 Year 11 Mathematics Standard

| MS-A1 Formulae and Equations | Unit duration |
| --- | --- |
| Algebra involves the use of symbols to represent numbers or quantities and to express relationships, using mathematical models and applications. Knowledge of algebra enables the modelling of a problem conceptually so that it is simpler to solve. Study of algebra is important in developing students’ reasoning skills and logical thought processes, as well as their ability to represent and solve problems. | 2 weeks |

| Subtopic focus | Outcomes |
| --- | --- |
| The principal focus of this subtopic is to provide a solid foundation in algebraic skills, including finding solutions to a variety of equations in work-related and everyday contexts. Students develop awareness of the applicability of algebra in their approach to everyday life.Within this subtopic, schools have the opportunity to identify areas of Stage 5 content which may need to be reviewed to meet the needs of students. | A student:* uses algebraic and graphical techniques to compare alternative solutions to contextual problems MS11-1
* makes predictions about everyday situations based on simple mathematical models MS11-6
* uses appropriate technology to investigate, organize and interpret information in a range of contexts MS11-9
* justifies a response to a given problem using appropriate mathematical terminology and/or calculations MS11-10

**Related Life Skills outcomes:** MALS6-1, MALS6-7, MALS6-8 MALS6-13, MALS6-14 |

| Prerequisite knowledge | Assessment strategies |
| --- | --- |
| The material in this topic builds on content from the Number and Algebra Strand of the K–10 Mathematics syllabus, including the Stage 5.2 substrands of Algebraic Techniques, Equations and Linear Relationships. | * Informal assessment could include exit tickets and Kahoot quizzes
* Students could investigate formulas used in different career paths, explaining the different variables in the formulas and examples of how they are used.
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All outcomes referred to in this unit come from [Mathematics Standard Stage 6](https://syllabus.nesa.nsw.edu.au/mathematics-standard-stage6/) Syllabus © NSW Education Standards Authority (NESA) for and on behalf of the Crown in right of the State of New South Wales, 2017

Glossary of terms

| Term | Description |
| --- | --- |
| blood alcohol content (BAC) | Blood alcohol content measures the amount of alcohol present in the bloodstream, and may be used for legal purposes. |
| Blood pressure | Blood pressure is the pressure exerted by circulating blood upon the walls of blood vessels. It is usually measured at a person's upper arm. Blood pressure is expressed in terms of the systolic (maximum) pressure over diastolic (minimum) pressure and is measured in millimetres of mercury (mm Hg). |
| standard drink | A drink that contains 10 grams of alcohol is called a standard drink. |

| Lesson sequence | Content | Suggested teaching strategies and resources  | Date and initial | Comments, feedback, additional resources used |
| --- | --- | --- | --- | --- |
| Substitution (2 lessons) | * review substitution of numerical values into linear and non-linear algebraic expressions and equations
* review evaluating the subject of a formula, given the value of other pronumerals in the formula
* change the subject of a formula
* solve problems involving formulae, including calculating distance, speed and time (with change of units of measurement as required) or calculating stopping distances of vehicles using a suitable formula **AAM**
 | **Introducing substitution*** Teacher introduces (reviews) of substitution by relating it to relevant contexts such as substitution in sport, a substitute teacher and substituting an ingredient when cooking.

**Substituting into expressions*** Teacher to model substitution into expressions and evaluating the result. This should include substitution of positive and negative values into expressions containing multiple variables, positive and negative coefficients, fractions, powers and square roots.
* Examples of algebraic expressions for substitution of numerical values includes:
* Student activity: Students practice substituting into expressions and evaluating the result.

Resource: substitution.DOCX (part 1)**Evaluating the subject of a formula*** Teacher defines what the subject of a formula is.
* Teacher models evaluating the subject of formula through substitution of numerical values.
* Examples of formula include:
* Student activity: Students to practice evaluating the subject of a formula.

Resource: substitution.DOCX (part 2)**Changing the subject of a formula*** Teacher to model changing the subject of linear formula. Coefficients should be presented in a range of forms e.g. integer, fractional, decimal.
* Relate changing the subject of a formula to the steps used to solve a similar equation. E.g. to make the subject of the formula , consider how you solve .
* Student activity: Students practice changing the subject of a formula and then evaluating the subject. Example:
* Make the subject of the formula
* Hence, evaluate if and

**Solving problems involving formulae*** Teachers to select from practical contexts including, but not limited to, formulae students will encounter in other topics.
* Calculate distance, speed and time (with change of units of measurement as required)
* Stopping distance:
* Consider what influences the stopping distance of a car. Investigate stopping distances for different speeds, road conditions, and weather conditions. Refer to Queensland Government’s [stopping distance article](https://www.qld.gov.au/transport/safety/road-safety/driving-safely/stopping-distances).
* Investigate the safety aspects of stopping distances in relation to speed limits. Calculate the difference in stopping distance if travelling 5 km/h over the speed limit.

Reaction time is the time period from when a driver decides to brake to when the driver first commences braking.Resources: substitution.DOCX (part 3) and online calculators: [average speed](http://www.countcalculate.com/cars-and-speed/average-speed), [stopping distance](http://www.countcalculate.com/cars-and-speed/stopping-braking-distance), [km/h to m/s](http://www.countcalculate.com/cars-and-speed/convert-kmh-ms-and-mph)* Body mass index (BMI): Students can use the BMI formula to calculate the BMI, mass or height of an individual.

Resource: bmi-scenario-generator.XLSX |  |  |
| Solving linear equations (2 lessons) | * develop and solve linear equations, including those derived from substituting values into a formula, or those developed from a word description **AAM**
 | **Solving linear equations*** Teacher models methods of
* solving linear equations
* substituting values into formula and solving the resulting equation.

Example: Substitute and into the formula and hence evaluate .* Students to practice solving linear equations.

Resource: [Two-Step Equations Basketball Game](http://www.math-play.com/two-step-equations-basketball-game/two-step-equations-basketball-game_html5.html)**Developing equations from a word description*** Teacher to review metalanguage to relate words to operations. Example:
* Addition: sum, increase, more than…
* Teacher to model changing a worded description into an equation:
* 3 more than is equal to 10.

Students may like to relate descriptions to numerical example. Consider how they would write an expression for 3 more than 4.* Student activity: Students match worded descriptions to their equations.

Resource: words-to-equation-matching-activity.DOCX (part 1)* Teacher to model changing a worded description into an equation then substituting values and evaluating the result.
* Student activity: Students combine worded descriptions, equations and solutions once substitutions have been conducted.

Resource: words-to-equation-matching-activity.DOCX (Part 2) |  |  |
| Blood alcohol content (2 lessons) | * calculate and interpret blood alcohol content (BAC) based on drink consumption and body weight **AAM**
* use formulae, both in word form and algebraic form, to calculate an estimate for blood alcohol content , including and where is the number of standard drinks consumed, is the number of hours of drinking, and is the person’s weight in kilograms
* determine the number of hours required for a person to stop consuming alcohol in order to reach zero BAC, eg using the formula
* describe limitations of methods estimating BAC
 | **Introducing blood alcohol content (BAC)*** Teacher to define Blood Alcohol Content (BAC) as the measure of alcohol concentration in the bloodstream. It is measured in grams of alcohol per 100 millilitres of blood. A BAC of 0.02 means that there are 0.02 grams (20 milligrams) of alcohol in every 100 millilitres of blood.
* Teacher to lead a discussion of [factors which affect BAC](https://www.health.gov.au/health-topics/alcohol/about-alcohol/what-are-the-effects-of-alcohol#its-different-for-each-person) such as body weight, gender, fitness, health and liver function.
* Students investigate the meaning of a ‘standard drink’ as different countries have different definitions.
* SBS article, [standard drink defined by country.](https://www.sbs.com.au/topics/voices/health/article/2016/04/14/how-much-alcohol-standard-drink-answer-varies-country)
* The Guardian article, [How much alcohol is a standard drink?](https://www.theguardian.com/society/shortcuts/2016/apr/13/how-much-alcohol-in-a-standard-drink-austria-serves-almost-double-uk-measures)
* Students identify the BAC limit for all learner and provisional drivers. (Zero)

**Analysing blood alcohol content*** Teacher introduces and models the use of the formulae to estimate BAC.

 and * is the number of standard drinks consumed
* is the number of hours of drinking
* is the person’s weight in kilograms

Note: This should be introduced using both words and algebra.* The teacher introduces and models the use of the formula to estimate the number of hours a person must stop consuming alcohol in order to reach a zero BAC.
* Discuss and describe the limitations to the estimation of BAC including that the formulae are based on average values and will not apply equally to everyone.
* Student activity: Students perform related calculations and investigations analysing a range of scenarios.

Resource: analysing-bac.DOCX, bac-scenario-generator.XLSX |  |  |
| Medication dosages (2 lessons) | * calculate required medication dosages for children and adults from packets, given age or weight, using Fried’s, Young’s or Clark’s formula as appropriate **AAM**
* Fried’s formula:
* Young’s formula:
* Clark’s formula:
 | **Introducing medication dosages*** Teacher to lead a discussion on why different dosages may be required for different people by considering the persons weight.
* The teacher models the calculation of medication dosages for different medication types, such as oral medication in liquid or tablet form. NESA sample question:
* A patient is prescribed 1000 mg of a mild painkiller. The medication available contains 100 mg in 5 mL. How much medication should be given to the patient?
* A patient is prescribed 750 mg of a medication. Tablets, each of 500 mg, are available. How many tablets should be given?
* Note: A range of methods to solve such problems. For example the first problem can be solved using:
* A formula:
* Ratios

**Formula to calculate medication dosages*** The teacher introduces Fried’s, Young’s and Clark’s formulae for calculating medication dosages.
* Student identify the variables in each.
* Student activity: Students examine a range of dosages such as dosage panels from over-the-counter medications.
* Students compare child dosages identified on the dosage panels to those obtained using Fried’s, Young’s and Clark’s formulae.
* Students examine when each formula provides a more accurate results compared to the dosage panel.
* Students discuss which formula might be the more reliable calculation of dosage and possible reasons for this. For example: A formulae that uses weight maybe more reliable since age is not necessarily a predictor of weight, although Clark’s formula effectively assumes an average adult weight of 70 kg.
* Students apply the formulae in the solution of practical problems including the amount per dose and the frequency of dosage.
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Reflection and evaluation

Please include feedback about the engagement of the students and the difficulty of the content included in this section. You may also refer to the sequencing of the lessons and the placement of the topic within the scope and sequence. All ICT, literacy, numeracy and group activities should be recorded in the ‘Comments, feedback, additional resources used’ section.