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Introduction to Core Maths

INDUCTION BOOKLET

Introduction

Thank you for choosing to study Mathematics in the sixth form.

The Mathematics Department is committed to ensuring that you make good progress throughout your Core Maths course. In order that you make the best possible start to the course, we have prepared this booklet. It is <u>vital</u> that you spend time working through the questions in this booklet over the summer. You need to have a good knowledge of these topics <u>before</u> you commence your course in September. You should have met all the topics before at GCSE. Work through what you need to from each chapter, making sure that you understand the examples. Then tackle the exercise to ensure you understand the topic thoroughly. The answers are at the back of the booklet. You will need to bevery organised so keep your work in a folder & mark any queries to ask at the beginning of term.

Use this introduction to give you a good start to your Year 12 work that will help you to enjoy, and benefit from, the course. The more effort you put in, right from the start, the better you will do.

Sources for further help are indicated throughout the booklet. All the topics can be found on resources such as Corbett Maths, Hegarty Maths or DrFrostMaths.

https://hegartymaths.com/

https://www.drfrostmaths.com/

https://corbettmaths.com/

What is included in this workbook?

- ★ Keywords
- ★ Types of data (Corbett 342,343, 343a) (Hegarty 392, 393)
- ★ Sampling (Corbett 281,282) (Hegarty 394-398)
- ★ Reading Table and Graphs (Bar Charts, Frequency Tables) (Corbett 147,148, 51,54) (Hegarty 415-418)
- ★ Constructing Tables and Graphs (Corbett 147-150) (Hegarty 897)
- ★ Line Charts and Time Series Graphs (Corbett 160, 382) (Hegarty 450-452)
- ★ Pie Charts and Pictograms (Corbett 161 164) (Hegarty 426-429)
- ★ Mean Median Mode (Corbett 53 57) (Hegarty 404-410)
- ★ Applying Statistics
- ★ Scatter Graphs/Line of Best Fit (Corbett 165 168) (Hegarty 453-454)

Keywords

Quantitative	Data that describes a quality that can be measured or counted in numerical form
Qualitative	Data that describes a quality that cannot be counted e.g. answers to open ended questions
Discrete Data	Usually concerned with a limited number of countable values
Continuous Data	Data-is measured on some scale and can take any value within that scale e.g height
Categorical Data	Data that is grouped into categories
Bivariate Data	Data that has two variables
Bar Chart	a diagram in which the numerical values of variables are represented by the height or length of lines or rectangles of equal width.
Closed ended Question	Question that allow a limited answer
Open ended Question	Questions that allow elaborative answers that can be expanded
Tally Chart	Tally Chart is a uniform way of showing data using tally marks in the form of atable.
Pie Chart	A type of graph in which a circle is divided into sectors that each represent a proportion of the whole.
Time Series Graph	A time series graph is a great way to evaluate patterns and behavior in data over time.

Line of Best Fit	A line of best fit (or "trend" line) is a straight line that best represents the data on a scatter plot. This line may pass through some of the points, none of the points, or all of the points.
Mean	Finding an average; add up all the numbers and divide by how many numbers there are e.g. 3,4,5,6,7- 3+4+5+6+7=25 25÷5=5 Mean=5
Median	Put all the numbers in value order and find the middle number
Mode (Modal)	The value that appears most frequently in any given set of data
Range	The difference between the highest and lowest values
Inter quartile range	The upper quartile minus the lower quartile
Cumulative Frequency	The total frequency up to and including a particular value.
Correlation	The statistical word for a connection between two variables
Mutually Exclusive events	An event that cannot occur at the same time
Independent events	Two events are independent if the outcome of the second is not affected by the outcome of the first

HIGHLIGHT THESE NOTES

Sampling

What is it?

Sampling means selecting people/objects from a population in order to test the population for something. For example, we might want to find out how people are going to vote at the next election. Obviously we can't ask everyone in the country, so we ask a sample.

Example question

A bus company attempted to estimate the number of people who travel on local buses in a certain town. They telephoned 100 people in the town one evening and asked 'Have you travelled by bus in the last week?'

Nineteen people said 'Yes'. The bus company concluded that 19% of the town's population travel on local buses.

Give 3 criticisms of this method of estimation.

In answering this question, there are no 3 correct answers. As long as what you say is plausible and sensible, you should get the marks. For example, you might say:

- 100 people in a large town is not a large enough proportion of the population to give a good sample.
- People who travel on local buses once a fortnight may have said no to the question. They nevertheless travel on local buses.
- On the evening that the sample was carried out, anybody travelling by bus would be out.

Have a go, 1 mark each:

Use "COMMON SENSE" answers and write a full sentence, neatly. REMEMBER: A sample is **biased** if you are asking people that are more likely to agree or disagree.



1.Tesco wants to find out about the spending habits of their customer so they conduct a telephone survey between 9am and 5pm. Why might their sample not be representative of the population?

2. Ealing council are surveying people about the need for more parking spaces in the town centre. They asked 100 people at the car park in town. Why might this not be representative?

3. People at the local gym were asked about the importance of exercise. Why might this be unrepresentative?



Collecting and Recording Data

Using the tally system to record your results is faster than writing out words or figures all the time.

If you record your findings in a tally chart, the data is already collected into groups, and you will not need to group it later on.

To investigate the most popular colour of car passing your house, it is easier to draw tally marks in one of five columns than to write red, blue, silver, silver, red, other, black etc.

If you use a tally chart, you could note down the colour of the cars as they pass, and find the total frequencies at the end of the one-hour period.

Colour	Tally	Frequency
Red	HHT HHT III	13
Blue	++++	9
White	HHT HHT HHT HHT IIII	24
Black	++++ ++++	12
Other	++++	9

Have a go:

Read the tally and fill in the frequency. Do not forget to include 0 in your frequency if there are no tally marks.

Number of CDs	Tally	Frequency
0 - 4		
5 - 9		
10 -14		
15 - 19	HHH HHH	
20 - 24	HHT	
25 - 29		
30 - 34	HHT	
35 - 39	HHT	
40 - 44	HHT 11	
45 - 49	HH	
more than 49		

Two Way Tables

You can use a two way table to show two sets of information.

This is an example of a two-way table and it is used to show two different features in a survey.

In this case it shows:

- 1. Boys and girls
- 2. Left-handed or right-handed

	Left-handed	Right-handed
Boys	2	14
Girls	1	12

Have a go:

Q1. How many right-handed children are there in the class?

Q2. How many children are there in total?

Grouping Continuous Data

Continuous data is data which can take any value. Examples include time, height and weight.

Because continuous data can take any value, there are an infinite number of possible outcomes. So continuous data must be <u>grouped</u> before it can be represented in a frequency table or statistical diagram.

Grouping continuous data

When choosing groups for the data, make sure that each piece of data can be placed in one (and only one) of the groups. It is very easy to make a mistake when grouping data.

Investigation example

You are investigating the length of time each member of a class spends on the internet per week. Look at the class groupings below - do you think they are right?

Time (h)	Frequency
0 ≤ time ≤ 10	
10 ≤ time ≤ 20	
20 ≤ time ≤ 30	

Right or wrong? Why?

Time (h)	Frequency
0 < time < 10	
10 < time < 20	
20 < time < 30	
Right or wrong? Why?	

Time (h)	Frequency
0 ≤ time < 10	
10 ≤ time < 20	
20 ≤ time < 30	
Right or wrong? Why?	

Investigation example

Question

Cameron records the heights of 30 of his classmates. His results are shown below:

144	150	143	170	161	171	134	140	155	162
144	165	157	147	177	155	156	149	168	159
149	133	170	156	156	161	168	151	172	155

Copy the tally chart and complete it with Cameron's results:

Height (cm)	Tally	Frequency
130 < h ≤ 140		
140 < h ≤ 150		
150 < h ≤ 160		
160 < h ≤ 170		
170 < h ≤180		



Averages

These are notoriously difficult to remember. Year 10 and 11 students have struggled with these for years! **There is no quick trick.** The key is to practice them and use them in your mathematical conversations in class.

Here we will look at each one in a bit more detail.

Hey diddle diddle...

The Median is the middle

The **median** is the middle number in a set of data, when the data has been written in **size order.**

If there is an odd number of items of data, there will be one number in the middle.

If there is an even number of items of data, there will be two numbers in the middle. The median is the number that is halfway between these two numbers.

To find the median, put all numbers into ascending order and work into the middle by crossing off numbers at each end.

Assisted Example

7 babies weigh the following amounts:

2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

Find the median mass of the babies.

The numbers are already in order. Find the median amount by finding the middle number.

Cross off the first and last item of data (the items in bold):

2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

Repeat until you reach the middle:



You add and divide for the... Mean

The **mean** is the most commonly used average. To find the mean of a list of numbers, add them all together and divide by how many numbers there are:

 $mean = \frac{sum \ of \ all \ the \ numbers}{amount \ of \ numbers}$

Assisted Example

7 babies weigh the following amounts:

2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

Find the **mean** mass of the babies.



CHECK YOUR ANSWER

 $mean = \frac{2.5 + 3.1 + 3.4 + 3.5 + 3.5 + 4 + 4.1}{7} = \frac{24.1}{7} = 3.44$ (2 dp)

The mean mass of the babies is 3.44 kg.\

The **Mode** is the one that appears the most

The **mode** is the number, or item, which occurs most often in a set of data.

Assisted Example

7 babies weigh the following amounts:

2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

What is the mode?

And the Range is the difference between..

In statistics, a **range** shows how spread out a set of data is. The bigger the range, the more spread out the data. If the range is small, the data is closer together or more consistent.

The range of a set of numbers is the largest value, subtract the smallest value.

range = largest number - smallest number

7 babies weigh the following amounts:

2.5 kg, 3.1 kg, 3.4 kg, 3.5 kg, 3.5 kg, 4 kg, 4.1 kg

Find the **range** of the masses of the babies.

Advantages and disadvantages of averages

Average	Advantage	Disadvantage
Mean	The mean takes account of all values to calculate the average.	Very small or very large values can affect the mean.
Median	The median is not affected by very large or very small values.	If there is an even number of numbers, the median is found by averaging the two middle numbers. This means the median value may not actually be a number in the original data set.
Mode	The mode is the only average that can be used if the data set is not in numbers, for instance the colours of cars in a car park.	There can be more than one mode, and there can also be no mode which means the mode is not always representative of the data.

Have a go, fluency questions:

- 1. Calculate the mean, mode, median and range of :
 - (a) 1, 6, 9, 5, 11, 8, 5, 13, 5.
 - (b) 23, 11, 17, 12, 14, 29, 30, 11, 29, 19.

(c.) 8, 3, 6, 5, 2, 10, 1, 7, 4, 9.

(d) 103, 134, 109, 112, 121, 148, 134.

(e) 9, 1, 7, 3, 5, 4, 3, 5, 4, 8, 2, 9.

2. This list shows the amounts spent by seven families on their holidays :

£100, £400, £320, £300, £5430, £100, £350.

(a) Calculate the mean, mode, median and range of these amounts.

(b) Suggest which of the three averages is the most useful indicator of how much a typical family spends on their holiday.

3. A sports shop is offering a discount on a particular type of running shoe. The manager wants to look at the number of each size sold so far in order to predict how many will be sold in the next week. This should hopefully mean that all sizes are available in the shop. Here's the list of all sizes sold:

7, 8, 8, 8, 8, 9, 9, 10, 10, 11, 11,

(a) Calculate the mean, mode, and median of the data.

(b) Which of the three averages is most useful to the manager?

4. The temperature at noon on five days in January were :

Day	Monday	Tuesday	Wednesday	Thursday	Friday
Temperature (^o C)	6	6	3	2	3

Calculate the mean noon temperature and the range of temperatures.

Have a go, GCSE Exam Questions:

10. Here an	re seven numb	ers.							
13	6	12		7		6	4	8	
(a) Work o	ut the range o	of the seve	n nur	nbers.					
Circle y	our answer.								
									[1]
		5	6	7	8	9			
(b) What is	s the mode of	the seven	numl	bers?					
Circle y	our answer.								
									[1]
		5	6	7	8	9			
13. Adam an	d six other me	en ran a ra	ce.						
The times	s, in seconds,	of the six (other	men a	re sh	own.			
9.75	9.79	9.80	9	9.88	9	9.94	9.98		
The mear	n time for all s	seven mer	n was	9.83	secon	ds.			
Did Adam win the race?									
You must	You must show your working.								

Key skills using MMMR Averages from tables

To make calculations more efficient, tables are often used to group the data. The table below shows the number of goals scored in 10 football matches.

Number of goals	Frequency
0	2
1	2
2	5
3	1

Finding the mode from a table

The mode or **modal value** is the value that occurs most. From a table, this means the modal value is the one with the highest **frequency**

Number of goals	Frequency
0	2
1	2
2	5
3	1

There were five football matches where 2 goals were scored, which is a higher frequency than any other amount of goals.

The modal number of goals scored is 2.

Finding the mean from a table

The **mean** is found by adding up all the numbers and dividing by how many numbers there are.

To find the mean in this example, the total number of goals must be found and then divided by the number of games.

From the table, it can be seen that in 2 games no goals were scored. This makes a grand total of zero goals so far. The rest of the total amount of goals can be worked out in this way, by multiplying goals (*x*) by the frequency (f). Call this column f^x (f multiplied by x).

	Number of goals (<i>x</i>)	Frequency (f)	fx
	0	2	$0 \times 2 = 0$
	1	2	$1 \times 2 = 2$
	2	5	$2 \times 5 = 10$
	3	1	$3 \times 1 = 3$
Total		10	15

The total number of goals is 15. There were 10 football games so $15 \div 10 = 1.5$.

The mean number of goals is 1.5 goals per game.

Have a go GCSE questions:

Mark	Frequency
14	2
15	10
16	2
17	3
18	13
	Total = 30

11. The table shows information about the marks of 30 students in a test.

Students who scored less than the mean mark have to retake the test.

How many students have to retake the test?

You must show your working.

[3]

12.	The t	times	that	80	customers	waited	at a	supermarket	checkout a	are shown.

Time, <i>t</i> (minutes)	Frequency
0 ≤ <i>t</i> < 2	32
2 <i>≤ t</i> < 4	19
4 <i>≤ t</i> < 6	20
6 <i>≤ t</i> < 8	7
8 <i>≤ t</i> < 10	2

(a) In which class interval is the median?Circle your answer.

 $0 \leqslant t < 2 \qquad 2 \leqslant t < 4 \qquad 4 \leqslant t < 6 \qquad 6 \leqslant t < 8$

(b) The manager of the supermarket says,

"90% of our customers wait less than 6 minutes."

Does the data support this statement?

You must show your working.

[2]

[1]

Displaying Data

There are many ways to display data. For your GCSE you need to know:



Pie Charts Scatter Graphs



Line Graphs (Time Series)



Composite bar chart



Pictogram



Bar Chart

Bar Charts are probably the most well known charts. There are still lots of marks you can lose if you are not careful... First step: **PENCIL AND RULER!**

A **bar chart**, like a **frequency diagram**, shows the frequency of events occurring. The height of the bar is the frequency.

A simple bar chart may look like this.



Notice there is a space between the bars and the axis are labelled.

Composite bar charts

Bar charts may be needed to compare data.

The following frequency table shows information for the numbers of pets owned by a class.

	0 pets	1 pet	2 pets	3 or more pets
Boys	2	4	2	3
Girls	3	3	2	1

A **composite bar chart** can show this information. <u>A key</u> that shows which bar represents which data is necessary to be able to read the bar chart properly.



Have a go, basics:



Have a go, GCSE questions:

7. Zayn records his weekly sales.

Every week his costs are £87.50



(a) Work out his profit in Week 1

£_____[2]

(b) His sales in Week 4 were half of his sales in Week 1

Zayn says,

"This means that my profit in Week 4 was half of my profit in Week 1"

Is he correct?

You must show your working.

8. The table shows how 25 students travel to school.

Walk	Bus	Car	Taxi
9	8	7	1

Draw a bar chart to show this information.

1							

10. The table shows the number of Year 11 students who were absent in one week.

	Monday	Tuesday	Wednesday	Thursday	Friday
Number absent	14	13	11	15	16

Jack uses this information to draw a bar chart.



Write down two mistakes that he has made.

Mistake 1

Mistake 2

Pictograms

A **pictogram** shows the frequency of events using pictures. A key that shows what each picture is worth is needed to be able to read a pictogram properly.

Example

= 2 people

С

= 1 person

C

20 pupils were asked about their favourite type of film. The table shows their responses.

	Movie genre	9	Frequency
	Horror		3
	Action		7
	Romance		4
	Comedy		5
	Other		1
Movie genre	Frequency		
Horror			
Action			
Romance			
Comedy			
Other	Ļ		THIS IS THE KE
= 4 peo	ple 📮 = 3 people		

Have a go, basics:

Pictograph - Charity Clothes

Good Shepherd Elementary School organized a donation program to motivate the kids to donate clothes for charity. At the end of the program, the management collected a data to show the number of clothes donated by each grade. Draw pictograph to represent the data and answer the questions.

Grade 1	Grade 2	Grade 3	Grade 4	Grade 5
120	60	180	150	120

Charity Clothes						
	Grade	Number of Clothes				
	Grade 1					
	Grade 2					
	Grade 3					
	Grade 4					
	Grade 5					
		Key = 30 Clothes				
1)	Which two grad	les were donated the equal number of dresses?				
2)	Which grade ha	s donated fewer dresses, Grade 3 or Grade 4?				
3)	Three-fourth of t-shirts. How ma	the clothes donated by 5th grade students were any t-shirts did 5th grade students donate?				
4)	Which grade ha	s donated dresses fewer than 100?				

Have a go, GCSE Questions

4. The pictogram shows some information about DVDs.

The key is missing.



The total number of DVDs is 260 Work out the number of Sport DVDs.

[4]

Pie charts

A **pie chart** is a circular chart. It shows the proportion of each group at a glance. Remember that there are 360° in a circle so each group in the pie chart will be a proportion of 360°.

A survey of the number of people in 180 vehicles is taken. The results are in the table.

Number of people in a vehicle	Frequency
1	120
2	40
3	13
4	5
5 or more	2
Total	180

To draw a pie chart for this data, find the proportion of 360.

Number of people in vehicle	Frequency	Calculation	Angle
1 person	120	$\frac{120}{180} \times 360^{\circ}$	240°
2 people	40	$\frac{40}{180} \times 360^{\circ}$	80°
3 people	13	$\frac{13}{180} \times 360^{\circ}$	26°
4 people	5	$\frac{5}{180} \times 360^{\circ}$	10°
5 or more	2	$\frac{2}{180} \times 360^{\circ}$	4°
Total	180		



Use a protractor to measure each angle and a compass to draw the circle.

You can apply number sense here. If one category is more than half of your data, then you know that category is going to take up more than half of your pie chart.

1. Cambury Council asked 60 customers what they thought of the local leisure centre.

The results are shown in this bar chart.



Draw and label a pie chart to represent this data.

