Subject Area: AQA Level 3 Mathematical Studies (Core Maths)

Curriculum Intent: We endeavour to develop understanding of mathematical processes in a way that promotes critical thinking, confidence, fosters enjoyment and cultivates life-ready, rational decision-makers. We instil precise mathematical language necessary to construct conjectures or inferences through a coherent line of reasoning and with a pervasive recognition that different areas of mathematics are connected. We utilise mathematical modelling to blur the distinction between abstract and practical modes of thought.

Dates	Content	Assessment	Rationale
1 and 2	<u>Introduction to Spreadsheets</u> It is expected that spreadsheets and tables will be used throughout the teaching and learning of this Mathematical Studies specification. Spreadsheet formulae will include: "=A1+A2+A3" to sum values in cells "=2*B3" to multiply a value in a given cell "= SUM (A1:A10)" • F1.1: substituting numerical values into spreadsheets. <u>Types of Data and Collecting Data</u> • D1.1: appreciating the difference between qualitative and quantitative data; • D1.2: appreciating the difference between primary and secondary data (including the use of secondary data that has been processed e.g. grouped); • D1.3: collecting quantitative and qualitative primary and secondary data. <u>Numerical Calculations</u> • E1.1: The modelling cycle: representing a situation mathematically, making assumptions and simplifications; • E1.2: selecting and using appropriate mathematical techniques for problems and situations; • E1.3: interpreting results in the context of the given problem • E1.4: evaluating methods and situations including how they may have been affected by assumptions made; • F1.1: substituting numerical values into formulae; • F1.2: using conventional notation for priority of operations, including brackets, powers, roots and reciprocals. PS/CV's: Teachers model and uphold the professional standards to promote similar behaviours in the student body. This imbibes wisdom and self-restraint as a guiding mechanism towards long-term good habits. <u>Percentages</u> • F2.1: interpreting percentages and percentage changes as a fraction or a decimal and interpreting these multiplicatively • F2.2: expressing one quantity as a percentage of another • F2.3: comparing two quantities using percentages • F2.4: working with percentages over 100% • F2.5: solving problems involving percentage change: • including percentage increase/decrease and original value problems including simple and compound interest; <u>Fermi Estimation</u> • E2.1: Fermi estimation - making fast, rough estimates using quantities which are either difficult or impossible to measure directly; • F1.1: substituting numerical values into financial expressions (including bank accounts); • F1.2: finding approximate solutions to problems in financial contexts;	<u>Progress Checks</u>: PC1 PC2 Weekly Fluency Check Weekly Spaced Retrieval worksheets	Revision of GCSE content is necessary to scaffold some of the new ideas that will be introduced. 75% of Core Maths is adapted from GCSE content while 25% is similar to the current AS (Year 1) in the A level Mathematics course. The greatest overlap appears later when statistical ideas are introduced and the students can make good use of the ClassWiz calculator that we provide. We spend a bit of time looking at how data is collected and how the results can be represented. This is an excellent opportunity for students to develop critical thinking skills when discussing the utility of certain modes of data representation. Similarly, measures of central tendency and spread have pros and cons that must be understood if sensible conclusions are to be drawn. Stating assumptions and the limitations of the mathematical models used is an essential tool for any problem-solver. (This will be extended further when Fermi estimation is introduced). Percentages are a key component of the financial mathematics to be assessed on a weekly basis through spaced retrieval fluency checks, quizzes, independent study and in-class skills tasks.
	<u>Representing Data Numerically 1</u> • D3.1: calculating/identifying mean, median, mode from raw data; • D3.2: calculating/identifying quartiles, percentiles, range, interquartile range, standard deviation from raw data; • D3.3: interpreting these numerical measures and reaching conclusions based on these measures; <u>Representing Data Diagrammatically 1</u> • D4.1: deconstructing and interpreting diagrams for grouped discrete data and continuous data and know their appropriate use: - box and whisker plots; - stem-and-leaf diagrams (including back-to-back). CEIAG: You will learn practical mathematical skills that will also help you with your other A-Level subjects, in particular: sciences, geography, business studies, psychology, and economics. <u>Representing Data Diagrammatically 2</u> • D4.1: constructing and interpreting diagrams for grouped discrete data and continuous data and know their appropriate use: - histograms with equal and unequal class intervals; - cumulative frequency graphs. <u>Representing Data Numerically 2</u> • D3.1: calculating/identifying mean, median, mode from cumulative frequency diagrams, stem and leaf diagrams or boxplots; • D3.1: calculating/identifying quartiles, percentiles, range, IQR, standard deviation from cum. Freq. diagrams, stem and leaf diagrams or boxplots; • D3.2: interpreting these numerical measures and reaching conclusions based on these measures; • E1.2: selecting and using appropriate mathematical techniques for problems and situations. <u>Collecting and Sampling Data</u> • D2.2: appreciating the strengths and limitations of random, cluster, stratified and quota sampling methods and applying this understanding when designing sampling strategies; • D2.2: appreciating that improving accuracy by removing bias and increasing sample size may cost/save both time and money; • D2.2: inferring properties of populations or distributions from a sample, whilst knowing the limitations of sampling. <u>Perimeter, Circumference & Area</u> - knowledge and use of the perimeter of 2D shapes and their areas; - knowledge and use of the formulae for the circumference and the area of circle; - knowledge and use of the formulae for calculating fractional areas of circles and composite shapes. <u>Similarity & Pythagoras' Theorem</u> • The application of the concepts of similarity including lengths in similar figures; • Pythagoras' theorem applied to 2-D figures;	<u>Progress Checks:</u> PC3 PC4 PC5 Weekly Fluency Check Weekly Spaced Retrieval worksheets CEIAG: Only 20% of students study maths beyond GCSE in the UK – one of the lowest rates in leading developed countries in the world! In Japan, this figure is 85%. This gives Core Maths and A-level Maths students a huge advantage in the UK.	Given that this course explores mostly real-world applications of GCSE topics, there is ample opportunity to provide much-needed context to many of the skills cultivated in prior learning or in other disciplines such as geography or psychology. Rather than providing reams of revision material as a precursor to learning some new applications of mathematics, the prior learning that demands a recap will be woven into the new ideas and embedded through spaced retrieval and synoptic testing as the course progresses.

	• Similarity & Pythagoras' Theorem (continued) • Pythagoras' theorem applied to 3-D figures. <u>Analyse Critically</u> • C3.2: critical analysis of data quoted in media, political campaigns, marketing etc; - questions will concentrate on the analysis of numerical and graphical data; - numerical data will normally be given in tabular or spreadsheet form; • E1.1: The modelling cycle: - representing a situation mathematically, making assumptions and simplifications; • E1.2: selecting and using appropriate mathematical techniques for problems and situations; • E1.3: interpreting results in the context of the given problem; • E1.4: evaluating methods and situations including how they may have been affected by assumptions made. <u>Repayments and Credit</u> • F4.1: student loans and mortgages; • E1.2: Annual Percentage Rate (APR). <u>Interest Rates</u> • F3.1: simple and compound interest; • F3.1: Annual Equivalent Rate (AER); • F3.2: savings and investments; • E1.2: selecting and using appropriate mathematical techniques for problems and situations. <u>Solutions to Financial Problems</u> • F7.1: the effect of inflation; • F7.1: Retail Price Index (RPI), Consumer Price Index (CPI); • F7.2: setting up, solving and interpreting the solutions to financial problems, including those that involve compound interest using iterative methods; • F7.3: currency exchange rates including commission; • F7.4: budgeting; • E1.2: selecting and using appropriate mathematical techniques for problems and situations. <u>Taxation: VAT and Income tax and National Insurance</u> • F6.1: Taxation: income tax, National Insurance; • E2.1: selecting and using appropriate mathematical techniques for problems and situations.	CEIAG: Many roles in today's workplace require high levels of budget management and problem-solving skills; Core Maths will equip you with these skills. CEIAG: Universities have already come out in strong support of Core Maths qualifications; even subjects like history now recognise the importance of statistics and problem-solving skills learned studying Core Maths.	<u>Progress Checks:</u> PC5 Weekly Fluency Check Weekly Spaced Retrieval worksheets	PS/CV's: Core Maths (just like any other qualification in mathematics) will make heavy demands on your commitment, time-management, patience and perseverance. The skills you imbibe through the rigor of mathematical reasoning will allow you to make, better, objective and rational decisions in the future. Your learning could be put to important use in a variety of fields and will even help you in your personal lives. Financial calculations will be fed directly from pay-day-loan websites and mortgage brokers to firmly plant these skills in a real-life setting. Students can also refer to their own payslips and use data from their own households to enrich the ideas presented in the classroom and tailor the course to their own situation. CEIAG: Employers are keenly looking for potential employees with strong critical thinking skills. The ability to rationalise a situation and use reasoning to solve problems will draw upon your critical thinking and analysis skills on a daily basis. This is applicable to a huge range of professions where some degree of responsibility is placed upon you.
3 and 4	**STATISTICS:** <u>Correlation and regression</u> • S7.1: recognising when pairs of data are uncorrelated, correlated, strongly correlated, positively correlated and negatively correlated; • S7.2: appreciating that correlation does not necessarily imply causation; • S8.1: understanding the idea of an outlier; • S8.1: understanding that the strength of correlation is given by the pmcc; • S8.2: understanding that pmcc always has a value in the range from – 1 to + 1; • S8.3: appreciating the significance of a positive, zero or negative value of pmcc in terms of correlation of data; • S9.1: the plotting of data pairs on scatter diagrams and the drawing, by eye, of a line of best fit through the mean point (the idea of residuals will not be required); • S9.2: understanding the concept of a regression line; • S9.3: plotting a regression line from its equation; • S9.4: using interpolation with regression lines to make predictions; • S9.5: understanding that there are problems concerning extrapolation; • S10.1: where raw data is given, candidates will be expected to use a calculator to calculate the pmcc and the equation of the regression line (calculations from grouped data will not be required); • C1.1: presenting logical and reasoned arguments in context; • C1.1: criticising the arguments of others; • C1.1: communicating mathematical approaches and solutions. <u>Probabilities and estimation</u> • S4.1: understand what is meant by the term 'population' in statistical terms; • S4.2: developing ideas of sampling to include the concept of a simple random sample from a population; • S5.1: knowing that the mean of a sample is called a 'point estimate' for the mean of the population appreciating that accuracy is likely to be improved by increasing the sample size; • S6.1: confidence intervals for the mean of a normally distributed population of known variance using σ2/n; (confidence intervals will always be symmetrical; the confidence level required and the sample size will always be stated); • C1: presenting logical and reasoned arguments in context; • C1: criticising the arguments of others; • C1: communicating mathematical approaches and solutions. <u>The Normal Distribution</u> • S1.1: knowledge that this is a symmetrical distribution and that the area S1.1: underneath the knowledge that approximately 2/3 rds of observations lie within 1 standard deviation of the mean and that approximately 95% of observations lie within 2 standard deviations of the mean normal 'bell' shaped curve represents probability; • S2.1: use of the notation N(0, 1) for the standardised normal distribution with mean = 0 and standard deviation = 1 • S3.1: using a calculator or tables to find probabilities for normally distributed data with mean = 0 and standard deviation = 1 • S3.1: using a calculator or tables to find probabilities for normally distributed data with known mean and standard deviation (the finding of an unknown mean or standard deviation by making use of percentage points will not be required) • C1.1: presenting logical and reasoned arguments in context • C1.1: criticising the arguments of others • C2.1: communicating mathematical approaches and solutions		PS/CV's: An underlying theme in the financial component of this course is the care needed to manage finances, particularly debt, in a way that is not detrimental to you or your loved ones. This course teaches you to be cautious and realistic when money matters inevitably test your resolve. Students will be provided with a ClassWiz calculator to carry out some of the more complex statistical calculations such as the pmcc. They will learn the significance of each measure and the implications within several real-world scenarios. Again, students can submit their own data: such as their birth weight and head circumference as an example of linear regression. CEIAG: "The Core Maths qualification gives students the opportunity to maintain and develop everyday maths skills that will be really useful to them both at university and when they start work." -Dr Deidre Hughes OBE, chair of the National Careers Council, England PS/CV's: The knowledge you gain will make you not just an ambassador for TSFA but you should feel obliged to share what you learn with friends and relatives. You may inspire people to plan sensibly for the future rather than being impulsive, or you may help someone think more critically, rather than jumping to conclusions or making decisions based purely on emotion.