## Perth Modern School rgb linear

**Programme and Course Outline**

**Year 11 Mathematics : Methods**

**Stages 1 & 2**

**This outline is subject to change!**

The program you have been issued references all objectives in the Australian Curriculum. The syllabus may be easily downloaded from the Schools Curriculum and Standards Authority (SCASA) website at (http://www.scsa.wa.edu.au/).

**UNIT Name of course:** Mathematics Methods

**Rationale**

Mathematics is the study of order, relation and pattern. From its origins in counting and measuring, it has evolved in highly sophisticated and elegant ways to become the language now used to describe much of the modern world. Statistics are concerned with collecting, analysing, modelling and interpreting data in order to investigate and understand real-world phenomena and solve problems in context. Together, mathematics and statistics provide a framework for thinking and a means of communication that is powerful, logical, concise and precise.

The major themes of the Mathematics Methods ATAR course are calculus and statistics. They include, as necessary prerequisites, studies of algebra, functions and their graphs, and probability. They are developed systematically, with increasing levels of sophistication and complexity. Calculus is essential for developing an understanding of the physical world because many of the laws of science are relationships involving rates of change. Statistics is used to describe and analyse phenomena involving uncertainty and variation. For these reasons, this course provides a foundation for further studies in disciplines in which mathematics and statistics have important roles. It is also advantageous for further studies in the health and social sciences. This course is designed for students whose future pathways may involve mathematics and statistics and their applications in a range of disciplines at the tertiary level.

**Aims**

The Mathematics Methods ATAR course aims to develop students’:

* understanding of concepts and techniques drawn from algebra, the study of functions, calculus, probability and statistics
* ability to solve applied problems using concepts and techniques drawn from algebra, functions, calculus, probability and statistics
* reasoning in mathematical and statistical contexts and interpretation of mathematical and statistical information, including ascertaining the reasonableness of solutions to problems
* capacity to communicate in a concise and systematic manner using appropriate mathematical and statistical language
* capacity to choose and use technology appropriately and efficiently.

**Organisation**

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

## **Structure of the syllabus**

The Year 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

## **Organisation of content**

Unit 1

Contains the three topics:

* Functions and graphs
* Trigonometric functions
* Counting and probability.

Unit 1 begins with a review of the basic algebraic concepts and techniques required for a successful introduction to the study of functions and calculus. Simple relationships between variable quantities are reviewed, and these are used to introduce the key concepts of a function and its graph. The study of probability and statistics begins in this unit with a review of the fundamentals of probability, and the introduction of the concepts of conditional probability and independence. The study of the trigonometric functions begins with a consideration of the unit circle using degrees and the trigonometry of triangles and its application. Radian measure is introduced, and the graphs of the trigonometric functions are examined and their applications in a wide range of settings are explored.

Unit 2

Contains the three topics:

* Exponential functions
* Arithmetic and geometric sequences and series
* Introduction to differential calculus.

In Unit 2, exponential functions are introduced and their properties and graphs examined. Arithmetic and geometric sequences and their applications are introduced and their recursive definitions applied. Rates and average rates of change are introduced and this is followed by the key concept of the derivative as an ‘instantaneous rate of change’. These concepts are reinforced numerically (by calculating difference quotients), geometrically (as slopes of chords and tangents), and algebraically. This first calculus topic concludes with derivatives of polynomial functions, using simple applications of the derivative to sketch curves, calculate slopes and equations of tangents, determine instantaneous velocities, and solve optimisation problems.

Each unit includes:

* a unit description – a short description of the focus of the unit
* learning outcomes – a set of statements describing the learning expected as a result of studying the unit
* unit content – the content to be taught and learned.

Role of technology

It is assumed that students will be taught this course with an extensive range of technological applications and techniques. If appropriately used, these have the potential to enhance the teaching and learning of the course. However, students also need to continue to develop skills that do not depend on technology. The ability to be able to choose when or when not to use some form of technology and to be able to work flexibly with technology are important skills in this course.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week/s** | **Essential Content** | **ACARA Reference and Elaborations** | **Reference and Resources** | **Cross Curricular Priorities / General Capabilities** | **Assessment** |
| 1-2  Term I  2019 | Lines and linear relationships. | 1.1.1 Determine the coordinates of the mid-point between two points.  1.1.2 Determine an end-point given the other end-point and the mid-point.  1.1.4 Recognise features of the graph of , including its linear nature, its intercepts and its slope or gradient.  1.1.5 Determine the equation of a straight line given sufficient information; including parallel and perpendicular lines.  1.1.6 Solve linear equations, including those with algebraic fractions and variables on both sides. | Cambridge Senior  Mathematical Methods Yr 11  **Ch 1&2**  **MangaHigh**  **Mathspace** |  |  |
| 3-4  Term I  2019 | Quadratic relationships | 1.1.7 Examine examples of quadratically related variables  1.1.8 Recognise features of the graphs of , and , including their parabolic nature, turning points, axes of symmetry and intercepts  1.1.9 Solve quadratic equations, including the use of quadratic formula and completing the square  1.1.10 Determine the equation of a quadratic given sufficient information  1.1.11 Determine turning points and zeros of quadratics and understand the role of the discriminant  1.1.12 Recognise features of the graph of the general quadratic | Cambridge Senior  Mathematical Methods Yr 11  **Ch 3** |  |  |
| 5  Term I  2019 | Graphs | 1.1.14 Recognise features and determine equations of the graphs of and , including their hyperbolic shapes and their asymptotes.  1.1.15 Recognise features of the graphs of for , including shape, and behaviour as and  1.1.16 Identify the coefficients and the degree of a polynomial  1.1.21 Recognise features and determine equations of the graphs of and  , including their circular shapes, their centres and their radii  1.1.22 Recognise features of the graph of , including its parabolic shape and its axis of symmetry | Cambridge Senior  Mathematical Methods Yr 11  **Ch 4** |  | **TEST 1** |
| 6  Term I  2019 | Inverse proportion | 1.1.3 Examine examples of direct proportion and linearly related variables.  1.1.13 Examine examples of inverse proportion | Cambridge Senior  Mathematical Methods Yr 11  **Ch 5** |  | **INV 1** |
| 7  Term I  2019 | Functions relations and transformations | 1.1.23 Understand the concept of a function as a mapping between sets and as a rule or a formula that defines one variable quantity in terms of another  1.1.24 Use function notation; determine domain and range; recognise independent and dependent variables | Cambridge Senior  Mathematical Methods Yr 11  **Ch 6**  **MangaHigh** |  |  |
| 8  Term I  2019 | Functions relations and transformations | 21CLT– Use of technology – introduction to transformations. <https://student.desmos.com/>  1.1.25 Understand the concept of the graph of a function  1.1.28 Recognise the distinction between functions and relations and apply the vertical line test  1.1.26 Examine translations and the graphs of and  1.1.27 Examine dilations and the graphs of and | Cambridge Senior  Mathematical Methods Yr 11  **Ch 6**  **DESMOS transformation activity.** |  |  |
| 9-10  Term I  2019 | Functions relations and transformations | 1.1.17 Expand quadratic and cubic polynomials from factors  1.1.18 Recognise features and determine equations of the graphs of , and , including shape, intercepts and behaviour as and  1.1.19 Factorise cubic polynomials in cases where a linear factor is easily obtained  1.1.20 Solve cubic equations using technology, and algebraically in cases where a linear factor is easily obtained | Cambridge Senior  Mathematical Methods Yr 11  **Ch 7** |  | **TEST 2** |
| 11-12  Term II  2019 | Probability | 1.3.6 Review the concepts and language of outcomes, sample spaces, and events, as sets of outcomes  1.3.7 Use set language and notation for events, including:  (or for the complement of an event  and for the intersection and union of events and respectively  and for the intersection and union of the three events respectively  recognise mutually exclusive events.  1.3.8 Use everyday occurrences to illustrate set descriptions and representations of events and set operations  1.3.9 Review probability as a measure of ‘the likelihood of occurrence’ of an event  1.3.10 Review the probability scale: for each event with if is an impossibility and if is a certainty  1.3.11 Review the rules: and  1.3.12 Use relative frequencies obtained from data as estimates of probabilities | Cambridge Senior  Mathematical Methods Yr 11  **Ch 9**  **Mathspace** |  |  |
| 13  Term II  2019 | Probability | 1.3.13 Understand the notion of a conditional probability and recognise and use language that indicates conditionality  1.3.14 Use the notation and the formula  13.15 Understand the notion of independence of an event *A* from an event *B*, as defined by  1.3.16 Establish and use the formula for independent events and , and recognise the symmetry of independence  1.3.17 Use relative frequencies obtained from data as estimates of conditional probabilities and as indications of possible independence of events | Cambridge Senior  Mathematical Methods Yr 11  **Ch 9**  **MangaHigh** |  |  |
| * **FIND OUT ALL YOU CAN ABOUT THE FORMAT OF THE EXAM:**   Time allowed, number of questions, marks and average time spent per question.  Do past WACE. papers to be familiar with the format and standard.   * **BE PREPARED:**   Revise, revise, revise! Means PRACTICE, PRACTICE, PRACTICE,  Bring pens, pencil, drawing instruments, tables books, calculator (check calculator works!), spare batteries, your brain (ditto!).  Eat and sleep well, be early, be confident, be a little nervous.   * **USE THE READING TIME TO PLAN YOUR EXAM:**   Read all instructions carefully.  Skim through all questions to see the work that is ahead of you.  Note the difficult questions which will require more time; plan your time! What order will you do the questions in?   * **SPEND THE FIRST MINUTE OF EACH QUESTION PLANNING AND THINKING:**   You don’t need to be writing all of the time. (What you’re writing may be wrong and a waste of time!)  Read each question carefully and decide what needs to be found.  Make sure you use all the information given.   * **PACE YOURSELF; KEEP AN EYE ON THE TIME:**   Work steadily; make sure you are not spending too much time on one question.  Don’t rush or you’ll make silly mistakes, and your work will be messy.  Don’t panic if you run out of time; it is better to get *most* **questions right than to get *all* questions wrong.**  **Complete the work you *do* know, rather than rushing.**   * **WRITE CLEARLY, DRAW BIG DIAGRAMS:**   Show working; spread out your work neatly, use as much paper as you like.  Demonstrate to the marker that you *know* your Maths.  Write *down* the page, not across; use words and diagrams if appropriate.  Don’t use liquid paper; draw a line through mistakes; use pencil only for diagrams.   * **MAKE SURE YOU HAVE ANSWERED THE QUESTION:**   Does it sound reasonable? Correct units included? Correct number of decimal places?  Highlight the final answer in a box. Should you write it in a sentence?  Feel confident about yourself when you have answered a question correctly.  Cont…   * **ATTEMPT EVERY QUESTION:**   Aim to earn *some* marks for every question, even if it requires an educated guess.  Try to finish each question before moving on, so that you don’t have to worry about coming back to it.  If a question is too hard, skip it and leave time to come back to it later.   * **MOVE ON IF YOU’RE GETTING NOWHERE:**   If your working-out of a hard question is taking too long, then it’s probably *wrong*!  If you’re stuck, don’t waste valuable time getting bogged down. Stop, retrace your steps, think about a simpler method, or start again. Sometimes it’s even better to skip the question and return to it with a fresh mind.   * **AT THE END OF THE EXAM:**   Check your work, and go back | | | | | |
| 14 – 15  Term II  2019 |  | **SEMESTER 1 EXAMS** |  |  | EXAM |

Unit 2

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Week/s** | **Essential Content** | **Elaborations** | **Reference and Resources** | **Cross Curricular Priorities / General Capabilities** | **Assessment** |
| 16  Term II  2019 | Combinations, Counting and probability | 1.3.1 Understand the notion of a combination as a set of r objects taken from a set of n distinct objects  1.3.2 Use the notation  and the formula  for the number of combinations of r objects taken from a set of n distinct objects  1.3.1 Expand *(x + y) n*for small positive integers n  1.3.4 Recognise the numbers as binomial coefficients (as coefficients in the expansion of *(x + y) n*  1.3.5 Use Pascal’s triangle and its properties | Cambridge Senior  Mathematical Methods Yr 11  **Ch 10** |  |  |
| 17  Term II  2019 | Circular Functions | 1.2.5 Define and use radian measure and understand its relationship with degree measure  1.2.6 Calculate lengths of arcs and areas of sectors and segments in circles  1.2.7 Understand the unit circle definition of and periodicity using radians  1.2.8 Recognise the exact values of at integer multiples of and  1.2.9 Recognise the graphs of on extended domains  1.2.10 Examine amplitude changes and the graphs of and  1.2.11 Examine period changes and the graphs of and  1.2.12 Examine phase changes and the graphs of and  1.2.13 Examine the relationships and  1.2.14 Prove and apply the angle sum and difference identities  1.2.15 Identify contexts suitable for modelling by trigonometric functions and use them to solve practical problems  1.2.16 Solve equations involving trigonometric functions using technology, and algebraically in simple cases | Cambridge Senior  Mathematical Methods Yr 11  **Ch 12**  **MangaHigh** |  |  |
| 18  Term II  2019 | Trig ratios and applications | 1.2.4 Establish and use the cosine and sine rules, including consideration of the ambiguous case and the formula for the area of a triangle | Cambridge Senior  Mathematical Methods Yr 11  **Ch 13** |  |  |
| 19  Term II  2019 | Exponential functions  Exponential functions | 2.1.1 Establish and use the algebraic properties of exponential functions  2.1.2 Recognise the qualitative features of the graph of *y = a x* (*a* > 0) , including asymptotes, and of its translations (*y = a x + b* and *y = a x - c* )  2.1.3 Identify contexts suitable for modelling by exponential functions and use them to solve practical problems  2.1.4 Establish and use the algebraic properties of exponential functions  2.1.5 recognise the qualitative features of the graph of , including asymptotes, and of its translations ( and )  2.1.6 Identify contexts suitable for modelling by exponential functions and use them to solve practical problems  2.1.7 Solve equations involving exponential functions using technology, and algebraically in simple cases | Cambridge Senior  Mathematical Methods Yr 11  **Ch 14**  **Mathspace** |  | **INV 2** |
| 20  Term II  2019 | Arithmetic and geometric sequences and series  Arithmetic sequences | 2.2.1 Recognise and use the recursive definition of an arithmetic sequence: *t n+1 = t n + d*  2.2.2 Develop and use the formula  *t n = t 1 + (n – 1)d* for the general term of an arithmetic sequence and recognise its linear nature  2.2.3 Use arithmetic sequences in contexts involving discrete linear growth or decay, such as simple interest  2.2.4 Establish and use the formula for the sum of the first *n* terms of an arithmetic sequence | Cambridge Senior  Mathematical Methods Yr 11  **Ch 15**  **MangaHigh** |  |  |
| 21  Term III  2019 | Arithmetic and geometric sequences and series  Geometric sequences | 2.2.5 Recognise and use the recursive definition of a geometric sequence:  *t n+1 = tn×r*  2.2.6 Develop and use the formula *t n = t1×r n-1* for the general term of a geometric sequence and recognise its exponential nature  2.2.7 Understand the limiting behaviour as  of the terms *tn* in a geometric sequence and its dependence on the value of the common ratio r  2.2.8 Establish and use the formula  for the sum of the first n terms of a geometric sequence  2.2.9 Use geometric sequences in contexts involving geometric growth or decay, such as compound interest | Cambridge Senior  Mathematical Methods Yr 11  **Ch 15** |  |  |
| 22  Term III  2019 | Introduction to differential calculus  Rates of change | 2.3.1 Interpret the difference quotient  as the average rate of change of a function f  2.3.2 Use the Leibniz notation  and  for changes or increments in the variables x and y  2.3.3 Use the notation  for the difference quotient  where *y = f(x*)  2.3.4 Interpret the ratios  and  as the slope or gradient of a chord or secant of the graph of *y = f(x)* | Cambridge Senior  Mathematical Methods Yr 11  **Ch 17**  **MangaHih**  Classpad Activity 28 from Yellow Sheppard & Pateman |  | **TEST 3** |
| 23  Term III  2019 | Introduction to differential calculus  The concept of the derivative | 2.3.5 Examine the behaviour of the difference quotient  as  as an informal introduction to the concept of a limit  2.3.6 Define the derivative  as  2.3.7 Use the Leibniz notation for the derivative:  and the correspondence  where *y = f(x)*  2.3.8 Interpret the derivative as the instantaneous rate of change  2.3.9 Interpret the derivative as the slope or gradient of a tangent line of the graph of *y = f(x*) | Cambridge Senior  Mathematical Methods Yr 11  **Ch 17** |  |  |
| 24  Term III  2019 | Introduction to differential calculus  Computation of derivatives  Properties of derivatives | 2.3.10 Estimate numerically the value of a derivative for simple power functions  2.3.11 Examine examples of variable rates of change of non-linear functions  2.3.12 Establish the formula  for non-negative integers n expanding  or by factorising  2.3.13 Understand the concept of the derivative as a function  2.3.14 Identify and use linearity properties of the derivative  2.3.15 Calculate derivatives of polynomials | Cambridge Senior  Mathematical Methods Yr 11  **Ch 17** |  |  |
| 25  Term III  2019 | Introduction to differential calculus  Applications of derivatives | 2.3.16 Determine instantaneous rates of change  2.3.17 Determine the slope of a tangent and the equation of the tangent | Cambridge Senior  Mathematical Methods Yr 11  **Ch 17** |  |  |
| 26  Term III  2019 | Introduction to differential calculus  Applications of derivatives  Anti-derivatives | 2.3.22 Calculate anti-derivatives of polynomial functions  2.3.20 Sketch curves associated with simple polynomials, determine stationary points, and local and global maxima and minima, and examine behaviour as  and  2.3.21 Solve optimisation problems arising in a variety of contexts involving polynomials on finite interval domains | Cambridge Senior  Mathematical Methods Yr 11  **Ch 18** |  |  |
| 27  Term III  2019 | Introduction to differential calculus  Applications of derivatives | 2.3.18 Construct and interpret position-time graphs with velocity as the slope of the tangent  2.3.19 Recognise velocity as the first derivative of displacement with respect to time |  |  | **INV 3** |
| 28-32  Term III  2019 |  | Revision |  |  | **TEST 4** |
| 33 to 34  Term IV  2019 |  | EXAMS |  |  |  |