex, neither are the graphs, yet the evidence is clearly presented, in an easy to understand fashion. In fact, the dominant feature of the item is the clarity of organisation of the work, and the following through of the enquiry.

There are, of course, shortcomings. He seems to have made no checks on the accuracy of his figures. They seem to have been taken from the published data, and there is no reference to checking these at home. Does a family of four only use a washing machine six times a week? How does the one use of the outdoor tap constitute five gallons? More generally, do the published figures match up to real consumption and what assumptions are made?

Despite this, for an Intermediate Level candidate, the 'argument' is well stated, if not elaborately pursued, and the conclusion reached and supported by reasoning. This work just achieves a grade C.

Applications A2/5

Higher Level

Grade C

I am in two minds about this piece of work. On the one hand, a definitely Higher Level of 'mathematical content' is evident and yet there appears to be no argument of a case following through the problem. In fact, there seems to be no real problem at all! She gives no background to the task. What is she trying to do, what is her hypothesis, where do the figures used derive from? She presents a series of results, makes good observations and derives some valid conclusions, yet to what point?

To my mind each coursework task should be a distinct problem for which pupils should devise their own method of solution. This should be developed and refined, where possible, and extended into other aspects of the task. Pupils should bring these points out in their coursework, and I don't feel that this has been well done by this candidate. She has demonstrated ability in a range of skills, and shown awareness of the results she has obtained, but she has not fitted this into a good coursework structure. Comments like 'The next task was ....' always tend to imply direction by the teacher to the pupil, rather than self directed action.

Applications A2/6

Higher Level

Grade A

What a very comprehensive and exhaustive answer to this task! One of the criticisms levelled at published items by teachers engaging in coursework, is that they are often too long and indicate far too much work for a standard coursework item. 'Regrettably' it is often the case that good students *do* write at length on their chosen item and devote a good deal of time and labour to answering it well. I should not specify that a piece should be of this length to gain a grade A but, clearly, this one *is* worth it. Yes, there are errors, some minor and some more important - confusing fluid oz with oz, and using the volume of a sphere when it should be a cylinder, but these are minimised by the overall weight of the piece.

What distinguishes this item is the real personal involvement; not being content with one figure, she checks and checks again. She doesn't take one household but a variety for comparison, and she follows her method accurately throughout. She also comments fluently upon her findings and shows a clear awareness of the results obtained. On the whole, she has incorporated many, if not all, the strengths of a good coursework item.

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Application A2/6

Higher Level

[illegible]

[illegible]

[illegible]