Mathematics Standard and Mathematics Advanced

Year 11 and Year 12 Common Content

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This document is designed to assist teachers in programming appropriate sequences of learning for students studying the Mathematics Standard and Mathematics Advanced Year 11 and Year 12 courses.

Sequencing in Mathematics

Learning in mathematics is sequential. Teachers need to ensure that they program in an appropriate order those topics that contain the knowledge, skills and understanding that are prerequisite to the study of other topics.

Scope and Sequence

The creation of a scope and sequence is an important step in the design of effective teaching and learning programs within a course. A scope and sequence provides an overview of the placement, sequence and duration of units of work.

There is no predetermined order in which the content of the Mathematics Standard Year 11 course, the Mathematics Standard 1 Year 12 course and the Mathematics 2 Year 12 course should be taught. This flexibility supports different programming arrangements to suit the requirements of different schools and classes of students. Similarly there is no predetermined order in which the Mathematics Advanced Year 11 course or Mathematics Advanced Year 12 course should be taught.

Sample scope and sequences can be found as part of the Support Materials provided for the syllabuses. The sample scope and sequences indicate some of the ways in which units of work may be grouped to form teaching sequences and different ways of ordering the units of work within a school's teaching and learning program.

The scope and sequences indicate some periods for school assessment. These periods vary from school to school in terms of both location and duration, and do not imply any specific number of tasks or type of assessment task. Decisions about the number, timing and type of assessment tasks are made at the school level.

Common Content

As part of the stronger HSC standards, NESA is researching options for a common scale in mathematics marking to allow comparison of students doing easier or harder courses. Placing mathematics courses on a common scale would act as a disincentive for capable students who deliberately choose easier courses for a perceived ATAR advantage.

The common scale would allow better recognition of student efforts and encourage them to take a mathematics course that better suits their ability.

For mathematics courses to be marked on a common scale in future HSC examinations there needs to be common material in adjacent courses. Within the Mathematics Standard and the Mathematics Advanced syllabus documents the symbol 📎 is used to indicate opportunities for examination of common content across these courses.

Common Content Table 1 summarises the common material across Year 11 and Year 12 in Mathematics Standard and Mathematics Advanced. In this table, the corresponding subtopics of work from within topics are identified.

Common Content Table 2 lists the explicit content statements in corresponding topics and subtopics.

In many instances the symbol 📎 will identify precisely the same content statement that is present across the syllabuses. However there are also instances where the content statement from the Mathematics Advanced syllabus is identified as common content but also has added levels of sophistication or complexity attached to it. In such cases teachers should refer to the Mathematics Standard content statement to determine the level required.

Common content occurs across both Year 11 and Year 12. The Mathematics Standard Year 11 course is assumed knowledge for the Mathematics Standard 1 Year 12 and Mathematics Standard 2 Year 12 courses and may be assessed in the HSC. Similarly, the Mathematics Advanced Year 11 course is assumed knowledge for the Mathematics Advanced Year 12 course and may be assessed in the HSC.

Common Content Table 1 – Corresponding subtopics

Topics	**Year 11**		**Year 12**		
	Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
▪ Algebra (MS) ▪ Functions (MA) ▪ Exponential and Logarithmic Functions (MA)	MS-A2	MA-F1 MA-E1	MS-A3	MS-A4	MA-F2
▪ Financial Mathematics (MS; MA)			MS-F2 MS-F3	MS-F4 MS-F5	MA-M1
▪ Measurement (MS) ▪ Calculus (MA)	MS-M1				MA-C4
▪ Measurement (MS) ▪ Trigonometric Functions (MA)		MA-T1	MS-M3	MS-M6	
▪ Statistical Analysis (MS; MA)	MS-S1		MS-S3	MS-S4	MA-S2
	MS-S2	MA-S1			
				MS-S5	MA-S3

Common Content Table 2 – Corresponding content statements

Topics: Mathematics Standard: Algebra **Mathematics Advanced: Functions; Exponential and Logarithmic Functions**

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
MS-A2 • model, analyse and solve problems involving linear relationships, including constructing a straight-line graph and interpreting features of a straight-line graph, including the gradient and intercepts **AAM** ◊ – recognise that a direct variation relationship produces a straight-line graph – determine a direct variation relationship from a written description, a straight-line graph passing through the origin, or a linear function in the form $y = mx$ – review the linear function $y = mx + c$ and understand the geometrical significance of m and c – recognise the gradient of a direct variation graph as the constant of variation **AAM** – construct straight-line graphs both with and without the aid of technology (ACMGM040) • construct and analyse a linear model, graphically or algebraically, to solve practical direct variation problems, including but not limited to the cost of filling a car with fuel or a currency conversion graph **AAM** ◊ – identify and evaluate the limitations of a linear model in a practical context	**MA-F1** • model, analyse and solve problems involving linear functions **AAM** – recognise that a direct variation relationship produces a straight-line graph – explain the geometrical significance of m and c in the equation $f(x) = mx + c$ • model, analyse and solve problems involving quadratic functions **AAM** – recognise features of the graph of a quadratic, including its parabolic nature, turning point, axis of symmetry and intercepts (ACMMM007) • solve practical problems involving a pair of simultaneous linear and/or quadratic functions algebraically and graphically, with or without the aid of technology; for example determining and interpreting the break-even point of a simple business problem **AAM** • recognise that functions of the form $f(x) = \frac{k}{x}$ represent inverse variation, identify the hyperbolic shape of their graphs and identify their asymptotes **AAM** **MA-E1** • recognise and sketch the graphs of $y = a^x, y = a^{-x}$ and $y = \log_a x$ • graph an exponential function of the form $y = a^x$ for $a > 0$ and its transformations $y = ka^x + c$ and $y = ka^{x+c}$ where k and c are constants – interpret the meaning of the intercepts of an exponential graph and explain the circumstances in which these do not exist solve problems involving exponential functions in a variety of practical and	**MS-A3** • solve a pair of simultaneous linear equations graphically, by finding the point of intersection between two straight-line graphs, using technology • develop a pair of simultaneous linear equations to model a practical situation **AAM** • solve practical problems that involve finding the point of intersection of two straight-line graphs, for example determine and interpret the break-even point of a simple business problem where cost and revenue are represented by linear equations **AAM** • determine the best model (linear or exponential) to approximate a graph by considering its shape, using technology where appropriate **AAM**	**MS-A4** • solve a pair of simultaneous linear equations graphically, by finding the point of intersection between two straight-line graphs, using technology • develop a pair of simultaneous linear equations to model a practical situation **AAM** • solve practical problems that involve finding the point of intersection of two straight-line graphs, for example determine and interpret the break-even point of a simple business problem where cost and revenue are represented by linear equations **AAM** • use an exponential model to solve problems **AAM** – graph and recognise an exponential function in the form $y = a^x$ and $y = a^{-x}$ $(a > 0)$ using technology – interpret the meaning of the intercepts of an exponential graph in a variety of contexts – construct and analyse an exponential model to solve a practical growth or decay problem • construct and analyse a quadratic model to solve practical problems involving quadratic functions or expressions of the form $y = ax^2 + bx + c$, for example braking distance against speed **AAM** – recognise the shape of a parabola and that it always has a turning point and an axis of symmetry – graph a quadratic function using technology – interpret the turning point and intercepts of a parabola in a practical context – consider the range of values for x and y for which the quadratic model makes sense in a practical context • recognise that reciprocal functions of the	**MA-F2** • use graphical methods with supporting algebraic working to solve a variety of practical problems involving any of the functions within the scope of this syllabus, in both real life and abstract contexts **AAM** – select and use an appropriate method to graph a given function including finding intercepts, considering the sign of $f(x)$ and using symmetry – determine asymptotes and discontinuities where appropriate (vertical and horizontal asymptotes only) – determine the number of solutions of an equation by considering appropriate graphs

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
	abstract contexts, using technology, and algebraically in simple cases (ACMMM067) **AAM**		form $y = \frac{k}{x}$, where k is a constant, represent inverse variation, identify the rectangular hyperbolic shape of these graphs and their important features **AAM** – use a reciprocal model to solve practical inverse variation problems algebraically and graphically, eg the amount of pizza received when sharing a pizza between increasing numbers of people	

Topics: Mathematics Standard: Measurement **Mathematics Advanced: Calculus**

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
MS-M1 • calculate perimeters and areas of irregularly shaped blocks of land by dissection into regular shapes including triangles and trapezia **AAM** – derive the Trapezoidal rule for a single application, $A \approx \frac{h}{2}(d_f + d_l)$ – use the Trapezoidal rule to solve a variety of practical problems				**MA-C4** • determine the approximate area under a curve using a variety of shapes including squares, rectangles (inner and outer rectangles), triangles or trapezia • use the trapezoidal rule to estimate areas under curves **AAM**

Topics: Mathematics Standard: Measurement **Mathematics Advanced: Trigonometric Functions**

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
	MA-T1 • use the sine, cosine and tangent ratios to solve problems involving right-angled triangles where angles are measured in degrees, or degrees and minutes • establish and use the sine rule, cosine rule and the area of a triangle formula for solving problems where angles are measured in degrees, or degrees and minutes **AAM** • solve problems involving the use of trigonometry in two and three dimensions **AAM** – interpret information about a two or	**MS-M3** • review the application of Pythagoras' theorem to solve practical problems in two dimensions **AAM** • review and extend the use of trigonometric ratios (sin, cos, tan) to solve practical problems **AAM** – work with angles correct to the nearest degree and/or minute • solve practical problems involving angles of elevation and depression and bearings **AAM** – convert between compass and true	**MS-M6** • review and use the trigonometric ratios to find the length of an unknown side or the size of an unknown angle in a right-angled triangle **AAM** • determine the area of any triangle, given two sides and an included angle, by using the rule $A = \frac{1}{2}ab\sin C$, and solve related practical problems **AAM** • solve problems involving non-right-angled triangles using the sine rule, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ (ambiguous case excluded) and the cosine rule,	

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
	three-dimensional context given in diagrammatic or written form and construct diagrams where required ● solve practical problems involving Pythagoras' theorem and the trigonometry of triangles, which may involve the ambiguous case, including but not limited to finding and using angles of elevation and depression and the use of true bearings and compass bearings in navigation **AAM**	bearings, eg convert N35°W into a true bearing	$c^2 = a^2 + b^2 - 2ab\cos C$ **AAM** ● solve practical problems involving Pythagoras' theorem, the trigonometry of right-angled and non-right angled triangles, angles of elevation and depression and the use of true bearings and compass bearings **AAM** – work with angles correct to the nearest degree and/or minute	

Topics: Mathematics Standard: Financial Mathematics **Mathematics Advanced: Financial Mathematics**

Year 12		
Standard 1	**Standard 2**	**Advanced**
MS-F2 ● calculate the future value (FV) or present value (PV) and the interest rate (r) of a compound interest investment using the formula $FV = PV(1+r)^n$ – compare the growth of simple interest and compound interest investments numerically and graphically, using technology – investigate the effect of varying the interest rate, the term or the compounding period on the future value of an investment, using technology – compare and contrast different investment strategies performing appropriate calculations when needed ● solve practical problems involving compounding, for example determine the impact of inflation on prices and wages or calculate the appreciated value of items, for example antiques **AAM** **MS-F3** ● calculate the depreciation of an asset using the declining-balance method using the formula $S = V_0(1-r)^n$, where S is the salvage value of the asset after n periods, V_0 is the initial value of the asset, r is the depreciation rate per period, expressed as a decimal, and n is the number of periods, and realise that this is the compound interest formula, with a negative value for r **AAM** – use technology to investigate depreciating values, numerically and graphically ● recognise a reducing balance loan as a compound interest loan with periodic repayments and use a spreadsheet to model a reducing balance loan – recognise that a smaller or additional repayment may affect the term and cost of your loan – use an online calculator to investigate the effect of the interest rate,	**MS-F4** ● calculate the future value (FV) or present value (PV) and the interest rate (r) of a compound interest investment using the formula $FV = PV(1+r)^n$ – compare the growth of simple interest and compound interest investments numerically and graphically, linking graphs to linear and exponential modelling using technology – investigate the effect of varying the interest rate, the term or the compounding period on the future value of an investment, using technology – compare and contrast different investment strategies performing appropriate calculations when needed ● solve practical problems involving compounding, for example determine the impact of inflation on prices and wages **AAM** ● calculate the depreciation of an asset using the declining-balance method using the formula $S = V_0(1-r)^n$, where S is the salvage value of the asset after n periods, V_0 is the initial value of the asset, r is the depreciation rate per period, expressed as a decimal, and n is the number of periods, as an application of the compound interest formula **AAM** ● solve practical problems involving reducing balance loans, for example determining the total loan amount and monthly repayments **AAM** **MS-F5** ● solve compound interest related problems involving financial decisions, for example a home loan, a savings account, a car loan or an annuity **AAM** – identify an annuity as an investment account with regular, equal contributions and interest compounding at the end of each period, or as a single sum investment from which regular, equal withdrawals are made	**MA-M1** ● solve compound interest problems involving financial decisions, including but not limited to a home loan, a savings account, a car loan or superannuation **AAM** – identify an annuity (present or future value) as an investment account with regular, equal contributions and interest compounding at the end of each period, or a single-sum investment from which regular, equal withdrawals are made – use technology to model an annuity as a recurrence relation and investigate (numerically or graphically) the effect of varying the interest rate or the amount and frequency of each contribution or a withdrawal on the duration and/or future or present value of the annuity – use a table of future value interest factors to perform annuity calculations, eg calculating the future value of an annuity, the contribution amount required to achieve a given future value or the single sum that would produce the same future value as a given annuity ● use geometric sequences to model and analyse practical problems involving exponential growth and decay (ACMMM076) **AAM** – calculate the effective annual rate of interest and use results to compare investment returns and cost of loans when interest is paid or charged daily, monthly, quarterly or six-monthly (ACMGM095) – solve problems involving compound interest loans or investments, eg determining the future value of an investment or loan, the number of compounding periods for an investment to exceed a given value and/or the interest rate needed for an investment to exceed a given value (ACMGM096) – recognise a reducing balance loan as a compound interest loan with periodic repayments, and solve problems including the amount owing

Year 12		
Standard 1	**Standard 2**	**Advanced**
the repayment amount or the making of an additional lump-sum payment, on the time taken to repay a loan	– using technology, model an annuity as a recurrence relation, and investigate (numerically or graphically) the effect of varying the amount and frequency of each contribution, the interest rate or the payment amount on the duration and/or future value of the annuity – use a table of future value interest factors to perform annuity calculations, eg calculating the future value of an annuity, the contribution amount required to achieve a given future value or the single sum that would produce the same future value as a given annuity	on a reducing balance loan after each payment is made ● solve problems involving financial decisions, including but not limited to a home loan, a savings account, a car loan or superannuation **AAM**

Topics: Mathematics Standard: Statistical Analysis **Mathematics Advanced: Statistical Analysis**

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
MS-S1 ● classify data relating to a single random variable ◊ – classify a categorical variable as either ordinal, eg income level (low, medium, high) or nominal, for example place of birth (Australia, overseas) – classify a numerical variable as either discrete, eg the number of rooms in a house, or continuous, eg the temperature in degrees Celsius ● review how to organise and display data into appropriate tabular and/or graphical representations **AAM** ◊ – display categorical data in tables and, as appropriate, in both bar charts or Pareto charts – display numerical data as frequency distribution tables and histograms, cumulative frequency distribution tables and graphs, dot plots and stem and leaf plots (including back-to-back where comparing two datasets) – construct and interpret tables and graphs related to real-world contexts, including but not limited to: motor vehicle safety including driver behaviour, accident statistics, blood alcohol content over time, running costs of a motor vehicle, costs of purchase and insurance, vehicle		**MS-S3** ● understand and use the statistical investigation process: identifying a problem and posing a statistical question, collecting or obtaining data, representing and analysing that data, then communicating and interpreting findings – identify the target population to be represented (ACMEM132) – investigate questionnaire design principles, eg simple language, unambiguous questions, consideration of number of choices, how data may be analysed to address the original question, issues of privacy and bias, ethics, and responsiveness to diverse groups and cultures **AAM** – implement the statistical investigation process to answer questions that involve comparing the data across two or more groups ● construct a bivariate scatterplot to identify patterns in the data that suggest the presence of an association (ACMGM052) **AAM** ● use bivariate scatterplots (constructing them when needed) to describe the patterns, features and associations of bivariate datasets, justifying any conclusions **AAM** – describe bivariate datasets in terms	**MS-S4** ● construct a bivariate scatterplot to identify patterns in the data that suggest the presence of an association (ACMGM052) **AAM** ● use bivariate scatterplots (constructing them when needed) to describe the patterns, features and associations of bivariate datasets, justifying any conclusions **AAM** – describe bivariate datasets in terms of form (linear/non-linear) and, in the case of linear, the direction (positive/negative) and strength of any association (strong/moderate/weak) – identify the dependent and independent variables within bivariate datasets where appropriate – describe and interpret a variety of bivariate datasets involving two numerical variables using real-world examples from the media or freely available from government or business datasets – calculate and interpret Pearson's correlation coefficient (r) using technology to quantify the strength of a linear association of a sample (ACMGM054) ● model a linear relationship by fitting an appropriate line of best fit to a scatterplot	**MA-S2** ● classify data relating to a single random variable ● organise, interpret and display data into appropriate tabular and/or graphical representations including but not limited to Pareto charts, cumulative frequency distribution tables or graphs, parallel box-plots and two-way tables **AAM** – compare the suitability of different methods of data presentation in real-world contexts (ACMEM048) ● summarise and interpret grouped and ungrouped data through appropriate graphs and summary statistics **AAM** ● calculate measures of central tendency and spread and investigate their suitability in real-world contexts and use to compare large datasets – investigate real-world examples from the media illustrating appropriate and inappropriate uses or misuses of measures of central tendency and spread (ACMEM056) **AAM** ● identify outliers and investigate and describe the effect of outliers on summary statistics – use different approaches for identifying outliers, for example consideration of the distance from the mean or median, or the use of below $Q_1 - 1.5 \times IQR$ and above

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
depreciation, rainfall graphs, hourly temperature, household and personal water usage • interpret and compare data by considering it in tabular and/or graphical representations **AAM** ◊ – choose appropriate tabular and/or graphical representations to enable comparisons – compare the suitability of different methods of data presentation in real-world contexts, including their visual appeal, eg a heat map to illustrate climate change data or the median house prices across suburbs • summarise and interpret grouped and ungrouped data through appropriate graphs and summary statistics **AAM** ◊ – discuss the mode and determine where possible – calculate measures of central tendency, including the arithmetic mean and the median (ACMEM050) – investigate the suitability of measures of central tendency in real-world contexts and use them to compare datasets – calculate measures of spread including the range, quantiles (including but not limited to quartiles, deciles and percentiles), interquartile range (IQR) and standard deviation (calculations for standard deviation are only required by using technology) • investigate and describe the effect of outliers on summary statistics ◊ – use different approaches for identifying outliers, including consideration of the distance from the mean or median, or the use of $Q_1 - 1.5 \times IQR$ and $Q_3 + 1.5 \times IQR$ as criteria, recognising and justifying when each approach is appropriate – investigate and recognise the effect of outliers on the mean and median • investigate real-world examples from the		of form (linear/non-linear) and, in the case of linear, the direction (positive/negative) and strength of any association (strong/moderate/weak) – identify the dependent and independent variables within bivariate datasets where appropriate – describe and interpret a variety of bivariate datasets involving two numerical variables using real-world examples from the media, or freely available from government and business datasets • model a linear relationship to the data by fitting a line of best fit by eye and by using technology (ACMEM141, ACMEM142) **AAM** • use the line of best fit to make predictions by either interpolation or extrapolation (ACMEM145) **AAM** – recognise the limitations of interpolation and extrapolation (ACMEM146)	and using it to describe and quantify associations **AAM** – fit a line of best fit both by eye and by using technology to the data (ACMEM141, ACMEM142) – fit a least-squares regression line to the data using technology – interpret the intercept and gradient of the fitted line (ACMGM059) • use the appropriate line of best fit, both found by eye and by applying the equation, to make predictions by either interpolation or extrapolation – recognise the limitations of interpolation and extrapolation, and interpolate from plotted data to make predictions where appropriate (ACMGM062) • implement the statistical investigation process to answer questions that involve identifying, analysing and describing associations between two numerical variables **AAM** • construct, interpret and analyse scatterplots for bivariate numerical data in practical contexts **AAM** – demonstrate an awareness of issues of privacy and bias, ethics, and responsiveness to diverse groups and cultures when collecting and using data – investigate using biometric data obtained by measuring the body or by accessing published data from sources including government organisations, and determine if any associations exist between identified variables	$Q_3 + 1.5 \times IQR$ as criteria, recognising and justifying when each approach is appropriate – investigate and recognise the effect of outliers on the mean, median and standard deviation • describe, compare and interpret the distributions of graphical displays and/or numerical datasets and report findings in a systematic and concise manner **AAM** • construct a bivariate scatterplot to identify patterns in the data that suggest the presence of an association (ACMGM052) • use bivariate scatterplots (constructing them where needed), to describe the patterns, features and associations of bivariate datasets, justifying any conclusions **AAM** – describe bivariate datasets in terms of form (linear/non-linear) and in the case of linear, also the direction (positive/negative) and strength of association (strong/moderate/weak) – identify the dependent and independent variables within bivariate datasets where appropriate – describe and interpret a variety of bivariate datasets involving two numerical variables using real-world examples in the media or those freely available from government or business datasets • calculate and interpret Pearson's correlation coefficient (r) using technology to quantify the strength of a linear association of a sample (ACMGM054) • model a linear relationship by fitting an appropriate line of best fit to a scatterplot and using it to describe and quantify associations **AAM** – fit a line of best fit to the data by eye and using technology (ACMEM141, ACMEM142) – fit a least-squares regression line to

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
media illustrating appropriate and inappropriate uses or misuses of measures of central tendency and spread (ACMEM056) **AAM** • describe, compare and interpret the distributions of graphical displays and/or numerical datasets and report findings in a systematic and concise manner **AAM** ◊ – identify modality (unimodal, bimodal or multimodal) – identify shape (symmetric or positively or negatively skewed) – identify central tendency, spread and outliers, using and justifying appropriate criteria – calculate measures of central tendency or measures of spread where appropriate • construct and compare parallel box-plots **AAM** – complete a five-number summary for different datasets (ACMEM058) – compare groups in terms of central tendency (median), spread (IQR and range) and outliers (using appropriate criteria) – interpret and communicate the differences observed between parallel box-plots in the context of the data				the data using technology (ACMGM057) – interpret the intercept and gradient of the fitted line (ACMGM059) • use the appropriate line of best fit, both found by eye and by applying the equation of the fitted line, to make predictions by either interpolation or extrapolation **AAM** – distinguish between interpolation and extrapolation, recognising the limitations of using the fitted line to make predictions, and interpolate from plotted data to make predictions where appropriate • implement the statistical investigation process to answer questions by identifying, analysing and describing associations between two numeric variables **AAM** • construct, interpret and analyse scatterplots for bivariate numerical data in practical contexts **AAM** – demonstrate an awareness of issues of privacy and bias, ethics, and responsiveness to diverse groups and cultures when collecting and using data
MS-S2 • review, understand and use the language associated with theoretical probability and relative frequency ◊ – construct a sample space for an experiment and use it to determine the number of outcomes (ACMEM154) – review probability as a measure of the 'likely chance of occurrence' of an event (ACMMM052) – review the probability scale: $0 \leq P(A) \leq 1$ for each event A, with $P(A) = 0$ if A is an impossibility and $P(A) = 1$ if A is a certainty	**MA-S1** • understand and use the concepts and language associated with theoretical probability, relative frequency and the probability scale • solve problems involving simulations or trials of experiments in a variety of contexts **AAM** – identify factors that could complicate the simulation of real-world events (ACMEM153) – use relative frequencies obtained from data as point estimates of probabilities (ACMMM055) • use arrays and tree diagrams to			

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
(ACMMM053) • determine the probabilities associated with simple games and experiments ◊ – use the following definition of probability of an event where outcomes are equally likely: $P(\text{event}) = \frac{\text{number of favourable outcomes}}{\text{total number of outcomes}}$ – calculate the probability of the complement of an event using the relationship $P(\text{an event does not occur}) = 1 - P(\text{the event does occur}) = P(\overline{\text{the event does occur}}) = P(\text{event}^c)$ • use arrays and tree diagrams to determine the outcomes and probabilities for multi-stage experiments (ACMEM156) **AAM** – construct and use tree diagrams to establish the outcomes for a simple multi-stage event – use probability tree diagrams to solve problems involving two-stage events • solve problems involving simulations or trials of experiments in a variety of contexts **AAM** ◊ – perform simulations of experiments using technology (ACMEM150) – use relative frequency as an estimate of probability (ACMEM152) – recognise that an increasing number of trials produces relative frequencies that gradually become closer in value to the theoretical probability – identify factors that could complicate the simulation of real-world events (ACMEM153) • solve problems involving probability and/or relative frequency in a variety of contexts **AAM** – use existing known probabilities, or estimates based on relative frequencies to calculate expected frequency for a given sample or population, eg predicting, by	determine the outcomes and probabilities for multi-stage experiments (ACMEM156) **AAM** • use the rules: $P(\bar{A}) = 1 - P(A)$ and $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (ACMMM054) **AAM**			

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
calculation, the number of people of each blood type in a population given the percentage breakdowns – calculate the expected frequency of an event occurring using np where n represents the number of times an experiment is repeated, and on each of those times the probability that the event occurs is p				
			MS-S5 • recognise a random variable that is normally distributed, justifying their reasoning, and draw an appropriate 'bell-shaped' frequency distribution curve to represent it – identify that the mean and median are approximately equal for data arising from a random variable that is normally distributed • calculate the z-score (standardised score) corresponding to a particular value in a dataset **AAM** – use the formula $z = \frac{x-\bar{x}}{s}$, where $\bar{x}$ is the mean and s is the standard deviation – describe the z-score as the number of standard deviations a value lies above or below the mean – recognise that the set of z-scores for data arising from a random variable that is normally distributed has a mean of 0 and standard deviation of 1 • use calculated z-scores to compare scores from different datasets, for example comparing students' subject examination scores **AAM** • use collected data to illustrate that, for normally distributed random variables, approximately 68% of data will have z-scores between -1 and 1, approximately 95% of data will have z-scores between -2 and 2 and approximately 99.7% of data will have z-scores between -3 and 3 (known as the empirical rule) – apply the empirical rule to a variety of	**MA-S3** • identify the numerical and graphical properties of data that is normally distributed • understand and calculate the z-score (standardised score) corresponding to a particular value in a dataset **AAM** – use the formula $z = \frac{x-\mu}{\sigma}$, where μ is the mean and σ is the standard deviation – describe the z-score as the number of standard deviations a value lies above or below the mean • use z-scores to compare scores from different datasets, for example comparing students' subject examination scores **AAM** • use collected data to illustrate the empirical rules for normally distributed random variables – apply the empirical rule to a variety of problems • use z-scores to identify probabilities of events less or more extreme than a given event **AAM** • use z-scores to make judgements related to outcomes of a given event or sets of data **AAM**

Year 11		Year 12		
Standard	**Advanced**	**Standard 1**	**Standard 2**	**Advanced**
			problems – indicate by shading where results sit within the normal distribution, eg where the top 10% of data lies • use z-scores to identify probabilities of events less or more extreme than a given event **AAM** • use z-scores to make judgements related to outcomes of a given event or sets of data **AAM**	