

Essential Knowledge Milestones	Teaching Points
<ul style="list-style-type: none"> <li>Understand how to calculate the mean, mode and median from raw data, frequency tables and grouped frequency tables</li> <li>Understand how to calculate measures of location like percentiles and deciles from raw data, frequency tables and grouped frequency tables</li> <li>Understand how to calculate measures of spread like Range, interquartile range and interpercentile range from raw data, frequency tables and grouped frequency tables</li> <li>Understand how to calculate variance and standard deviation</li> <li>Understand and use coding</li> </ul>	<ul style="list-style-type: none"> <li>The calculation of the mean, median and mode should be recapped from GCSE however the focus now is on students using calculators to do the calculations. Check understanding of the terminology and teach calculator methods.</li> <li>Students require an understanding of measures of variation too and should be able to use their calculators to calculate the variance and standard deviation. They should be able to use the statistic <math>S_{xx} = \sum (x - \bar{x})^2 = \sum x^2 - \frac{(\sum x)^2}{n}</math>. Students are expected to use standard deviation <math>= \sqrt{\frac{S_{xx}}{n}}</math> but equivalents including spreadsheet formula (<math>s = \sqrt{\frac{S_{xx}}{n-1}}</math>) will be accepted. If time allows, there are some good investigation sheets to support finding these and why the calculations make sense and provide context. Ensure that students are happy to write down the appropriate formula, summary statistics and values. Although calculator work is encouraged, we want the method marks too.</li> <li>I have created a sheet to stimulate arguments around the best average to use and why particular groups of people may use particular statistics to justify their own rhetoric</li> <li>The data may be discrete or continuous, grouped or ungrouped, and students need to be able to interpret these summary statistics clearly and be able to make inferences from them. Significance tests will not be expected.</li> <li>It is hugely important to discuss the various ways that grouped data can be displayed. The idea of 'closing that gap' is vital to calculations where classes in tables don't overlap.</li> <li>Coding for both mean and standard deviation needs to be covered. Be clear that students need to be able to uncode both mean and standard deviation. Emphasise that the standard deviation is unaffected by the addition or subtraction of constants.</li> <li>Students are expected to be able to use linear interpolation to calculate percentiles from grouped data.</li> <li>I would encourage the use of spreadsheets for coding. Data can easily be manipulated with the spreadsheet changing means and sd instantly to draw conclusions.</li> <li>As with all applied maths, it is important to always consider the data that is being presented and whether conclusions are reasonable and appropriate.</li> </ul>
<p><b>Success Criteria</b></p>	
<ul style="list-style-type: none"> <li>Be able to calculate the mean, mode, median, range, interquartile range, interpercentile range variance and standard deviation in a variety of contexts</li> <li>Understand the advantages and disadvantages of these techniques</li> <li>Know how to adapt the techniques and methods if the data is raw, grouped, discrete or continuous</li> <li>Know how to use your calculator and formula book to support your work</li> <li>Can code/decode the data and can explain the benefits</li> </ul>	
<p><b>Assumed Prior Knowledge/ Links / Interleaving</b></p>	
<p><b>GCSE (9-1) in Mathematics at Higher Tier</b></p> <ul style="list-style-type: none"> <li>S4 Interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers), quartiles and inter-quartile range</li> </ul>	

Potential Barriers to Access /Misconceptions		Opportunities for Reasoning/Problem Solving/Proofs	
<ul style="list-style-type: none"> <li>When calculating the mean, of grouped data some student may divide by the number of groups rather than the number of items of data, they may also use class widths in the calculation rather than the mid-points. As always, check for reasonable answers!</li> <li>When finding the standard deviation, the most common error is forgetting to take the square root (perhaps because they are not clear about the difference between variance and standard deviation). Some students waste time by ignoring given values and recalculating <math>\Sigma fx</math> and <math>\Sigma fx^2</math>.</li> <li>Difficulties with coding are due to a lack of understanding about how coding affects the mean and standard deviation, and poor algebraic skills. Students sometimes substitute for the wrong variable, fail to solve equations correctly or get the order of operations the wrong way around. This is why modelling many scenarios and drawing conclusions themselves is a good approach.</li> <li>Students should be reminded that they must be precise in their use of language and use the correct terms such as 'median', 'range' or 'inter-quartile range' rather than the more general 'average' and 'spread'. Students should also remember to use accurate values throughout calculations to avoid losing marks due to premature rounding.</li> </ul>		<ul style="list-style-type: none"> <li>There is opportunity for further use of the large data set here. Summary statistics of elements from the data set can be calculated and then used to compare and interpret for both location and variation statistics.</li> <li>Ask students to complete the 'calculate the standard deviation' sheet. It will provide some context as to why the measure works rather than just giving them a formula. It also explores the two versions of the formula.</li> <li>Coding is a nice opportunity to explore and model themselves. Use the 'apply coding to a set of data' sheet to help.</li> </ul>	
<b>Key Mathematical Vocabulary</b>	Continuous random variable, interpolation, extrapolation, mean, median, mode, variance, standard deviation, range, interquartile range, interpercentile range		
<b>Personal Development</b>		<b>Notes</b>	<b>Resources</b>
<p>Pupils are taught that they must 'respect' each other's opinions and well-being when working collectively in class. Pupils to learn that mathematicians have 'ambition' to push boundaries when aiming to solve new problems</p> <p><b>Resilience</b> – never giving up! Building confidence across the problem solving aspects of the course.</p> <p><b>Ambition</b> – living life to the full – fulfilling dreams and aspirations – linking to future career and ambition plans.</p> <p><b>Respect</b> – respect for others – the 9 protected characteristics</p> <p><b>Personal Best</b> – First Work – Best Work every time</p>			<ul style="list-style-type: none"> <li>GCSE problem solving questions</li> <li>Choosing the best average in context</li> <li>Quick coding quiz</li> <li>Standard deviation investigation</li> </ul>