 Year 11 mathematics extension 1

| ME-F1.2 Inequalities | Unit duration |
| --- | --- |
| The topic Functions involves the use of both algebraic and graphical conventions and terminology to describe, interpret and model relationships of and between changing quantities. This topic provides the means to more fully understand the behaviour of functions, extending to include inequalities, absolute values and inverse functions. A knowledge of functions enables students to discover connections between algebraic and graphical representations, to determine solutions of equations and to model theoretical or real-life situations involving algebra. The study of functions is important in developing students’ ability to find, recognise and use connections, to communicate concisely and precisely, to use algebraic techniques and manipulations to describe and solve problems, and to predict future outcomes in areas such as finance, economics and weather. | 1.5 weeks |

| Subtopic focus | Outcomes |
| --- | --- |
| The principal focus of this subtopic is to further explore functions in a variety of contexts including: reciprocal and inverse functions, manipulating graphs of functions, and parametric representation of functions. The study of inequalities is an application of functions and enables students to express domains and ranges as inequalities. Students develop proficiency in methods to identify solutions to equations both algebraically and graphically. The study of inverse functions is important in higher Mathematics and the calculus of these is studied later in the course. The study of parameters sets foundations for later work on projectiles. | A student:* uses algebraic and graphical concepts in the modelling and solving of problems involving functions and their inverses ME11-1
* manipulates algebraic expressions and graphical functions to solve problems ME11-2
* uses appropriate technology to investigate, organise and interpret information to solve problems in a range of contexts ME11-6
* communicates making comprehensive use of mathematical language, notation, diagrams and graphs ME11-7
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| Prerequisite knowledge | Assessment strategies |
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| Students should have studied the concepts explored in the year 11 Mathematics advanced topic of MA-F1 Working with functions. | * Verbal discussion on the need for testing points for the various inequalities
* Have students create their own questions and partner with a friend to see if the questions work. Discuss why, why not.
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All outcomes referred to in this unit come from [Mathematics Extension 1](http://educationstandards.nsw.edu.au/wps/portal/nesa/11-12/stage-6-learning-areas/stage-6-mathematics/mathematics-extension-1-2017) Syllabus
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Glossary of terms

| Term | Description |
| --- | --- |
| inequality | An inequality is a statement that compares two quantities and describes how they are different. |
| quadratic | Quadratic describes any function in the form $y=ax^{2}+bx+c$, where $a$, $b$ and $c$ are constants. |

Lesson sequence

| Lesson sequence | Content Students learn to: | Suggested teaching strategies and resources  | Date and initial | Comments, feedback, additional resources used |
| --- | --- | --- | --- | --- |
| Quadratic inequalities (2 lessons) | * solve quadratic inequalities using both algebraic and graphical techniques
 | **Assumed knowledge*** Students should already be able to factorise quadratic equations as this was explored in MA-F1.1.

**Solving by algebraic methods*** The process of solving a quadratic inequality is as follows:
	+ Factorise and solve the quadratic equation
	+ Plot the solutions to the equation on a number line
	+ Test values in the inequality from each of the intervals on the number line.
* Students should be aware that testing different points of the inequality is essential in finding the solution.

**Solving by graphical methods*** Students could plot any quadratic function on DESMOS in the form of $f\left(x\right)=ax^{2}+bx+c$ and write down their observations after using the graphing software to plot $y\geq f\left(x\right)$ and $y<f\left(x\right)$
* The process of solving a quadratic inequality is as follows:
* Factorise the quadratic function
* Draw a quick sketch of the quadratic showing only its x-intercepts and concavity
* Highlight the sections of the diagram that meet the given inequality
* Students should also be able to graph the solutions of their inequalities on a number line.
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| Harder inequalities (2 lessons) | * solve inequalities involving rational expressions, including those with the unknown in the denominator
 | **Solving harder inequalities*** It is important when approaching questions with an unknown in the denominator that students note that the denominator cannot equal to zero and determine this value of x. This is an important consideration that is often missed, particularly when this x-value lies within the range of solutions.
	+ Solve the equation by multiplying both sides of the inequality by the denominator
	+ Plot the solutions to the equation on a number line
	+ Test values in the inequality from each of the intervals on the number line.
* Students should also be able to graph the solutions of their inequalities on a number line.
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| Absolute value inequalities(2 lessons) | * solve absolute value inequalities of the form $|ax+b|\geq k$, $\left|ax+b\right|\leq k$, $\left|ax+b\right|<k$ and $$\left|ax+b\right|>k$$
 | **Absolute value inequalities*** Students would benefit from going over the basic rules of absolute value equations and inequalities including:
	+ If $\left|ax+b\right|=k$ then $ax+b=\pm k$
	+ If $\left|ax+b\right|<k$ or $\left|ax+b\right|\leq k$ then $-k<ax+b<k$ or $-k\leq ax+b\leq k$
	+ If $\left|ax+b\right|>k$ then $ax+b>k$ or $ax+b<-k$
	+ If or $\left|ax+b\right|\geq k$ then $ax+b\geq k$ or $ax+b\leq -k$
* It should be explicitly taught that students must show the multiple solutions for each absolute value inequality as well as test points.
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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.